

Preparing the environment

ICWE 2023

Tutorial:

Quantum Web Services:
development and deployment

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Preparing the environment

En el presente documento, se detalla la instalación de las diferentes herramientas y tecnologías necesarias para las diferentes charlas que tendrán lugar en el bloque "cuántico" del día 10 de noviembre.

To perform the practices, it is only necessary to follow the "FIRST STEPS", which allow us to run quantum code using our machines as local simulators through the Amazon Braket SDK. The "ADVANCED STEPS" are reserved for those people who really want to use Amazon Braket to exploit the full potential of the real quantum machines to which it allows us to connect, and are not necessary for the practical sessions (although, if someone wants to, they can do them).

In addition, the "EXTRA" section shows the steps to delete the software installed on our local machines after finishing the practical sessions.

FIRST STEPS: installation

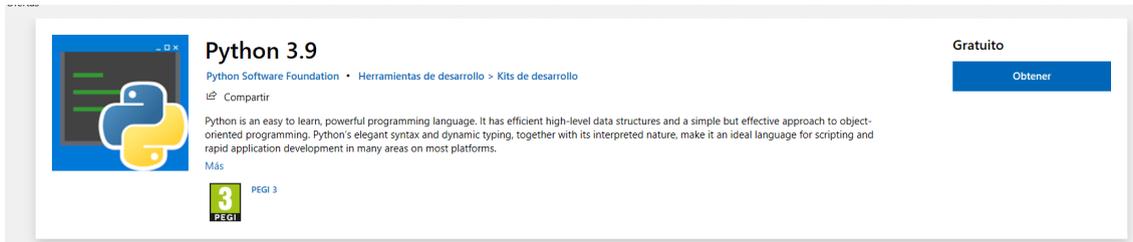
Installing Python 3

The first step is to install Python 3 on your computer (for those who don't already have it). To check if we have a version of Python 3 already installed in our computers, we can open a console and type the command "python3 --version" or "python --version", if the first one doesn't work. In either case, it should show us a message indicating that we have a version of Python 3 similar to this one: Python 3.x.x, where the "x" are subversions (it doesn't matter which one you have). It is important that it says Python3 and not Python2.

If you don't have Python 3 installed, you should follow the next steps (depending on your operating system):

- **Windows:**

1. Go to the Windows Store
2. Search for Python 3.9
3. Click on get



4. Open a CMD
5. Either of the commands "python --version" or "python3 --version" should show that we have a version of Python 3.9.

- **Ubuntu:** For the Python installation we will run the following commands:

1. `sudo apt-get update`
2. `sudo apt-get install python3.9`

```
(base) jaime@jaime-ZenBook-UX325UA-UM325UA:~$ sudo apt-get install python3.9
Leyendo lista de paquetes... Hecho
Creando árbol de dependencias
Leyendo la información de estado... Hecho
Se instalarán los siguientes paquetes adicionales:
 libpython3.9-minimal libpython3.9-stdlib python3.9-minimal
Paquetes sugeridos:
 python3.9-venv python3.9-doc binutils binfmt-support
Se instalarán los siguientes paquetes NUEVOS:
 libpython3.9-minimal libpython3.9-stdlib python3.9 python3.9-minimal
0 actualizados, 4 nuevos se instalarán, 0 para eliminar y 505 no actualizados.
Se necesita descargar 4.977 kB de archivos.
Se utilizarán 19,9 MB de espacio de disco adicional después de esta operación.
¿Desea continuar? [S/n] S
Des:1 http://es.archive.ubuntu.com/ubuntu focal-updates/universe amd64 libpython3.9-minimal amd64 3.9.5-3-20.04.1 [756 kB]
Des:2 http://es.archive.ubuntu.com/ubuntu focal-updates/universe amd64 python3.9-minimal amd64 3.9.5-3-20.04.1 [2.022 kB]
Des:3 http://es.archive.ubuntu.com/ubuntu focal-updates/universe amd64 libpython3.9-stdlib amd64 3.9.5-3-20.04.1 [1.776 kB]
Des:4 http://es.archive.ubuntu.com/ubuntu focal-updates/universe amd64 python3.9 amd64 3.9.5-3-20.04.1 [423 kB]
Descargados 4.977 kB en 4s (1.178 kB/s)
Seleccionando el paquete libpython3.9-minimal:amd64 previamente no seleccionado.
(Leyendo la base de datos ... 148559 ficheros o directorios instalados actualmente.)
Preparando para desempaquetar .../libpython3.9-minimal_3.9.5-3-20.04.1_amd64.deb ...
Desempaquetando libpython3.9-minimal:amd64 (3.9.5-3-20.04.1) ...
Seleccionando el paquete python3.9-minimal previamente no seleccionado.
Preparando para desempaquetar .../python3.9-minimal_3.9.5-3-20.04.1_amd64.deb ...
Desempaquetando python3.9-minimal (3.9.5-3-20.04.1) ...
Seleccionando el paquete libpython3.9-stdlib:amd64 previamente no seleccionado.
```

