

# CS 530 INTERNET, WEB AND CLOUD SYSTEMS

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## 07.1a: Terraform AWS Guestbook

### Setup

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Actions ▾

☒ AWS CloudShell

```
us-east-1

Preparing your terminal...
[cloudshell-user@ip-10-0-27-210 ~]$ Try these commands to get started:
aws help or aws <command> help or aws <command> --cli-auto-prompt
[cloudshell-user@ip-10-0-27-210 ~]$ sudo yum install -y yum-utils
Loaded plugins: priorities, update-motd, upgrade-helper
Existing lock /var/run/yum.pid; another copy is running as pid 37.
Another app is currently holding the yum lock; waiting for it to exit...
The other application is: yum
  Memory : 111 M RSS (402 MB VSZ)
  Started: Wed Nov 9 00:25:58 2022 - 00:10 ago
  State : Sleeping, pid: 37
Resolving Dependencies
--> Running transaction check
--> Package yum-utils.noarch 0:1.1.31-46.amzn2.0.1 will be installed
--> Processing Dependency: python-kitchen for package: yum-utils-1.1.31-46.amzn2.0.1.noarch
--> Processing Dependency: libxml2-python for package: yum-utils-1.1.31-46.amzn2.0.1.noarch
--> Running transaction check
--> Package libxml2-python.x86_64 0:2.9.1-6.amzn2.5.6 will be installed
--> Package python-kitchen.noarch 0:1.1.1-5.amzn2 will be installed
--> Processing Dependency: python-chardet for package: python-kitchen-1.1.1-5.amzn2.noarch
--> Running transaction check
--> Package python-chardet.noarch 0:2.2.1-1.amzn2 will be installed
--> Finished Dependency Resolution
Dependencies Resolved

=====
Package           Arch      Version            Repository          Size
=====
Installing:
yum-utils         noarch   1.1.31-46.amzn2.0.1    amzn2-core        120 k
Installing for dependencies:
libxml2-python    x86_64   2.9.1-6.amzn2.5.6    amzn2-core        246 k
python-chardet    noarch   2.2.1-1.amzn2          amzn2-core        227 k
python-kitchen    noarch   1.1.1-5.amzn2          amzn2-core        266 k
=====
Feedback  Looking for language selection? Find it in the new Unified Settings [?] © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences
```

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Actions ▾

☒ AWS CloudShell

```
us-east-1

Complete!
[cloudshell-user@ip-10-0-27-210 ~]$ sudo yum-config-manager --add-repo https://rpm.releases.hashicorp.com/AmazonLinux/hashicorp.repo
Loaded plugins: ovl, priorities
adding repo from: https://rpm.releases.hashicorp.com/AmazonLinux/hashicorp.repo
grabbing file https://rpm.releases.hashicorp.com/AmazonLinux/hashicorp.repo to /etc/yum.repos.d/hashicorp.repo
repo saved to /etc/yum.repos.d/hashicorp.repo
[cloudshell-user@ip-10-0-27-210 ~]$ sudo yum -y install terraform
Loaded plugins: ovl, priorities
hashicorp
hashicorp/x86_64/primary
hashicorp
Resolving Dependencies
--> Running transaction check
--> Package terraform.x86_64 0:1.3.4-1 will be installed
--> Processing Dependency: openssl for package: terraform-1.3.4-1.x86_64
--> Running transaction check
--> Package openssl.x86_64 1:1.0.2k-24.amzn2.0.4 will be installed
--> Finished Dependency Resolution
Dependencies Resolved

=====
Package           Arch      Version            Repository          Size
=====
Installing:
terraform         x86_64   1.3.4-1              hashicorp        13 M
Installing for dependencies:
openssl           x86_64   1:1.0.2k-24.amzn2.0.4    amzn2-core       497 k
=====
Transaction Summary
=====
Install 1 Package (+1 Dependent package)

Total download size: 13 M
Installed size: 59 M
Feedback  Looking for language selection? Find it in the new Unified Settings [?] © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences
```

aws | Services | Search | [Alt+S] | N. Virginia | vclabs/user2175716=vkarinje@pdx.edu @ 8246-5946-6980 ▾

Actions ▾

☒ AWS CloudShell

```
us-east-1

repo saved to /etc/yum.repos.d/hashicorp.repo
[cloudshell-user@ip-10-0-27-210 ~]$ sudo yum -y install terraform
Loaded plugins: ovl, priorities
hashicorp
hashicorp/x86_64/primary
hashicorp
Resolving Dependencies
--> Running transaction check
--> Package terraform.x86_64 0:1.3.4-1 will be installed
--> Processing Dependency: openssl for package: terraform-1.3.4-1.x86_64
--> Running transaction check
--> Package openssl1.x86_64 1:1.0.2k-24.amzn2.0.4 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package          Arch      Version           Repository      Size
=====
Installing:
  terraform      x86_64   1.3.4-1          hashicorp     13 M
Installing for dependencies:
  openssl        x86_64   1:1.0.2k-24.amzn2.0.4 amzn2-core    497 k

Transaction Summary
=====
Install 1 Package (+1 Dependent package)

Total download size: 13 M
Installed size: 59 M
Downloading packages:
(1/2): openssl-1.0.2k-24.amzn2.0.4.x86_64.rpm | 497 kB  00:00:00
warning: /var/cache/yum/x86_64/2/hashicorp/packages/terraform-1.3.4-1.x86_64.rpm: Header V4 RSA/SHA512 Signature, key ID a3219f7b: NOKEY
Public Key for terraform-1.3.4-1.x86_64.rpm is not installed
(2/2): terraform-1.3.4-1.x86_64.rpm | 13 MB  00:00:00

Feedback  Looking for language selection? Find it in the new Unified Settings [?]  © 2022, Amazon Web Services, Inc. or its affiliates.  Privacy  Terms  Cookie preferences
```

