

# Cloud Computing

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## 1 First Activity

The objective of this activity is to have a first contact with AWS services and to apply the knowledge obtained in the theoretical class.

For this purpose, the EC2 service will be used to prepare and deploy instances in the cloud.

1. Deploy an instance on EC2 that can be accessed by SSH from the outside, which we'll call SSH\_gate.
2. Deploy an instance on EC2 that has a web server that displays your name and your favourite hobby. This machine can only be accessed by SSH from the machine we deployed earlier SSH\_gate.

## 2 EC2

Amazon Elastic Compute Cloud (EC2) is a cloud computing service that provides resizable compute capacity in the cloud. It is a central part of Amazon Web Services (AWS), and it enables you to run virtually any type of application, such as web applications, databases, distributed computing, big data analytics, and machine learning.

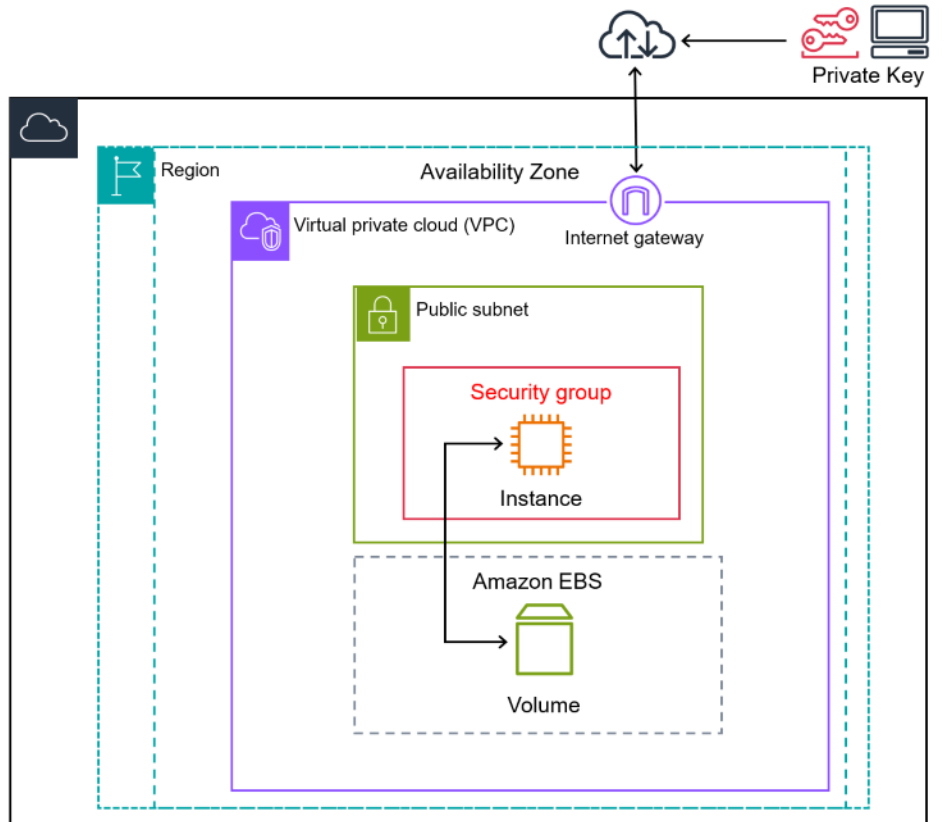
### 2.1 Structure

The diagram below shows a basic architecture of an Amazon EC2 instance deployed within an Amazon Virtual Private Cloud (VPC). In this example, the EC2 instance is within an Availability Zone in the Region.

The EC2 instance is secured with a security group, which is a virtual firewall that controls incoming and outgoing traffic. A private key is stored on the local computer and a public key is stored on the instance. Both keys are specified as a key pair to prove the identity of the user.

In this scenario, the instance is backed by an Amazon EBS volume. The VPC communicates with the internet using an internet gateway.

