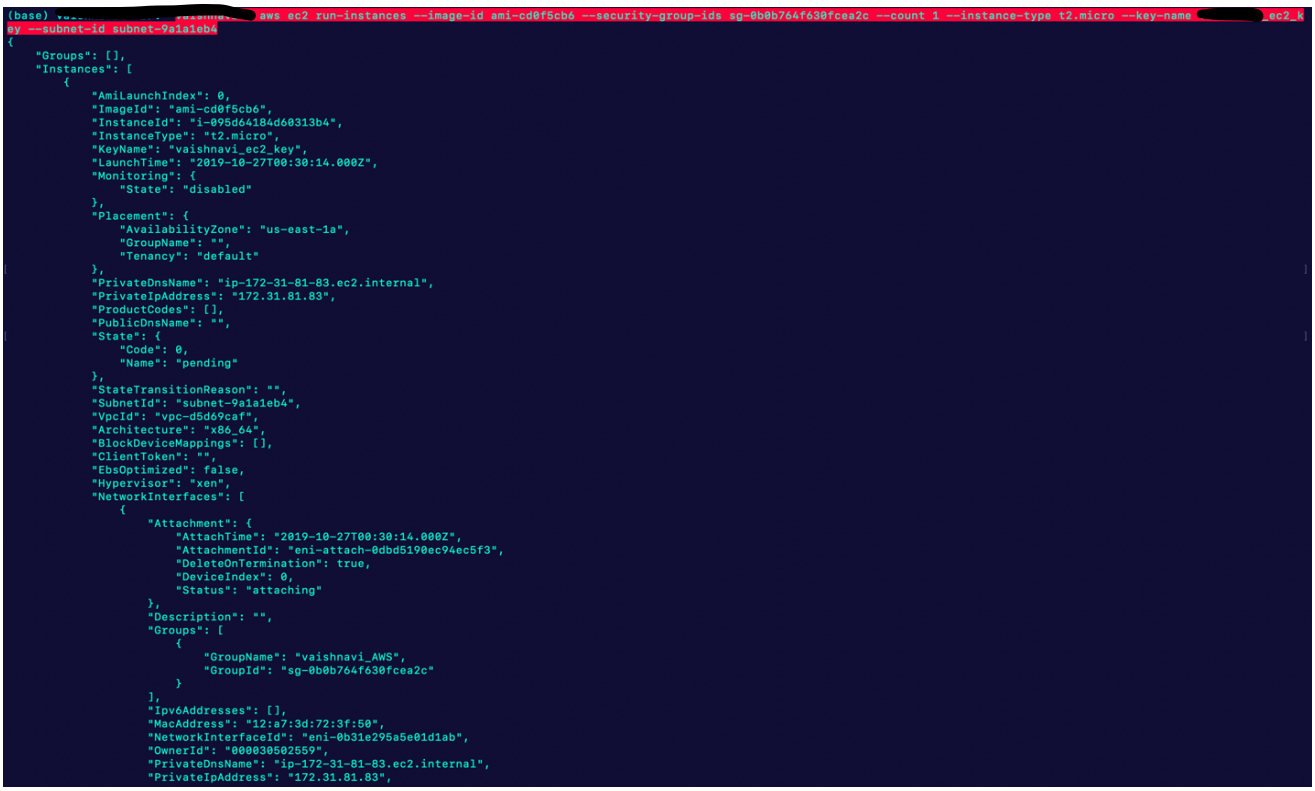
Cloud computing – project 2 - Using AWS and Docker

[redacted] [redacted]

1.1:

Command:

aws ec2 run-instances --image-id ami-cd0f5cb6 --security-group-ids sg-0b0b764f630fcea2c --count 1 --instance-type t2.micro --key-name [redacted]_ec2_key --subnet-id subnet-9a1a1eb4



SSH:login_command : ssh -i[redacted]_ec2_key.pem ubuntu@3.83.204.90

```
(base) [redacted]-MBP:~ [redacted]v$ ssh -i [redacted]_ec2_key.pem ubuntu@3.83.204.90
The authenticity of host '3.83.204.90 (3.83.204.90)' can't be established.
ECDSA key fingerprint is SHA256:GozrNhSSoEfi1/7FHPYqedJDeXJCsZavSxgJIy7oq9Q.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '3.83.204.90' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.4.0-1022-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  Get cloud support with Ubuntu Advantage Cloud Guest:
    http://www.ubuntu.com/business/services/cloud

0 packages can be updated.
0 updates are security updates.



The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-172-31-81-83:~$
```