- **MacOS:** The commands are:

1. `/bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/Homebrew/install.sh)"`
2. `export PATH="/usr/local/opt/python/libexec/bin:$PATH"`
3. `brew install python`

We check again, if we have not already done so, that we have Python 3 installed using the command "python3 --version" or "python --version", looking for a result like the one mentioned in the previous paragraph to the installation steps.

Depending on which command works ("python" or "python3"), this will be the command we will use from now on. Therefore, when we refer to the "python3" command in the rest of the guide, if the command that worked for us is "python" instead of "python3", we will replace "python3" with "python". If they both lead to the same version, we can use them interchangeably.

Python 3 pip installation

The next step is to install the Python 3 package manager "pip". To do this, we will first check that we do not have it installed or that it has not been installed automatically in the previous step. To do this, we use the following command: "python3 -m pip --version". If this command works, we have it installed, and we can move on to the next point. If not, we must install it following the next steps:

- **Windows:**
 1. It must have been installed using only the steps above.
 2. If you had Python3 before but not pip, you must download the script [get-pip.py](#) and run it with Python3. To do this, in the directory where you have downloaded it, open a console and run: "python3 get-pip.py".
- **Ubuntu:** the commands to be executed for the installation of "pip" are:
 1. `sudo apt-get update`
 2. `sudo apt install python3-pip`

```

python3.8.8
(base) jaim@jaim-ZenBook-UX325UA-UM325UA:~$ sudo apt install python3-pip
Leyendo lista de paquetes... Hecho
Creando árbol de dependencias
Leyendo la información de estado... Hecho
Se instalarán los siguientes paquetes adicionales:
 binutils binutils-common binutils-x86-64-linux-gnu build-essential cpp-9 dpkg-dev fakeroot g++ g++-9 gcc gcc-10-base gcc-9 gcc-9-base
 libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl libasan5 libatomic1 libbinutils libc-dev-bin libc6 libc6-dbg lib
 libbcc1-0 libcrypt-dev libctf-nobfd0 libctf0 libexpat1-dev libfakeroot libgcc-9-dev libgcc-s1 libgomp1 libitm1 liblsan0 libpython3-dev lib
 libpython3.8-dev libpython3.8-minimal libpython3.8-stdlib libquadmath0 libstdc++-9-dev libstdc++6 libtsan0 libubsan1 linux-libc-dev make
 python-pip-whl python3-dev python3-distutils python3-lib2to3 python3-setuptools python3-wheel python3.8 python3.8-dev python3.8-minimal
 zlib1g-dev
Paquetes sugeridos:
 binutils-doc gcc-9-locales debian-keyring g++-multilib g++-9-multilib gcc-9-doc gcc-multilib autoconf automake libtool flex bison gcc-de
 gcc-9-multilib glibc-doc libstdc++-9-doc make-doc python-setuptools-doc python3.8-venv python3.8-doc binfmt-support
Se instalarán los siguientes paquetes NUEVOS:
 binutils binutils-common binutils-x86-64-linux-gnu build-essential dpkg-dev fakeroot g++ g++-9 gcc gcc-9 libalgorithm-diff-perl
 libalgorithm-diff-xs-perl libalgorithm-merge-perl libasan5 libatomic1 libbinutils libc-dev-bin libc6-dev libcrypt-dev libctf-nobfd0 lib
 libexpat1-dev libfakeroot libgcc-9-dev libitm1 liblsan0 libpython3-dev libpython3.8-dev libquadmath0 libstdc++-9-dev libtsan0 libubsan1
 linux-libc-dev make manpages-dev python-pip-whl python3-dev python3-distutils python3-setuptools python3-wheel python3.8-dev
Se actualizarán los siguientes paquetes:
 cpp-9 gcc-10-base gcc-9-base libc6 libc6-dbg libcc1-0 libgcc-s1 libgomp1 libpython3.8 libpython3.8-minimal libpython3.8-stdlib libstdc++
 python3-lib2to3 python3.8 python3.8-minimal zlib1g
16 actualizados, 43 nuevos se instalarán, 0 para eliminar y 489 no actualizados.
    
```

