

# CLD Lab 01: Deploy web application on Infrastructure as a Service

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## Task 1: Set Up

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There are 2 things to do before creating and setting up our EC2 Instance. We need to create a keypair in order to be able to connect to the EC2 Instance via SSH and we also need to set up a security group in order to open the port 22 (SSH) and add other useful rules.

A security group controls the traffic that is allowed to reach and leave the resources that it is associated with. For example, after you associate a security group with an EC2 instance, it controls the inbound and outbound traffic for the instance. source: <https://docs.aws.amazon.com/vpc/latest/userguide/vpc-security-groups.html> (<https://docs.aws.amazon.com/vpc/latest/userguide/vpc-security-groups.html>).

### 1.1 Creating Keypair

In order to connect to our instance later using SSH, we must generate a key pair for authentication. Here are the steps to follow:

1. From the left menu on the EC2 dashboard, go to **Network & Security** -> **Key Pairs**
2. Click on **Create key pair** on the top right corner
3. Choose a name following our labs naming convention
4. Select **RSA** or **ED25519** encryption, note: **ED25519** only works for **Linux/Mac** instances
5. Choose the private key file format depending on your SSH client:
  - .pem for openSSH
  - .ppk for Putty (we used this in our lab)
6. Create a tag with "Name" as key and "GrX\_surname"
7. Click on **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

##### Key



##### Value - optional

[Remove](#)

*Window for creating a key pair*

## 1.2 Security Group Setup

In order to connect to our instance later using SSH, we must open the SSH port (22). Here are the steps to follow:

1. From the left menu on the EC2 dashboard, go to **Network & Security** -> **Security groups**.
2. Click on **Create security group** on the top right corner.
3. Type a name and a description (optional) for the security group.
4. Add an inbound rule by clicking on **Add rule** button.
5. Select SSH from the **Type** drop down menu.
6. Select **Anywhere-IPv4** from the **Source type** drop down menu.
7. Add an optional description
8. Click on the **Add rule** button.
9. Click on **Create security group** button on the bottom right.

Allow traffic from anywhere (0.0.0.0/0) to port 22/SSH.

Inbound rules [Info](#)

Security group rule ID	Type <a href="#">Info</a>	Protocol <a href="#">Info</a>	Port range <a href="#">Info</a>	Source <a href="#">Info</a>	Description - optional <a href="#">Info</a>	
sgr-0023c33e899858bd0	SSH ▼	TCP	22	Cu... ▼	<input type="text"/>	<input type="button" value="Delete"/>
				<input type="text" value="0.0.0.0/0"/>		

Window for creating a security group

## Task 2: Create an Amazon EC2 instance

What is the smallest and the biggest instance type (in terms of virtual CPUs and memory) that you can choose from when creating an instance?

Smallest :

- t2.nano
- 1 vCPU
- 0.5 GiB of RAM

Biggest :

- u-24tb1.112xlarge
- 448 vCPU
- 24576 GiB of RAM

How long did it take for the new instance to get into the running state?

Time running instance : < 30 seconds

From the EC2 Management Console copy the public DNS name of the instance into the report.

DNS name : [ec2-34-236-143-180.compute-1.amazonaws.com](http://ec2-34-236-143-180.compute-1.amazonaws.com) (<http://ec2-34-236-143-180.compute-1.amazonaws.com>)

What's the difference between time here in Switzerland and the time set on the machine?

Instance machine : UTC (+0)

Local machine : UTC (+1)

One hour difference.

```
ubuntu@ip-172-31-26-63:~$ timedatectl
      Local time: Tue 2024-02-27 12:18:20 UTC
      Universal time: Tue 2024-02-27 12:18:20 UTC
      RTC time: Tue 2024-02-27 12:18:20
      Time zone: Etc/UTC (UTC, +0000)
System clock synchronized: yes
      NTP service: active
      RTC in local TZ: no
```

*Check the status and synchronisation of time bases*

What's the name of the hypervisor?