Structure graph:



### 3 EC2 Instances

To launch an instance:

1. Log on to the site [Login as a Student](#) with your credentials, head to the lab section and start the lab by clicking "Start" in the upper right corner.
2. Once the AWS label in the upper left corner has a green colored dot **AWS** ● it's possible to access the AWS console.
3. From the EC2 console dashboard, in the Launch instance box, choose Launch instance, and then choose Launch instance from the options that appear.
4. Under Name and tags, for Name, enter a descriptive name for the instance. In this exercise the first instance is called **SSH\_GATE**.
5. Under Application and OS images select **Amazon Linux**.
6. Under Instance type, from the Instance type list, select the hardware configuration for your instance. Choose 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, there is a t3.micro instance under the free tier.
7. Under Key pair (login), for **Key pair name**, choose the key pair that you created when getting set up.

### 3.1 Security Groups

Two security groups called **MyFirstGroup** and **MyGroupA** are created in order to take advantage of the AWS architecture and allow only instance of the same group to communicate with each other by specifying it in the incoming rules.

Gruppi di sicurezza (2/7) Informazioni					Operazioni
Q Filtra i gruppi di sicurezza					
	Name	ID gruppo di sicurezza	Nome del gruppo d...	ID VPC	
<input checked="" type="checkbox"/>	-	sg-06530b34a98b92925	MyGroupA	vpc-0c58b681519cf0335	
<input type="checkbox"/>	-	sg-00566d5572877414f	launch-wizard-2	vpc-0c58b681519cf0335	
<input type="checkbox"/>	-	sg-0923f3eeb32766be3	launch-wizard-1	vpc-0c58b681519cf0335	
<input checked="" type="checkbox"/>	-	sg-0f86cd519c9823824	MyFirstGroup	vpc-0c58b681519cf0335	
<input type="checkbox"/>	-	sg-0905a90016cea4bfa	rds-ec2-1	vpc-0c58b681519cf0335	
<input type="checkbox"/>	-	sg-0d4be5ce7180ca630	default	vpc-0c58b681519cf0335	
<input type="checkbox"/>	-	sg-0eb5dde95bb6dde5	ec2-rds-1	vpc-0c58b681519cf0335	

### 3.2 Active Instances

By repeating the same procedures for the second instance **WebInstance**.  
So there are two active instances with Amazon Linux.

Istanze (2) Informazioni									Operazioni
Q Trova l'istanza per attributo o tag (case-sensitive)									
	Name	ID istanza	Stato dell'ista...	Tipo di istanza	Verifica dello st...	Stato dell'all...	Zona di disponi...	DNS IPv4 pubblico	
<input type="checkbox"/>	WebInstance	i-0bc8bb1e3649a06b9	In esecuzione	t2.micro	Inizializzazione in	Nessun allarme	us-east-1c	ec2-34-235-115-116.co...	
<input type="checkbox"/>	SSH_GATE	i-0f5d5503541b3ee2d	In esecuzione	t2.micro	Inizializzazione in	Nessun allarme	us-east-1b	ec2-44-201-241-66.co...	

As required by the exercise, the first instance only will be reachable from PC via SSH:

Regole in entrata					
Q Filtra regole					
Nome	ID della regola del gruppo...	Intervallo porte	Protocollo	Origine	Gruppi di sicurezza
-	sgr-0a77f4b6c70c6d61e	Tutti	Tutti	sg-0f86cd519c9823824	MyGroupA
-	sgr-0a70749292391c6b4	22	TCP	0.0.0.0/0	launch-wizard-1

While the second instance will be accessible only by instances of the same group:

Regole in entrata					
Q Filtra regole					
Nome	ID della regola del gruppo...	Intervallo porte	Protocollo	Origine	Gruppi di sicurezza
-	sgr-0a77f4b6c70c6d61e	Tutti	Tutti	sg-0f86cd519c9823824	MyGroupA

### 3.3 Connection

To connect to the instance via SSH, it was necessary to use the **key pair** created and assigned to the instance (.pem format), the **public address** of the instance (which always varies). Obviously, one must have an **SSH client**. (You can use programs such as Putty but the key must be in .ppk format). The command that you can use is:

```
ssh -i "MYKEY.pem" ec2-user@PUBLICDNS
```

Where "MYKEY.pem" is the key file and "PUBLICDNS" is the public address of the instance you wish to connect to.