- **MacOS:** in the Python installation in the previous step, Homebrew also installs pip.

We check again if it has been installed using the command "python3 -m pip --version" and see if this time any message is displayed.

Installing Jupyter with pip

Next, we proceed to install Jupyter Notebook with the pip command. This is an interactive work environment that will allow us to develop Python code.

The installation command is:

```
python3 -m pip install jupyter
```

Once the installation is complete, we run it:

```
jupyter notebook
```

```

(base) jaim@jaim-ZenBook-UX325UA-UM325UA:~$ jupyter notebook
[I 2021-11-03 22:50:45.905 LabApp] JupyterLab extension loaded from /home/jaime/anaconda3/lib/python3.8/site-packages/jupyterlab
[I 2021-11-03 22:50:45.905 LabApp] JupyterLab application directory is /home/jaime/anaconda3/share/jupyter/lab
[I 22:50:45.909 NotebookApp] Serving notebooks from local directory: /home/jaime
[I 22:50:45.909 NotebookApp] Jupyter Notebook 6.3.0 is running at:
[I 22:50:45.909 NotebookApp] http://localhost:8888/?token=fce68ec63dc173129e5819a2fd3827e4955ee32dc26364b6
[I 22:50:45.909 NotebookApp] or http://127.0.0.1:8888/?token=fce68ec63dc173129e5819a2fd3827e4955ee32dc26364b6
[I 22:50:45.909 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 22:50:46.007 NotebookApp]

To access the notebook, open this file in a browser:
file:///home/jaime/.local/share/jupyter/runtime/nbserver-3695-open.html
Or copy and paste one of these URLs:
http://localhost:8888/?token=fce68ec63dc173129e5819a2fd3827e4955ee32dc26364b6
or http://127.0.0.1:8888/?token=fce68ec63dc173129e5819a2fd3827e4955ee32dc26364b6
    
```

And we can start working with it by accessing the following address:

<http://localhost:8888>



Installing the Amazon Braket SDK in Python

To work with Amazon Braket locally, we need to install its SDK. To do this, we use the following instruction:

```
python3 -m pip install amazon-braket-sdk
```

Installing the libraries to create services with Flask in Python 3

In order to define quantum services, we need a Python 3 library that allows us to define services. In our case, we have opted for Flask, which is as easy to install as it is to use:

```
python3 -m pip install flask
```

```
python3 -m pip install flask_cors
```

```
python3 -m pip install dwave-ocean-sdk
```

```
python3 -m pip install amazon-braket-ocean-plugin
```

```
python3 -m pip install matplotlib
```

```
python3 -m pip install pandas
```

ADVANCED STEPS: Setting up your environment with Amazon Braket

Amazon Braket is a fully managed quantum computing service designed to help accelerate scientific research and software development for quantum computing. In order to be able to take full advantage of its qualities, beyond developing tests with its SDK that we run locally, we are going to create an AWS account and start actually working with the Amazon Braket service.

AWS Account Creation

To access this service, you will need to have an Amazon Web Services (AWS) account. If you have an account, please go to the next section.

Below are the steps to follow for account creation:

1. Open the Amazon Web Services home page, via the following link.
2. <https://aws.amazon.com/es/>

Iniciar sesión

Usuario raíz
Propietario de la cuenta que realiza tareas que requieren acceso ilimitado. [Más información](#)

Usuario de IAM
Usuario de una cuenta que realiza tareas diarias. [Más información](#)

Dirección de email del usuario raíz

Siguiente

Al continuar, acepta el [Contrato de cliente de AWS](#) u otro acuerdo para los servicios de AWS y el [Aviso de privacidad](#). Este sitio utiliza cookies esenciales. Consulte nuestro [Aviso de cookies](#) para obtener más información.