Hypervisor name : XEN hypervisor

found with the commandline : lscpu

How much free space does the disk have?

```
ubuntu@ip-172-31-26-63:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        7.6G  1.8G   5.8G  24% /
tmpfs            475M      0  475M   0% /dev/shm
tmpfs            190M  840K  190M   1% /run
tmpfs            5.0M      0   5.0M   0% /run/lock
/dev/xvda15      105M   6.1M   99M   6% /boot/efi
tmpfs            95M    4.0K   95M   1% /run/user/1000
```

*provides valuable information on disk space utilization*

The information of the free space disk is on the line of the Filesystem /dev/root in the column Avail. and it's equal to 5.8G.

Try to ping the instance from your local machine. What do you see? Explain. Change the configuration to make it work. Ping the instance, record 5 round-trip times.

```
C:\Users\Dell>ping 50.17.5.124

Pinging 50.17.5.124 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 50.17.5.124:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

*ping request on the public address of the instance*

The instance don't respond to the sending ping. That's why we have "Request timed out" and 0 received and all sending packets are lost. This problem is due of the firewall of the instance that don't accept inbound ICMP request. So we need to add an inbound rules in the firewall for to allow incoming ping(ICMP).

### Inbound rule 2

[Delete](#)

Security group rule ID

sgr-0c6dee53d5c124ade

Type [Info](#)

Custom ICMP - IPv4 ▼

Protocol [Info](#)

Echo Request ▼

Port range [Info](#)

N/A

Source type [Info](#)

Anywhere-IPv4 ▼

Source [Info](#)



0.0.0.0/0 ✕

Description - optional [Info](#)

*Window for adding a rule in security groupe*

Result after add inbound ICMP in firewall.

```
C:\Users\Dell>ping 50.17.5.124 -n 5

Pinging 50.17.5.124 with 32 bytes of data:
Reply from 50.17.5.124: bytes=32 time=110ms TTL=43
Reply from 50.17.5.124: bytes=32 time=110ms TTL=43
Reply from 50.17.5.124: bytes=32 time=108ms TTL=43
Reply from 50.17.5.124: bytes=32 time=109ms TTL=43
Reply from 50.17.5.124: bytes=32 time=109ms TTL=43

Ping statistics for 50.17.5.124:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 108ms, Maximum = 110ms, Average = 109ms
```

*ping request on the public address of the instance*

Determine the IP address seen by the operating system in the EC2 instance by running the ifconfig command. What type of address is it? Compare it to the address displayed by the ping command earlier. How do you explain that you can successfully communicate with the machine?

```
ubuntu@ip-172-31-26-63:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 9001
    inet 172.31.26.63  netmask 255.255.240.0  broadcast 172.31.31.255
    inet6 fe80::8de:5aff:feal:6ce7  prefixlen 64  scopeid 0x20<link>
    ether 0a:de:5a:a1:6c:e7  txqueuelen 1000  (Ethernet)
    RX packets 91247  bytes 132623407 (132.6 MB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 3699  bytes 366477 (366.4 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop txqueuelen 1000  (Local Loopback)
    RX packets 126  bytes 14542 (14.5 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 126  bytes 14542 (14.5 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

*Information of the network interfaces*

It's a private address of class B.

ifconfig IP address	ping IP address
172.31.26.63	50.17.5.124

The address use to ping is a public address from class A.