1.2:

Command: python aws_boto_createInstances.py 2

Code:

```
mport boto3
import time
import sys

ec2=boto3.resource('ec2')


#check status of created instances
def check_Instance_status(instance_id):

    status = True # not running
    while(status):
        i=ec2.Instance(instance_id)
        #print(i.state['Code'])
        #check condition for "pending" and if pending sleep for 10 secs
        if i.state['Code']==0:
            time.sleep(10)
            status=True
        #check condition  for shutting-
down ,terminated,stopping and stopped,if instance status condition is met break loop w
ith current status of instance
```

```
        elif i.state['Code']==32 or i.state['Code']==48 or i.state['Code']==64 or i.st
ate['Code']==80 :
            if i.state['Code']==32 :
                error_status = 'Shutting-down'
            elif i.state['Code']==48 :
                error_status = 'Terminated'
            elif i.state['Code'] == 64:
                error_status = 'Stopping'
            elif i.state['Code']==80:
                error_status = 'Stopped'
            print("Instance {} has problem to start up or {}".format(instance_id,erro
r_status))
            instance_id=None
            status=False
        #condition check for "running" status of ec2 instance
        elif i.state['Code']==16:
            print("Instance {} has sucessfully started/running".format(instance_id))
            status = False

    return instance_id

#create ec2 instance
def create_ec2_instances(count_instances):
    #creates required number of instances for given ImageId
    return ec2.create_instances(ImageId='ami-
cd0f5cb6',InstanceType='t2.micro',SecurityGroupIds=['sg-0b0b764f630fcea2c'], \
                                    SubnetId='subnet-
9a1a1eb4', MaxCount=count_instances, MinCount=1, KeyName='vaishnavi_ec2_key')


if __name__=="__main__":
    num_instances=sys.argv[1]
    instances_created=create_ec2_instances(int(num_instances))
    print("Creating {} EC2 instances".format(int(num_instances)))
    instance_running=[]
    #iteratively check status of the instance created
    for i in instances_created:
        print("Instances with {} id has startup status {} ".format(i.id, i.state))
        instance_running.append(check_Instance_status(i.id))
    #print list of instances with running status
    print("list of instance id's with status code as running are \n",instance_running)

    #terminate all running instances .
    for i in ec2.instances.all():
        i.terminate()
```

1.3: Bucket name: [redacted]-cc-bucket4a0d4f90-c611-43ae-85c8-c4304d8f625c
Command: python aws_boto_s3_copy.py
Code:

```
import boto3
import botocore
import uuid,time

#generates unique bucket name
def generate_bucket_name(bucketName):
    #generates unique bucket name with bucketName argument as prefix for readable buck
et name
    return "".join([bucketName,str(uuid.uuid4())])
#create bucket at particular location where boto3 creates the session
def create_bucket(bucketName,s3):
    session=boto3.session.Session()
    region=session.region_name
    bucketName=generate_bucket_name(bucketName)
    #print(bucketName,region)
    if region == 'us-east-1':
        response=s3.create_bucket(Bucket=bucketName)
    else:
        response=s3.create_bucket(ucket=bucketName,CreateBucketConfiguration={'Locatio
nConstraint': region})

    return bucketName,response

#making bucket public
def make_bucket_public(bucket_name):
    time.sleep(1)
    s3.put_bucket_acl(Bucket=bucket_name,ACL='public-read-write')
    print("ACL set to public - read - write for bucket {}".format(bucket_name))

#copy files from one bucket to another
def bucket_copy(source_bucket_name,destination_bucket_name,key_filename):
    source= {'Bucket':source_bucket_name,'Key':key_filename}
    s3.copy(source,destination_bucket_name,key_filename)
    print("File {} sucessfully copied from {} to {}".format(key_filename,source_bucket
_name,destination_bucket_name))

#read contents of bucket
def read_files(bucketName,key):
    data=s3.get_object(Bucket=bucketName,Key=key)
    #(data)
    return data['Body'].read().decode()
```

```
#perform operations on bucket
#check for existance of bucket
#check if bucket is not empty

def Bucket_operations(source_bucket_name,destination_bucket_name):
    #code to check if bucket is not empty
    exists=True
    try:
        s3.head_bucket(Bucket=source_bucket_name)
        print("{} Bucket exist".format(source_bucket_name))
    except botocore.exceptions.ClientError as e:
        #check for any exception if error is 404 bucket does not exist
        #throw execption that the given bucket does not exist
        error_code=int(e.response['Error']['Code'])
        if error_code==404:
            print("{} Bucket does not exist".format(source_bucket_name))
            exists=False
    # perform file read and copy file content to destination bucket if bucket is not e
mpty
    if (exists):
        #finding all files in source bucket
        http_response = s3.list_objects_v2(Bucket=source_bucket_name)
        #return file names if files exist else store None in Keys_exist
        keys_exist=http_response.get('Contents')
        if keys_exist!=None:
                for file_metadata in http_response.get('Contents',[]):
                        key = file_metadata['Key']
                    #if file_metadata['Size']!=0:
                        try:
                                # read contents in files
                                content = read_files(source_bucket_name, key)
                                print("=======" * 10)
                                print("Filename name : {}".format(key))
                                # print content
                                print("*******"*10)
                                print(content)
                                print("*******"*10)
                                # copying files to bucket
                                bucket_copy(source_bucket_name, destination_bucket_nam
e, key)
                        except Exception as e:
                            #exception will be passed if directory or file is empty
                            pass
                    #else:
                    #    print("{} file is empty".format(key))
        else:
            print("Bucket is empty")
#create resource s3
```

```
if __name__=="__main__":
    s3=boto3.client('s3')
    source_bucket_name="wsu2017fall"
    destination_bucket_name,b_response=create_bucket("vaishnavi-cc-bucket",s3)
    print("My bucket Name{}".format(destination_bucket_name))
    make_bucket_public(destination_bucket_name)
    Bucket_operations(source_bucket_name,destination_bucket_name)
```