¿Es nuevo en AWS?

Crear una cuenta de AWS



3. Choose Create an AWS Account.

4. Enter the account information and then choose Continue. Make sure that the account information is correct, especially the email address. If you enter an incorrect email address you will not be able to access your account.



Explore Free Tier products with a new AWS account.

To learn more, visit aws.amazon.com/free.



Sign up for AWS

Email address

You will use this email address to sign in to your new AWS account.

Password

Confirm password

AWS account name

Choose a name for your account. You can change this name in your account settings after you sign up.

Continue (step 1 of 5)

[Sign in to an existing AWS account](#)



5. Choose Personal or Professional. Personal and professional accounts have the same features and functions.
6. Enter your personal or company information. Note that for professional AWS accounts, it is recommended to enter your company phone number instead of a personal phone number.

Free Tier offers

All AWS accounts can explore 3 different types of free offers, depending on the product used.



Always free
Never expires



12 months free
Start from initial sign-up date



Trials
Start from service activation date

Sign up for AWS

Contact Information

How do you plan to use AWS?

- Business - for your work, school, or organization
- Personal - for your own projects

Who should we contact about this account?

Full Name

Phone Number

Enter your country code and your phone number.

Country or Region

Address

Apartment, suite, unit, building, floor, etc.

City

State, Province, or Region

Postal Code

I have read and agree to the terms of the [AWS Customer Agreement](#).

Continue (step 2 of 5)



- You will then be asked to enter your payment method details. Note that we will not be charged for usage below the limits of the AWS free tier. They will only temporarily hold 1 USD/EUR as a pending transaction for 3-5 days to verify your identity.

The screenshot shows the AWS sign-up process. At the top is the AWS logo. Below it is the heading "Sign up for AWS". The "Billing Information" section includes a "Secure verification" box with a shield icon and a checkmark, containing the text: "We will not charge for usage below AWS Free Tier limits. We temporarily hold \$1 USD/EUR as a pending transaction for 3-5 days to verify your identity." Below this is a "Credit or Debit card number" input field, followed by logos for VISA, Mastercard, AMEX, and DISCOVER. A note states: "AWS accepts all major credit and debit cards. To learn more about payment options, review our FAQ". The "Expiration date" section has "Month" and "Year" dropdown menus. The "Cardholder's name" section has an input field. The "Billing address" section has two radio buttons: "Use my contact address" (selected) and "Use a new address". Below the radio buttons is the address: "Avenida de la Universidad s/n", "Cáceres Extremadura 10003", "ES". An orange button labeled "Verify and Continue (step 3 of 5)" is at the bottom. A small note at the bottom right says: "You might be redirected to your bank's website to authorize the verification charge."

- The next step is to verify the phone number. First, you will be shown a code on the screen, and then you will be called on the telephone number you have entered, and you will have to enter the code using the telephone keypad.

Para poder usar su cuenta de AWS, debe verificar su número de teléfono. Cuando continúe, el sistema automatizado de AWS se pondrá en contacto con usted para facilitarle un código de verificación.

¿Cómo deberíamos enviarle el código de verificación?

Mensaje de texto (SMS)
 Llamada de voz

Código de país o región

Número de teléfono

Comprobación de seguridad

gmax5d

Escriba los caracteres que se muestran arriba

Ponerse en contacto conmigo

9. On the next page we choose the Basic plan and click on finish registration.

Seleccione un plan

AWS ofrece una gran variedad de planes para satisfacer sus necesidades. Elija el que mejor se ajuste al uso que haga de AWS. [Más información](#)

Plan Basic	Plan Developer	Plan Business
Gratis	Desde 29 USD al mes	Desde 100 USD al mes
<ul style="list-style-type: none"> Incluido con todas las cuentas Acceso automático ininterrumpido a foros y recursos Comprobaciones de prácticas recomendadas para mejorar la seguridad y el desempeño Acceso al estado y a las notificaciones 	<ul style="list-style-type: none"> Para la adopción temprana, las pruebas y el desarrollo Acceso por correo electrónico a AWS Support en horario laboral El contacto principal puede abrir un número ilimitado de incidencias de soporte Tiempos de respuesta de 12 horas para sistemas que no son de producción 	<ul style="list-style-type: none"> Orientado a cargas de trabajo de producción y dependencias críticas para la empresa Acceso ininterrumpido a AWS Support por chat, teléfono y correo electrónico Cualquier usuario puede abrir un número ilimitado de incidencias de soporte Tiempos de respuesta de 1 hora para sistemas de producción

¿Necesita soporte de nivel Enterprise?