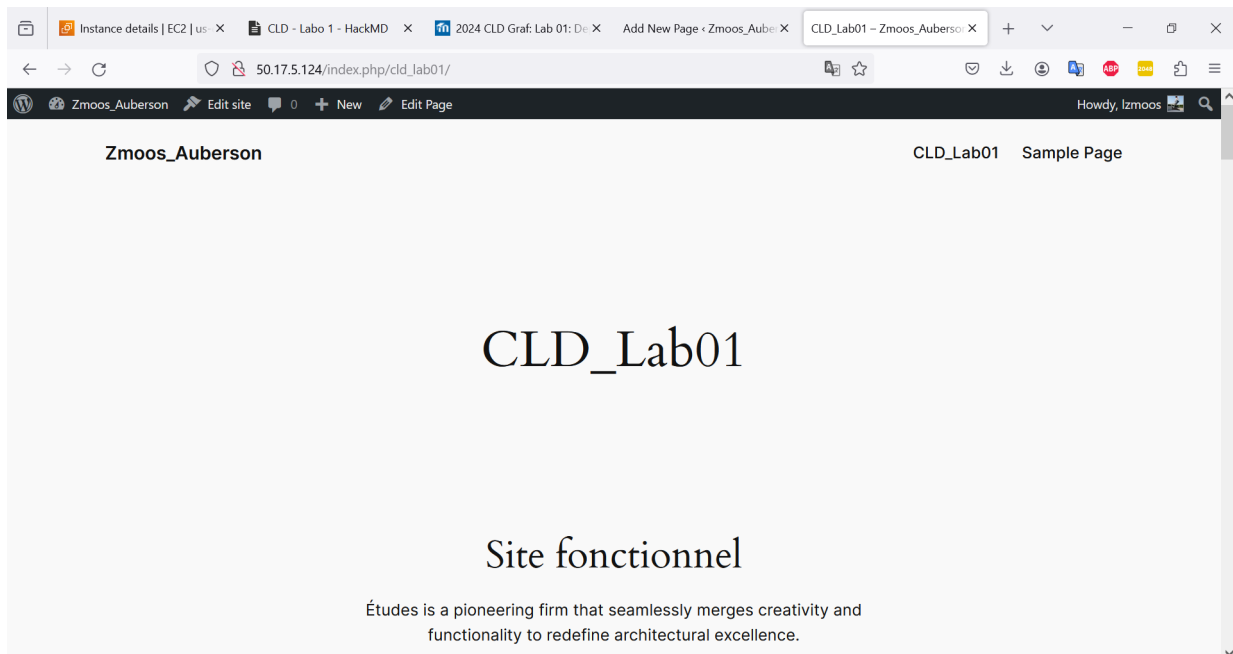
We can successfully communicate with our instance because there is the method of NAT activated. That mapping an private IP address into a public IP address.

Within the datacenter, each machine possesses a private address, inaccessible from outside. It's the responsibility of the datacenter routers to manage the routing of every incoming and outgoing packet. Thus, we have two distinct addresses: one for the local network, linked to our instance, and a public one accessible from outside the local network, facilitated by the router.

## Task 3: Install a web application

[http://50.17.5.124/index.php/cld\\_lab01/](http://50.17.5.124/index.php/cld_lab01/) ([http://50.17.5.124/index.php/cld\\_lab01/](http://50.17.5.124/index.php/cld_lab01/))

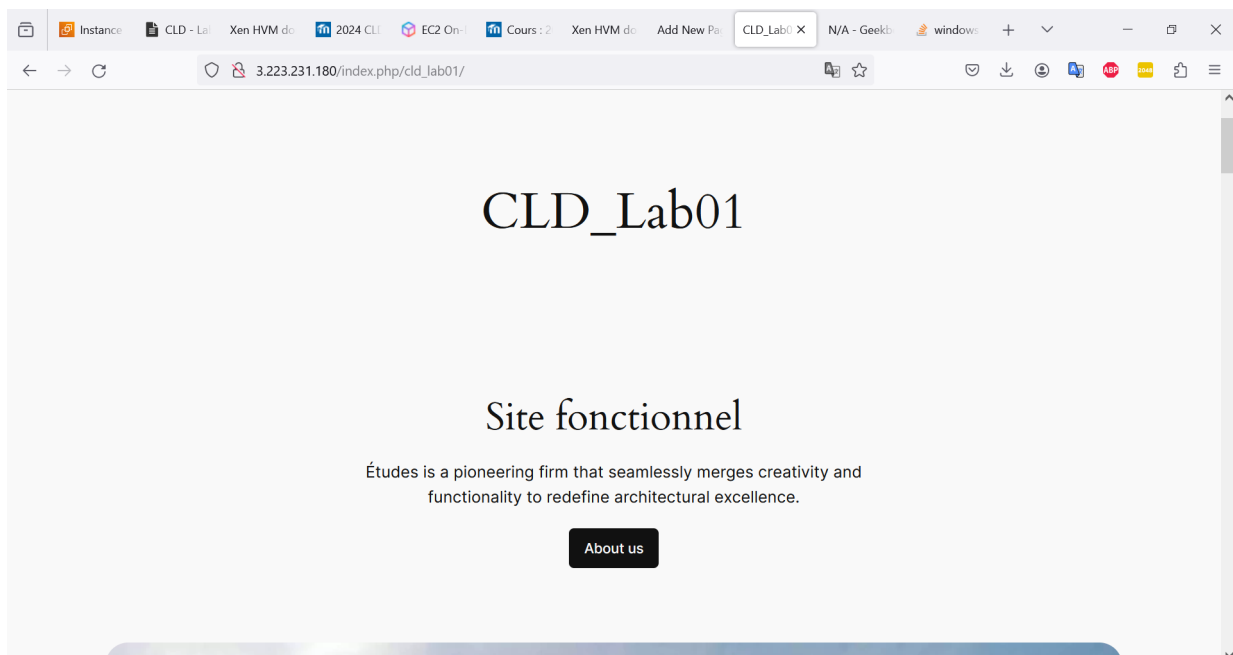
Add a screenshot of the page you created in Wordpress to the report.