1.4:

1.4.1 :Docker_File

```
FROM ubuntu:latest

#Intial setup of commands and required softwares.
RUN apt-get update &&\
    apt-get install -y openssh-server  openjdk-8-jdk python3 curl &&\
    ln -s /usr/bin/python3 /usr/bin/python && \
    apt-get clean

#ssh server setup
RUN ssh-keygen -f /root/.ssh/id_rsa -t rsa -
N "" && chmod 644 /root/.ssh/id_rsa.pub && \
     chmod 600 /root/.ssh/id_rsa && echo "" > /root/.ssh/known_hosts
#copy localhost/client publickey to docker container
COPY authorized_keys /root/.ssh/authorized_keys
#By default ubuntu is not creating this folder so need to create it and change the per
mission mode.
RUN  mkdir /var/run/sshd && chmod 0755 /var/run/sshd

#Spark-Setup
RUN curl -O https://www-us.apache.org/dist/spark/spark-2.4.4/spark-2.4.4-bin-
hadoop2.7.tgz && tar xvf spark-2.4.4-bin-hadoop2.7.tgz
RUN echo 'export SPARK_HOME=/spark-2.4.4-bin-hadoop2.7'>> ~/.bashrc
RUN echo 'JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-amd64/jre'>> ~/.bashrc
RUN echo 'PATH=$PATH:$SPARK_HOME/bin:$SPARK_HOME/sbin:$JAVA_HOME/bin'>> ~/.bashrc
# RUN echo ${SPARK_HOME} \
#     ${JAVA_HOME}\
#     ${PATH}
#spark word countprograms and text file
COPY wordcount.py /
COPY wordcount_inputfile /
#RUN /usr/sbin/sshd
EXPOSE 22
CMD ["/usr/sbin/sshd","-D"]
```

1.4.1: Docker_hub_link:

https://cloud.docker.com/repository/docker/[redacted]/ubuntu_spark

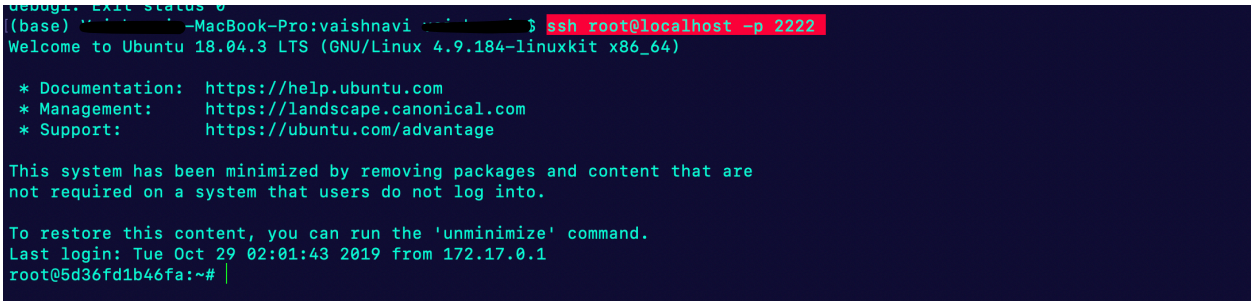
1.4.2:

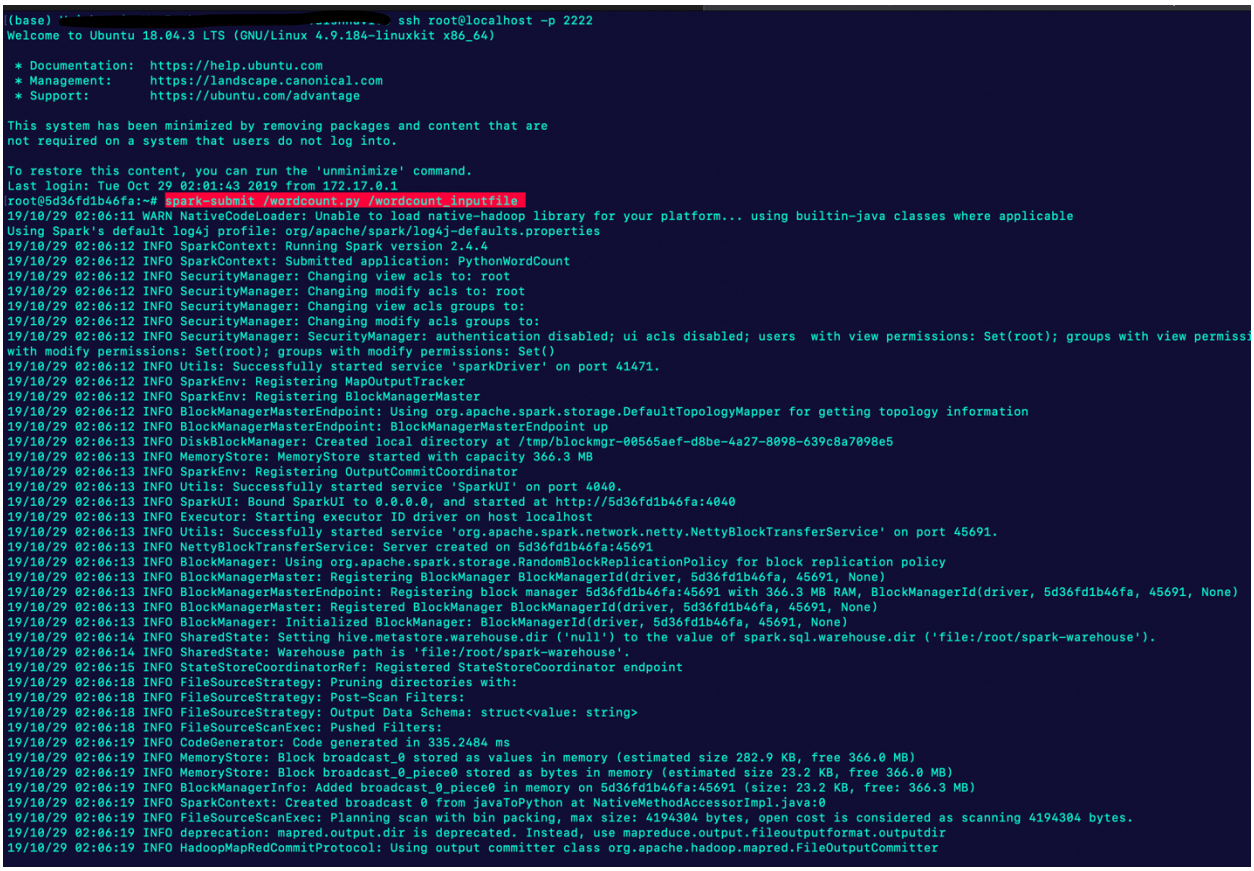
Command: docker run -ti -d -p 2222:22 [redacted]/ubuntu_spark