Póngase en contacto con su responsable de cuenta para obtener más información acerca de la ejecución de cargas de trabajo críticas y empresariales en AWS (desde 15 000 USD al mes). [Más información](#)

10. With this, we now have our Amazon AWS account created, and we will be redirected to the login page, where we will be able to access with the data created through the root user.

Iniciar sesión

Usuario raíz

Propietario de la cuenta que realiza tareas que requieren acceso ilimitado. [Más información](#)

Usuario de IAM

Usuario de una cuenta que realiza tareas diarias. [Más información](#)

Dirección de email del usuario raíz

nombredeusuario@ejemplo.com

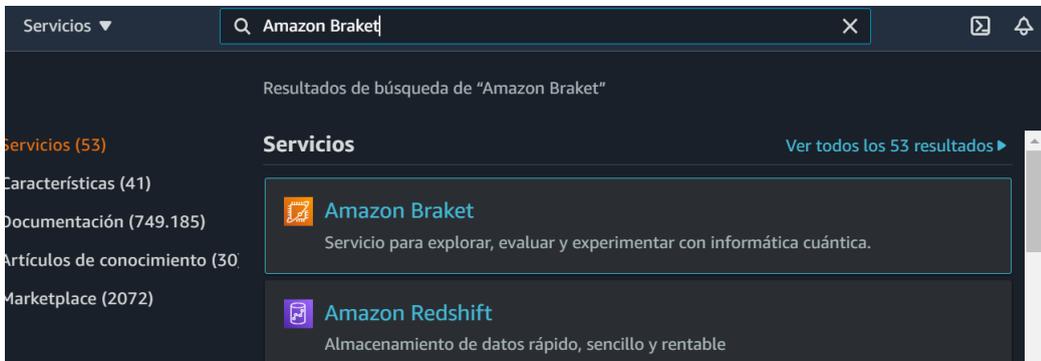
Siguiente

Al continuar, acepta el [Contrato de cliente de AWS](#) u otro acuerdo para los servicios de AWS y el [Aviso de privacidad](#). Este sitio utiliza cookies esenciales. Consulte nuestro [Aviso de cookies](#) para obtener más información.

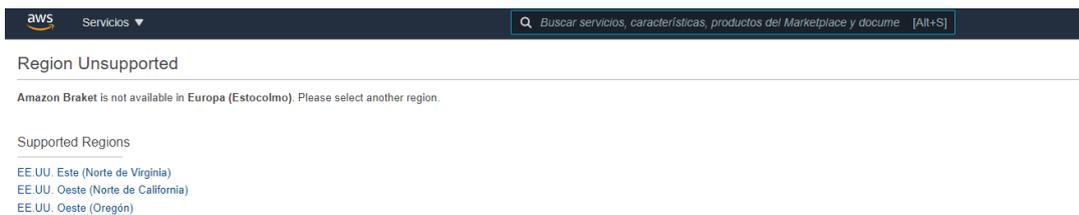
Using the Amazon Braket Jupyter Service

This section describes the steps to follow to use the Amazon Braket service.

1. Once logged into the AWS console, we access the Amazon Braket service.



2. This service is only available in certain regions, so we selected one of the three. In our case Northern Virginia.



3. Amazon Braket stores the results of the algorithms in an S3 bucket, so before entering the service we will be asked to indicate in which bucket we want to save the results. We leave the default option of creating a new bucket checked.

Getting started with Amazon Braket

Amazon Braket provides a development environment to design quantum algorithms, test them on quantum simulators, and run them on a quantum computer. To successfully configure and enable Amazon Braket, you need to use an account that has the AmazonBraketFullAccess. You, or your AWS admin, can attach the policy to your role, user, or group using the IAM console.