*Access to the Wordpress index*

Add the Elastic IP Address you created to the report.

Elastic address: 3.223.231.180



*Access to the Wordpress index with elastic address*

**Elastic IP address associated successfully.**  
Elastic IP address 3.223.231.180 has been associated with instance i-068f5384ddcba0e4e

EC2 > Elastic IP addresses > 3.223.231.180

3.223.231.180

Actions Associate Elastic IP address

**Summary**

Allocated IPv4 address 3.223.231.180	Type Public IP	Allocation ID eipalloc-038e9a9a3b51bdeb	Reverse DNS record -
Association ID eipassoc-041b8548abe05edda	Scope VPC	Associated instance ID <a href="#">i-068f5384ddcba0e4e</a>	Private IP address 172.31.26.63
Network interface ID <a href="#">eni-0fee39e8887546bd3</a>	Network interface owner account ID 851725581851	Public DNS ec2-3-223-231-180.compute-1.amazonaws.com	NAT Gateway ID -

### association of the elastic address

EC2 > Instances > i-068f5384ddcba0e4e

**Instance summary for i-068f5384ddcba0e4e (GrR\_Zmoos)** info

Updated 4 minutes ago

Connect Instance state Actions

Instance ID i-068f5384ddcba0e4e (GrR_Zmoos)	Public IPv4 address 3.223.231.180 (GrR_Zmoos) <a href="#">open address</a>	Private IPv4 addresses 172.31.26.63
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-3-223-231-180.compute-1.amazonaws.com   <a href="#">open address</a>
Hostname type IP name: ip-172-31-26-63.ec2.internal	Private IP DNS name (IPv4 only) ip-172-31-26-63.ec2.internal	Elastic IP addresses 3.223.231.180 (GrR_Zmoos) [Public IP]
Answer private resource DNS name IPv4 (A)	Instance type t2.micro	AWS Compute Optimizer finding User: arn:aws:iam::851725581851:user/leo.zmoos is not authorized to perform: compute-optimizer:GetEnrollmentStatus on resource: * because no identity-based policy allows the compute-optimizer:GetEnrollmentSt
Auto-assigned IP address -	VPC ID vpc-049e2f8e56e0bafef	

### validation of elastic association

Why is it a good idea to create an Elastic IP Address for a web site (our web application)? Why is it not sufficient to hand out as URL for the web site the public DNS name of the instance?

Creating an Elastic IP Address for a website is advisable to ensure a static address, thus avoiding issues with IP address expiration in DHCP configurations or the assignment of new addresses upon server restarts.

The public DNS name of an instance is associated with its IP address, which can change whenever the instance is stopped and restarted. This means that if the IP address changes, the DNS name associated with it will also change, and users will no longer be able to access the website.