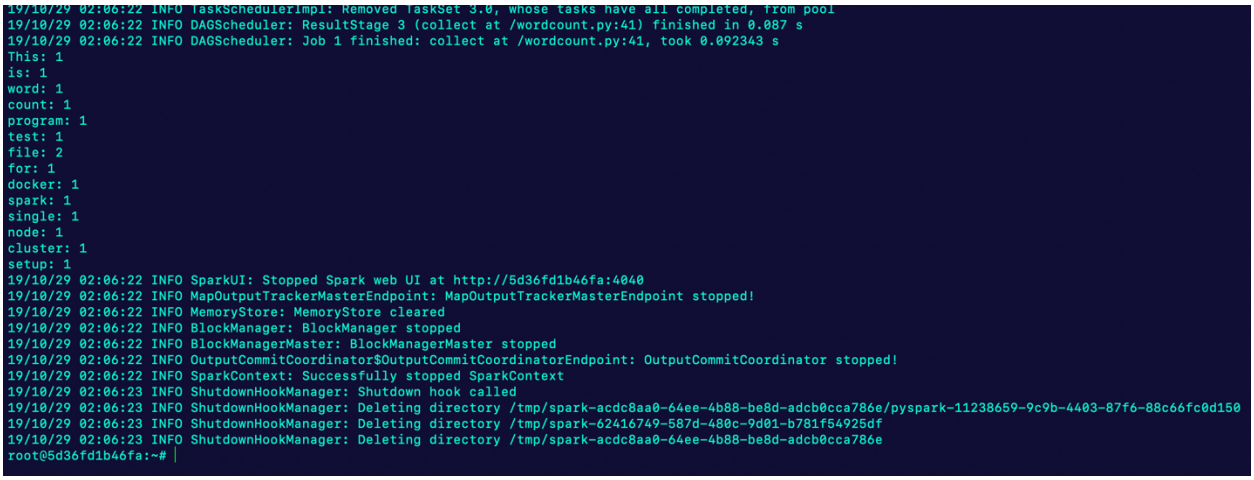
1.4.3:

Login command:ssh root@localhost -p 2222
test-run command: spark-submit /wordcount.py /wordcount_inputfile

screenshots for remote login and test_run success:







Part 2: Monitoring VM instances and Docker containers

2.1:
command: python paramaiko_cpuUsuage.py

Code:

```
import paramiko
import boto3
import time
import aws_boto_createInstances

def cpu_utilization():
    ec2_client=boto3.client("ec2")

    instances_details=ec2_client.describe_instances()

    #print(ec2_client.describe_instance_status())

    username="ubuntu"
    #connect SSH_client
    ssh_client=paramiko.SSHClient()

    #Connect to an SSH server and authenticate to it. The server's host key is checked
 against the system host keys
    ssh_client.load_system_host_keys()

    #Policy for automatically adding the hostname and new host key to the local HostKe
ys object
```

```
    ssh_client.set_missing_host_key_policy(paramiko.AutoAddPolicy())

    #load key
    key=paramiko.RSAKey.from_private_key_file("/Users/vaishnaviv/vaishnavi_ec2_key.pem
")



    #fetch instance details and display cpu utilization
    while(True):
        for reservation in instances_details['Reservations']:
            for instance in reservation['Instances']:
                instance_id=instance['InstanceId']
                if instance['State']['Name']=='running':
                    #connection to SSH server
                    ssh_client.connect(hostname=instance['PublicDnsName'],username=use
rname,pkey=key)
                    stdin,stdout,stderror=ssh_client.exec_command("top -
bn1 | grep Cpu")
                    cpu_info = stdout.readline()
                    print("%s \t %s"%(instance_id,cpu_info))
        time.sleep(5)


if __name__=="__main__":

    num_instances = 2
    instances_created = aws_boto_createInstances.create_ec2_instances(int(num_instance
s))
    print("Creating {} EC2 instances".format(int(num_instances)))
    instance_running=[]
    #iteratively check status of the instance created
    for i in instances_created:
        print("Instances with {} id has startup status {} ".format(i.id, i.state))
        instance_running.append(aws_boto_createInstances.check_Instance_status(i.id))
    #print list of instances with running status
    print("list of instance id's with status code as running are \n",instance_running)
    time.sleep(10)
    cpu_utilization()
```