**Attention!** In this case, it was used **ec2-user** as the user name. In the case of other systems, the name will change. You can view the list of user names by clicking [here](#).

The result is:

[illegible]

Now it is necessary to **SHARE** key file with the first of the two instances, so that it's possible to use it for a new ssh connection this time not from PC to SSH\_GATE but from SSH\_GATE to WebInstance with these commands:

- In your PC, in the folder where the key is saved, type:  
`scp -i "MYKEY.pem" MYKEY.pem ec2-user@PUBLICDNSofSSH_GATE:/path`
- Now SSH\_GATE has the key and can connect to WebInstance via:  
`ssh -i "MYKEY.pem" ec2-user@PUBLICDNSofWEBINSTANCE`

Once in `WebInstance` we create the web page:

- `sudo yum -y install httpd`
- `cd /var/www/html`
- `sudo nano index.html`
- `sudo systemctl start httpd`

This is an example of webpage to write on index.html:

```
ec2-user@ip-172-31-23-178:/var/www/html
GNU nano 5.8 index.html
<!DOCTYPE html>
<html>
  <head>
Prova
  </head>
  <body>
    I love to play the piano
  </body>
</html>
```

### 3.4 Results

The following is the web page of the WebInstance invoked by the first SSH.GATE instance:

```
[ec2-user@ip-172-31-89-5 key]$ curl http://ec2-34-235-115-116.compute-1.amazonaws.com/index.html
<!DOCTYPE html>
<html>
  <head>
    Prova
  </head>
  <body>
    I love to play the piano
  </body>
</html>
[ec2-user@ip-172-31-89-5 key]$ _
```

To visualize the web page better **w3m** it's possible to be install, below is the result visually better than with **curl**.

```
Prova I love to play the piano
```

Command **w3m** then shows the result of the web page and not its structure, as **curl** shows.

### 3.5 Costs

For this first part of the work on AWS, only two EC2 instances with Amazon Linux with the free plan need to be used. Thus, no costs are needed considering that the instances are only active for a few minutes and are terminated when the lab is stopped.

However, if instances remain active for too many hours, the free plan ends and charges are applied according to the grid below:

Nome	vCPU	RAM (GiB)	Crediti CPU/ora	Prezzo on demand/ora*	Istanza riservata effettiva di 1 anno all'ora*	Istanza riservata effettiva di 3 anno all'ora*
t2.nano	1	0,5	3	0,0058 USD	0,003 USD	0,002 USD
t2.micro	1	1,0	6	0,0116 USD	0,007 USD	0,005 USD
t2.small	1	2	12	0,023 USD	0,014 USD	0,009 USD
t2.medium	2	4	24	0,0464 USD	0,031 USD	0,021 USD
t2.large	2	8	36	0,0928 USD	0,055 USD	0,037 USD
t2.xlarge	4	16	54	0,1856 USD	0,110 USD	0,074 USD
t2.2xlarge	8	32	81	0,3712 USD	0,219 USD	0,148 USD

#### 3.5.1 Long-term analysis

Assuming we keep the instances running, using **t2.micro** as the system, we would then have a consumption of:

- 0.0116 \$/h after 750 hours of use.
- 0.007 \$/h after one year of use.
- 0.005 \$/h after three years of use.

Assuming then that we want to use this setup for our future projects, the overall cost will still remain very low even after hundreds of hours of use. The actual cost based on the number of hours is easily calculated using the data above to be multiplied by the number of hours of use **remembering the hourly rate change based on hours used**.

## 4 Extra

The extra activity involves installing **CLI** in an instance accessible from your PC so that you can stop or restart another instance, thus making the starting instance a kind of "Management Console" for the next instance.

### 4.1 Instances

An instance called "Console" is used as a console so that it can send commands to another instance called "Target".

Once connected to the "Console instance" via SSH from PC, it is possible to install CLI via **bundle**.