Furthermore, when using the public DNS name, we have no control over the DNS record. This means that we cannot configure SSL certificates, subdomains or other DNS features, which may be necessary for our website.

## Task 4: Performance analysis of your instance

Provide the URLs of the Geekbench results for the EC2 instance and your local machine.

<http://browser.primatelabs.com/geekbench3/9072454> (<http://browser.primatelabs.com/geekbench3/9072454>)

Provide system information about the EC2 instance.

### System Information

Xen HVM domU	
Operating System	Ubuntu 22.04.3 LTS 6.2.0-1017-aws x86_64
Model	Xen HVM domU
Processor	Intel Xeon E5-2676 v3 @ 2.40 GHz 1 Processor, 1 Core
Processor ID	GenuineIntel Family 6 Model 63 Stepping 2
L1 Instruction Cache	32 KB
L1 Data Cache	32 KB
L2 Cache	256 KB
L3 Cache	30720 KB
Motherboard	N/A
BIOS	Xen 4.11.amazon
Memory	949 MB

*System information of the instance*

Provide the single-core and multi-core performance scores for overall, integer, floating-point and memory performance of the EC2 instance.

### Integer Performance

Single-core	2640
Multi-core	2633

*Instance result on integer performance*

### Floating Point Performance

Single-core	2567
Multi-core	2558

*Instance result on floating point performance*

## Memory Performance

Single-core	2828
Multi-core	2799

*Instance result on memory performance*

Provide system information about your local machine.

<http://browser.primatelabs.com/geekbench3/9072464> (<http://browser.primatelabs.com/geekbench3/9072464>)

## System Information

	N/A
Operating System	Ubuntu 20.04.6 LTS 5.10.16.3-microsoft-standard-WSL2 x86_64
Model	N/A
Processor	Intel Core i5-4310U @ 2.59 GHz 1 Processor, 2 Cores, 4 Threads
Processor ID	GenuineIntel Family 6 Model 69 Stepping 1
L1 Instruction Cache	32 KB x 2
L1 Data Cache	32 KB x 2
L2 Cache	256 KB x 2
L3 Cache	3072 KB
Motherboard	N/A
BIOS	
Memory	12.41 GB

*System information of the local machine.*

Provide the single-core and multi-core performance scores for overall, integer, floating-point and memory performance of your local machine.