[Learn more](#)

Choose your data storage

Amazon Braket stores results from your algorithms in any Amazon S3 bucket starting with "amazon-braket-". To get you started, we can create a new bucket for you, or you choose to name your bucket, or select from a list of existing valid buckets.

- Create new
- Specify new
- Select existing

i We will create the new bucket **amazon-braket-923b4e67f6f0**.

Account permissions

Amazon Braket creates a service-linked role in your account. The role **allows Amazon Braket to access AWS** resources on your behalf. The following permissions policy is attached to the role when you enable Amazon Braket. [Learn more](#)

▶ Permissions

- Once inside the service, in the Notebooks section, proceed to create a new notebook instance by selecting the *Create notebook instance* button.

- During the creation process, we will indicate the type of instance to be created (ml.t3.medium), leaving the other options checked by default.

Notebook instance settings

Notebook instance name
amazon-braket-example
Maximum of 49 alphanumeric characters. Can include hyphens (-), but not spaces. Must be unique within your account in an AWS Region.

Notebook instance type
Instance types comprise varying combinations of CPU, GPU, memory for building, running your quantum tasks
ml.t3.medium

► Additional settings

Permissions and encryption

IAM role
Create a new role

Passing an IAM role gives Amazon SageMaker permission to perform actions in other AWS services on your behalf. Creating a role here will grant permissions described by the AmazonBraketFullAccess IAM policy to the role you create.

Root access — optional
 Enable - Give users root access to the notebook
 Disable - Don't give users root access to the notebook
Lifecycle configurations always have root access.

Encryption key — optional
Encrypt your notebook data. Choose an existing KMS key or enter a key ARN.
No custom encryption key

- With this, we have now created our notebook instance.

Notebooks (1)

Search notebooks

Name contains: amazon-braket- X Clear all

Name	Instance	Creation time	Status	URL
amazon-braket-example	ml.t3.medium	Nov 03, 2021 13:17 (UTC)	InService	amazon-braket-example-7cbc.notebook.us-east-1.sagemaker.aws

- Once the instance has been launched, clicking on its URL will take you to the Jupyter Notebook interface. Amazon Braket Notebook instances are pre-installed with the Amazon Braket SDK and all its dependencies.

jupyter

Open JupyterLab Quit Logout

Files Running Clusters Conda

Select items to perform actions on them.