1. The command to be executed is:  
**curl "https://s3.amazonaws.com/aws-cli/awscli-bundle.zip" -o "awscli-bundle.zip"**
2. Then the package is unzipped:  
**unzip awscli-bundle.zip**
3. Go into the newly unzipped folder:  
**cd awscli-bundle**
4. Start the installation of CLI using the following command:  
**sudo ./install -i /usr/local/aws -b /usr/local/bin/aws**

#### ATTENTION

Depending on the machine selected, there may be an error such as:

**/usr/bin/env: 'python': No such file or directory may appear.**

In this case (as with the "Console instance" under consideration) you need to enter this other command:

**sudo yum install python-is-python3**

5. Now it is necessary to configure AWS with:  
**aws configure**  
Four parameters are requested (from your IAM user):
  - AWS Access Key ID
  - AWS Secret Access Key
  - Default region name
  - Default output format
6. It's possible to use the command to stop the instance:  
**aws ec2 stop-instances --instance-ids ID\_INSTANCE**  
(Where ID\_INSTANCE is the **id** of the target instance.)

The instance now appears to be **stopped**, you can replicate the previous command with **start** instead of **stop** to restart it.

## 4.2 Problems and Peculiarities

In order to complete the extra activity, you must be able to create an IAM Account in the AWS IAM management panel.

The AWS Academy account that students have **DOES NOT PERMIT** the creation of IAM accounts, limiting the ability to control and manage instances.

## 4.3 Alternative Ways

- A different way from the one presented above is to create an **IAM Role** to be associated with the "Console instance" so that this instance can be used to turn the other one off and on.
- It's possible to create a **Lambda function** to be launched from the "Console instance" that performs the shutdown action of another instance, but still requires access from IAM user.
- **For AWS Academy accounts**  
For this type of limited account, it is impossible to carry out the extra activity in the manner previously reported. But you have a Role **LabInstanceProfile** already configured that you can assign to the console instance.

EC2 > Istanze > i-027b29a2da57dc8e8 > Modifica il ruolo IAM

### Modifica il ruolo IAM [Informazioni](#)

Collega un ruolo IAM all'istanza.

ID istanza  
i-027b29a2da57dc8e8 (Console)

Ruolo IAM  
Seleziona un ruolo IAM da collegare all'istanza o creane uno nuovo, se non ne hai già creato uno. Il ruolo selezionato sostituisce tutti i ruoli attualmente collegati all'istanza.

LabInstanceProfile
















[Crea un nuovo ruolo IAM](#)

This account does not need **Access key** and **Secret key** like an IAM account, so you only need to specify **Region name** to be able to manage the other instances.  
The code used is shown below:

```
[ec2-user@ip-172-31-41-243 ~]$ aws configure
AWS Access Key ID [None]:
AWS Secret Access Key [None]:
Default region name [us-east-1]: us-east-1
Default output format [None]:
[ec2-user@ip-172-31-41-243 ~]$ aws ec2 stop-instances --instance-ids i-0ca9facc5de3d177c
{
  "StoppingInstances": [
    {
      "CurrentState": {
        "Code": 64,
        "Name": "stopping"
      },
      "InstanceId": "i-0ca9facc5de3d177c",
      "PreviousState": {
        "Code": 16,
        "Name": "running"
      }
    }
  ]
}
```



As reported in the terminal, the state of instance is **Stopping**.  
This change can be observed in the AWS Dashboard:

	Name 	ID istanza	Stato dell'ista... 
<input checked="" type="checkbox"/>	Target	i-0ca9facc5de3d177c	 Arrestato  
<input type="checkbox"/>	WebInstance	i-0bc8bb1e3649a06b9	 In esecuzione  
<input type="checkbox"/>	SSH_GATE	i-0f5d5503541b3ee2d	 In esecuzione  
<input type="checkbox"/>	Console	i-027b29a2da57dc8e8	 In esecuzione  

Again, by re-launching the command with **start** instead of **stop**, it is possible to start the instance.

#### 4.4 Costs

This extra activity does not involve any additional costs compared with the previous analysis, as the same instances are simply used.

The packages to be downloaded are free, and the executed commands are terminated almost instantaneously.