## Integer Performance

Single-core	2872
Multi-core	6188

*Local machine result on integer performance*

## Floating Point Performance

Single-core	2753
Multi-core	5832

*Local machine result on floating point performance*

## Memory Performance

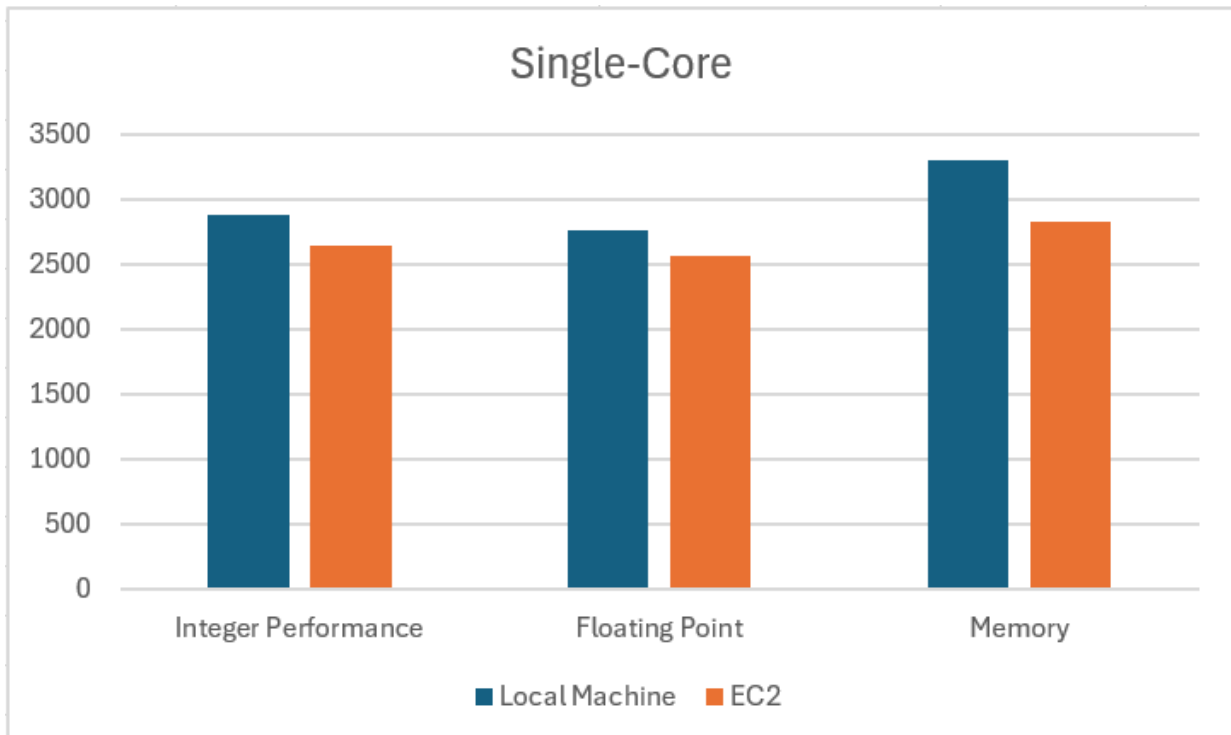
Single-core	3298
Multi-core	3323

*Local machine result on memory performance*

Compare the overall scores of the two machines.

## Comparison

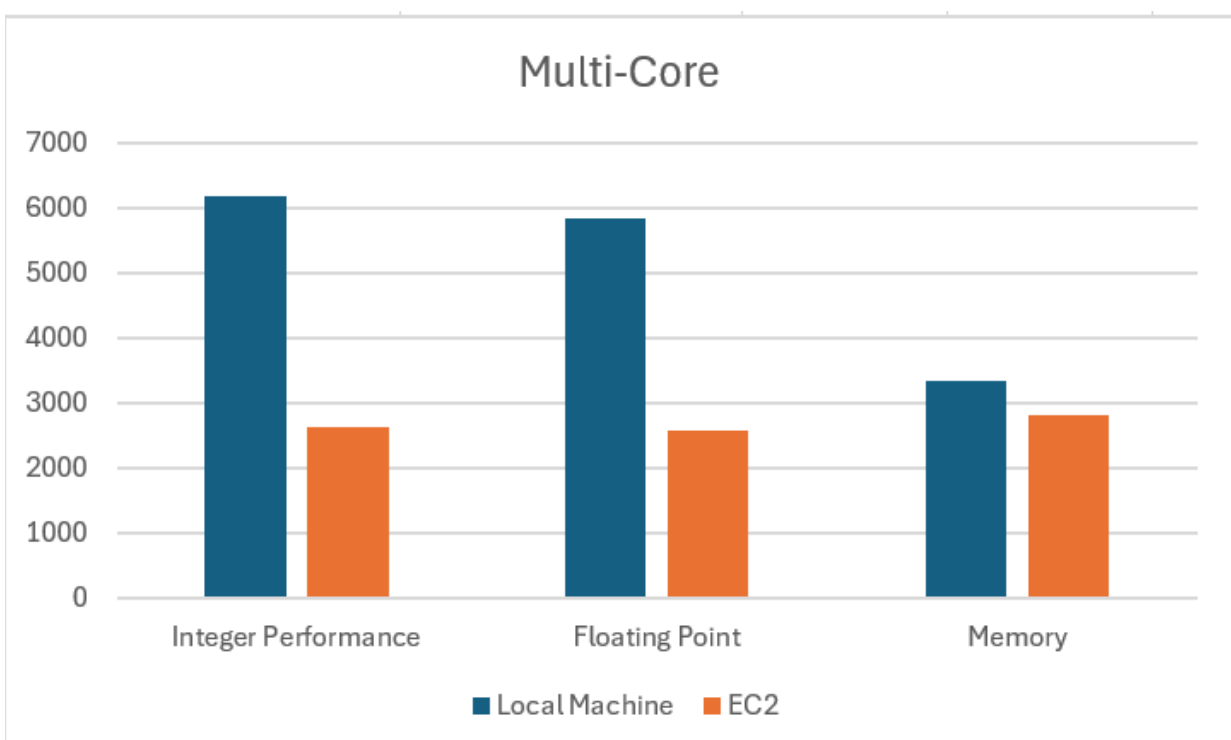
This is a graphic that represent the result of the benchmark in Single-Core and Multi-Core of each processor of the local machine and the instance on EC2.