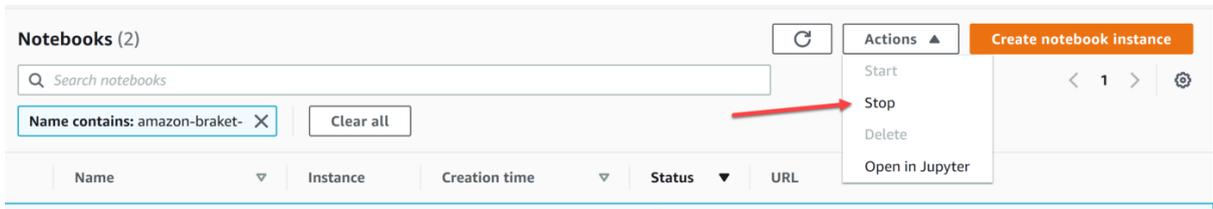
Upload New ↻

Name

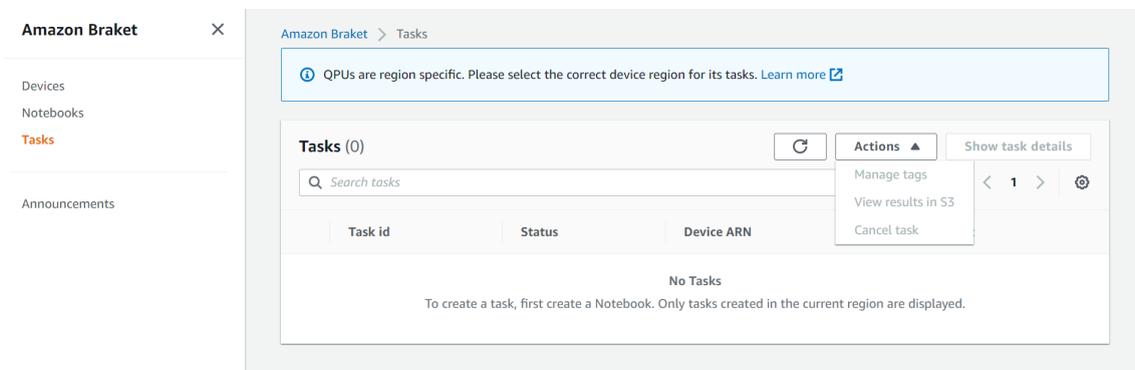
conda_braket

Other:
Text File
Folder
Terminal

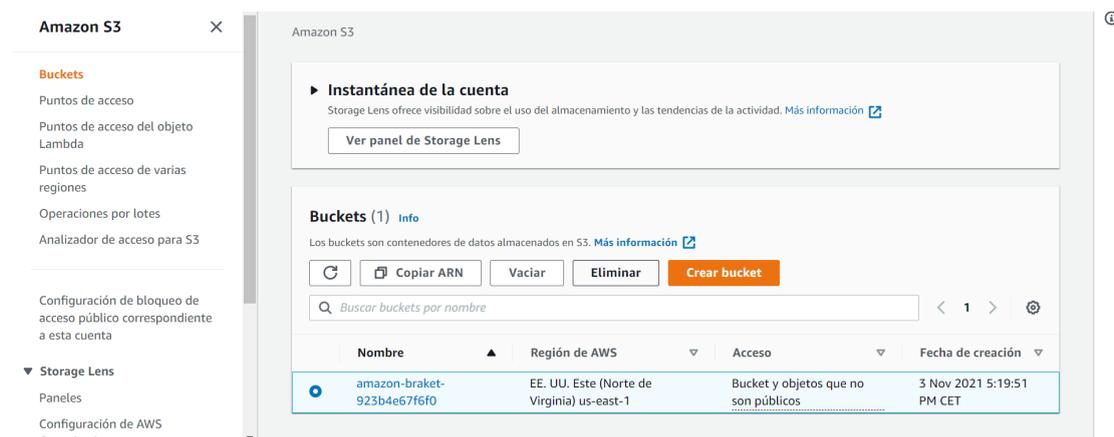
- Once we have finished, it will be necessary to export all the work done in Jupyter and then stop and delete all the instances that have been created to avoid possible costs. First, we will stop and delete the created instance of the notebook.



- We will also cancel any tasks that may be running in the *Tasks* section.



- Finally, in the Amazon S3 service, we will delete the created bucket.



Connecting our quantum services to the AWS account

To connect our quantum services or any code developed on our local machines using the Amazon Braket SDK with the real quantum machines, we will need to connect our computer to our AWS account.

To do this, we will follow the steps below:

1. Create a user in IAM to connect to our AWS account remotely
 - a. Log in to your AWS account and look for the IAM service.

Panel de IAM

Recomendaciones de seguridad

- ⚠️ **Agregar MFA para el usuario raíz**
Habilite la autenticación multifactor (MFA) para el usuario raíz para mejorar la seguridad de esta cuenta. [Agregar MFA](#)
- ✅ **El usuario raíz no tiene claves de acceso activas**
El uso de claves de acceso asociadas a un usuario de IAM en lugar del usuario raíz mejora la seguridad.

Recursos de IAM

Grupos de usuarios	Usuarios	Roles	Políticas	Proveedores de identidad
0	1	4	1	0

Novedades [Ver todo](#)

- b. Click on "users" in the left sidebar and click on "add users".
- c. Type in a user name and check "access by programming":

Añadir usuario(s)

Establecer los detalles del usuario

Puede añadir varios usuarios a la vez con los mismos permisos y el mismo tipo de acceso. [Más información](#)

Nombre de usuario*

[+ Añadir otro usuario](#)

Seleccionar el tipo de acceso de AWS

Seleccione cómo estos usuarios accederán principalmente a AWS. Si elige únicamente el acceso mediante programación, NO evitará que los usuarios accedan a la consola por medio de un rol asumido. Las claves de acceso y las contraseñas generadas automáticamente se proporcionan en el último paso. [Más información](#)

Seleccione el tipo de credenciales de AWS*

- Clave de acceso: acceso mediante programación**
Habilita una **ID de clave de acceso** y una **clave de acceso secreta** para el SDK, la CLI y la API de AWS, además de otras herramientas de desarrollo.
- Contraseña: acceso a la consola de administración de AWS**
Habilita una **contraseña** que permite a los usuarios iniciar sesión en la consola de administración de AWS.