2.2:
Command: python paramaiko_cpuUsuage_containers.py

Code:

```
import paramiko
import boto3
import time,sys
import aws_boto_createInstances

def cpu_usuage_container():
    ec2_client=boto3.client("ec2")

    instances_details=ec2_client.describe_instances()
    #print(instances_details)

    username="ubuntu"
    #connect SSH_client
    ssh_client=paramiko.SSHClient()

    #Policy for automatically adding the hostname and new host key to the local HostKe
ys object
    ssh_client.set_missing_host_key_policy(paramiko.AutoAddPolicy())

    #load key
    key=paramiko.RSAKey.from_private_key_file("/Users/vaishnaviv/vaishnavi_ec2_key.pem
")

    #installing docker on instances running
    error=[]
    for reservation in instances_details['Reservations']:
        for instance in reservation['Instances']:
            instance_id = instance['InstanceId']
            if instance['State']['Name']=='running':
                try:
                    # connection to SSH server on instances at given publicdns id
                    ssh_client.connect(hostname=instance['PublicDnsName'], username=us
ername, pkey=key)
                    stdin, stdout, stderror = ssh_client.exec_command("sudo apt-get -
y update ")
                    stdout.channel.recv_exit_status()
                    stdin, stdout, stderror = ssh_client.exec_command("sudo apt-
get install -y apt-utils")
                    stdout.channel.recv_exit_status()
                    stdin, stdout, stderror = ssh_client.exec_command("sudo apt autore
move docker docker-engine docker.io")
                    stdout.channel.recv_exit_status()
```

```
                    print("Docker installation in progress")
                    D_stdin, D_stdout, D_stderror = ssh_client.exec_command("sudo apt-
get install -y docker.io")
                    D_stdout.channel.recv_exit_status()
                    # #print(stderror.readlines())
                    stdin, stdout, stderror = ssh_client.exec_command("sudo chmod 666
/var/run/docker.sock")
                    # print(stdout.readlines())
                    # print(stderror.readlines())
                    print("docker service start in progress")
                    stdin, stdout, stderror = ssh_client.exec_command('sudo systemctl
start docker && sudo systemctl enable docker',get_pty=True)
                    print(stdout.readlines())
                    print("executing docker")
                    run_stdin, run_stdout, run_stderror = ssh_client.exec_command("sud
o docker run -d -t ubuntu sh")
                    #print(run_stdout.readline())
                    container_id=run_stdout.readline().rstrip()
                    #print(container_id)
                    #print(run_stderror.readline())
                    print("succesfully ran docker whose created container id is {} on
instance {}".format(container_id,instance_id))

                except Exception as e:
                    print(e)


    #fetch instance details and display cpu utilization
    #press contol+c to exit the while loop
    while(True):
            container_list=[]
            try:
                for reservation in instances_details['Reservations']:
                    for instance in reservation['Instances']:
                        instance_id=instance['InstanceId']
                        if instance['State']['Name']=='running':
                            #connection to SSH server
                            ssh_client.connect(hostname=instance['PublicDnsName'],user
name=username,pkey=key)
                            stdin, stdout, stderror = ssh_client.exec_command("sudo do
cker ps | grep ubuntu")
                            for output in stdout.readlines():
                                container_id=output.split()[0]
                                container_list.append(container_id)
                                stdin,stdout,stderror=ssh_client.exec_command("sudo do
cker exec {} top -bn1 | grep Cpu".format(container_id))
                                cpu_info=stdout.readline()
```

```
                                print("{} \t {} \t {}".format(instance_id,container_id
,cpu_info))
                #sleep for 5 sec and run the loop again
                time.sleep(5)
                print("Press control+c to terminate the loop which executes every 5 se
conds")

            except KeyboardInterrupt as e:
                print("Docker kill is in progress")
                for container_id in container_list:
                    ssh_client.exec_command("sudo docker kill {}".format(container_id)
)
                print("dockers killed sucessfully")
                _in,_out,_error=ssh_client.exec_command("sudo docker ps")
                #print(_out.readlines())
                # terminate all running instances .
                for i in aws_boto_createInstances.ec2.instances.all():
                    i.terminate()
                print("instances killed succesfully")

                sys.exit()
if __name__=="__main__":
    num_instances=2
    instances_created=aws_boto_createInstances.create_ec2_instances(int(num_instances)
)
    print("Creating {} EC2 instances".format(int(num_instances)))
    instance_running=[]
    #iteratively check status of the instance created
    for i in instances_created:
        print("Instances with {} id has startup status {} ".format(i.id, i.state))
        instance_running.append(aws_boto_createInstances.check_Instance_status(i.id))
    #print list of instances with running status
    print("list of instance id's with status code as running are \n",instance_running)
    #call to cpu utilization function
    time.sleep(20)
    cpu_usuage_container()
```