There is a small difference on the single-core due to different type of processor.

Instance : Intel Xeon E5-2676 v3 @ 2.40 GHz

Local machine : Intel Core i5-4310U @ 2.59 GHz



The big difference between local machine and the instance is that the instance have a single-core processor.

Instance : 1 Processor, 1 Core

Local machine : 1 Processor, 2 Cores, 4 Threads

## Task 5: Resource consumption and pricing

How much does your instance (including disk) cost per hour? What was its cost for this lab?

### Instance cost

Instance cost: 0.0116\$ per hour.

The instance has been running for 3 hours in total. So the total cost for this lab is:  
 $3 * 0.0116\$ = 0,0348\$$

Q t2.micro

X

1 match

< 1 >

Instance name	On-Demand hourly rate	vCPU	Memory	Storage	Network performance
t2.micro	\$0.0116	1	1 GiB	EBS Only	Low to Moderate

Change the parameters to an instance that runs continuously during the whole month. Note the total cost.

As discussed with the lab assistant, I'll simply compute the total instance cost like this:

$$24 * 30 * 0.0116\$ = 8,352\$$$

### Drive cost

When you buy a hard drive at Digitec (<https://www.digitec.ch/en/producttype/hard-drives-36>) how much do you pay per TB? (Look at the best selling model, which is the first in the list. Prices per TB are shown in gray.) How much does a 1 TB ESB Volume cost for a month?

According to Digitec, this hard drive is the top selling one:

<https://www.digitec.ch/en/s1/product/wd-red-plus-4-tb-35-cmr-hard-drives-22886688>

The price is 105.- CHF for 4TB so 26.25.- CHF per TB.

## Storage cost

According to <https://aws.amazon.com/ebs/pricing/> (<https://aws.amazon.com/ebs/pricing/>) , the lowest SSD (General Purpose SSD (gp3) - Storage) pricing is \$0.08 per GB-month.

So for 1TB(1000GB), it would cost  $1000 * 0.08\$ = 80\$$  by month.

Calculate the total cost of the configuration used in the lab if everything was running continuously in production during a whole month. Take additionally into consideration the resources below.

Prices for data transfer: Consider the data transfer from the EC2 Instance to the users. Assume 100'000 visitors downloading 85 MB each.

Calcul:

$$((NbVisitor * 85)/1000) * cost = ((100000 * 85)/1000) * 0.09 = 765\$$$

Cost:

First 10 TB / Month	\$0.09 per GB
---------------------	------------------

Prices for public IPv4 addresses:

According to <https://aws.amazon.com/vpc/pricing/> (<https://aws.amazon.com/vpc/pricing/>).

Hourly charge for In-use Public IPv4 Address \$0.005

Hourly charge for Idle Public IPv4 Address \$0.005

Assuming that the instance will run 24h/24 so the public IPv4 also need to be available 24h/24 => total cost is:  $cost * nbDays * nbHoursByDay = 0.005 * 30 * 24 = 3,6\$$

## Total cost

Here is the detailed explanation of the total cost for one month (24h/24):

Instance	EBS Volume (Storage)	Data Transfer	Public IPv4 adress	Total
8,352\$	80\$	765\$	3.6\$	856.952\$