- d. We move on to the next step, where we select "Associate existing policies directly", search for "braket" and select those options that appear:

Añadir usuario(s) 1 2 3 4 5

▼ Establecer permisos

Añadir un usuario al grupo

Copiar permisos de un usuario existente

Asociar directamente las políticas existentes

[Crear una política](#) [↻](#)

Filtrar políticas Mostrando 2 resultados

	Nombre de la política	Tipo	Utilizado como
<input checked="" type="checkbox"/>	AmazonBraketFullAccess	Administrado por AWS	Permissions policy (2)
<input checked="" type="checkbox"/>	AmazonBraketServiceSageMakerNotebookAccess-20210414...	Administrado por el cliente	Permissions policy (2)

► Establecer un límite de permisos

- e. Go to the last step without changing anything in the rest of the steps and click on "Create a user".
- f. We download the .csv with the user keys, which we will need in the next step.
- g. Click on close.

2. Enter the credentials on our computer:

- a. Create a folder ".aws" in the root of your user.
- b. Inside of this folder, we create two files WITHOUT EXTENSION called "credentials" and "config".
- c. In the "credentials" file, we write the following content (replacing the access key id and secret access key with those provided by IAM in the previous step in the .csv):

```
[default]
```

```
aws_access_key_id=AKIAIOSFODNN7EXAMPLE
```

```
aws_secret_access_key=wJalrXUtnFEMI/K7MDENG/bPxrFiCYEXAMPLEKEY
```

- d. In the "config" file, we write the following content (replacing the region with the one we are most interested in):

```
[default]
```

```
region=us-west-2
```

```
output=json
```

3. Install boto3 in our local python 3:
 - a. Open a console.
 - b. Run the command "python3 -m pip install boto3"

During the sessions we will look at what needs to be changed in our quantum code to actually run on Amazon Braket quantum machines and simulators, rather than on our local simulator.

EXTRA: Delete installed software

To delete the software we have installed in the previous steps, we can execute the following instructions:

1. `python3 -m pip uninstall amazon-braket-sdk`
2. `python3 -m pip uninstall flask`
3. `python3 -m pip uninstall flask_cors`
4. `python3 -m pip uninstall dwave-ocean-sdk`
5. `python3 -m pip uninstall amazon-braket-ocean-plugin`
6. `python3 -m pip uninstall tall matplotlib`
7. `python3 -m pip uninstall pandas`
8. `python3 -m pip uninstall boto3` (*if the advanced steps have been followed*)
9. Delete the ".aws" folder of the root of our user (*if the advanced steps have been followed*)
10. Uninstall Python 3:
 - a. Windows: Uninstall like any other program
 - b. Ubuntu: `sudo apt-get remove python3`
 - c. MacOS: you must run the following commands:
 - i. `sudo rm -rf /Library/Frameworks/Python.framework/Versions/3.9`
 - ii. `sudo rm -rf / Applications / Python 3.9`
 - iii. `ls -l / usr / local / bin | grep './Library/Frameworks/Python.framework/Versions/3.9'`
 - iv. `cd / usr / local / bin / ls -l / usr / local / bin | grep './Library/Frameworks/Python.framework/Versions/3.9' | awk '{print $ 9}' | tr -d @ | xargs rm`

11. Delete the IAM user by logging into the IAM dashboard in AWS, selecting the created user and clicking on "*Delete*".

IAM > Usuarios

Usuarios (Seleccionado 1/2) [Información](#)
Un usuario de IAM es una identidad con credenciales válidas a largo plazo que se utiliza para interactuar con AWS en una cuenta.

Eliminar Agregar usuarios

Buscar usuarios por nombre de usuario o clave de acceso

Nombre de usuario	Grupos	Última actividad	MFA	Antigüedad de la contraseña	Antigüedad de la clave activa
<input checked="" type="checkbox"/> aws_braket_sdk	Ninguno	Never	Ninguno	Ninguno	✔ hace 1 minuto
<input type="checkbox"/> python_sdk	Ninguno	✔ Hace 19 días	Ninguno	Ninguno	⚠ Hace 195 días