## Initial configuration

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Actions ▾

☒ AWS CloudShell

```
us-east-1

aws configure --profile default > ~/.aws/credentials
[default]
aws_access_key_id = AST44AMN13L5CVR4H77
aws_secret_access_key = yXuINPc1Lw5Zj5jP2RUS1M1fdtWBQ1sAA7kqJzE
aws_session_token=3woGZxIYXdxE1n//////////WeaD1aPhsMR1508+QpdhCLBAAdAFKFo1jbFzS+KSYaa1nJrgC16Sdg19aJw0vxQ1uTWQEEHersDZZPy+U2vzByVA3QGGsaq6Y10Ja+2sEcEyCaYQp0mjF0dpCRSy9dXj/nyQdSA587x3MRGrnVfj3t1vmtc
stHnroEnxrqfie1-j133nzJuM12NY7Plu8kxx09MzEojRXMjkuIquV6V6vf2eQHywiktFmsdzrE+v12h8C9en+SlmQbItH1lDg+nW7OT2shw3CUI1HZ00df3Mojepe2mwYldtz753l45792014t6azUR/2rjYETPH+6tppO6a6XQd8gtK6kkK8spj1jQ1wRA==

[cloudshell-user@ip-10-0-25-123 ~]$
```

The screenshot shows the AWS CloudShell interface in the us-east-1 region. The terminal window displays the completion of a Terraform command:

```
"main.tf" 11L, 2508 written
[cloudshell-user@ip-10-0-25-123 tf]$ cat main.tf
provider "aws" {
  profile    = "default"
  region    = "us-east-1"
}
resource "aws_instance" "guestbook" {
  ami          = "ami-01d08089481510ba2"
  instance_type = "t2.micro"
}
output "ec2instance" {
  value = aws_instance.guestbook.public_ip
}
[cloudshell-user@ip-10-0-25-123 tf]$
```

## Launching configuration

- Take a screenshot showing the completion of the command including its output

The screenshot shows the AWS CloudShell interface in the us-east-1 region. The terminal window displays the completion of Terraform commands:

```
[cloudshell-user@ip-10-0-25-123 tf]$ terraform init
Initializing the backend...
Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v4.39.0...
- Installed hashicorp/aws v4.39.0 (signed by HashiCorp)

Terraform has created a lock file .terraform.lock.hcl to record the provider selections it made above. Include this file in your version control repository so that Terraform can guarantee to make the same selections by default when you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see any changes that are required for your infrastructure. All Terraform commands should now work.

If you ever set or change modules or backend configuration for Terraform, rerun this command to reinitialize your working directory. If you forget, other commands will detect it and remind you to do so if necessary.
[cloudshell-user@ip-10-0-25-123 tf]$ terraform plan
Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
+ create

Terraform will perform the following actions:

# aws_instance.guestbook will be created
+ resource "aws_instance" "guestbook" {
  ami          = "ami-01d08089481510ba2"
  + arn
  + associate_public_ip_address = (known after apply)
```

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us-east-1

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these actions if you run "terraform apply" now.  
[cloudshell-user@ip-10-0-25-123 tf]\$ terraform apply

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:

- + create

Terraform will perform the following actions:

```
# aws_instance.guestbook will be created
+ resource "aws_instance" "guestbook" {
  ami           = "ami-01d08889481510ba2"
  arn           = (known after apply)
  associate_public_ip_address = (known after apply)
  availability_zone      = (known after apply)
  cpu_core_count        = (known after apply)
  cpu_threads_per_core = (known after apply)
  disable_api_stop     = (known after apply)
  disable_api_termination = (known after apply)
  ebs_optimized       = (known after apply)
  get_password_data   = false
  host_id           = (known after apply)
  host_resource_group_arn = (known after apply)
  id               = (known after apply)
  instance_initiated_shutdown_behavior = (known after apply)
  instance_state     = (known after apply)
  instance_type      = "t2.micro"
  ipv6_address_count = (known after apply)
  ipv6_addresses    = (known after apply)
  key_name          = (known after apply)
  monitoring         = (known after apply)
  outpost_arn       = (known after apply)
  password_data     = (known after apply)
```

aws Services Search [Alt+S] N. Virginia voclabs/user2175716=vkarinje@pdx.edu @ 8246-5946-6980 Actions

us-east-1

```
+ device_name      = (known after apply)
+ encrypted        = (known after apply)
+ iops             = (known after apply)
+ kms_key_id       = (known after apply)
+ tags             = (known after apply)
+ throughput       = (known after apply)
+ volume_id        = (known after apply)
+ volume_size      = (known after apply)
+ volume_type      = (known after apply)
}
```

Plan: 1 to add, 0 to change, 0 to destroy.

Changes to Outputs:

- + ec2instance = (known after apply)

Do you want to perform these actions?  
Terraform will perform the actions described above.  
Only 'yes' will be accepted to approve.

Enter a value: yes

```
aws instance.guestbook: Creating...
aws instance.guestbook: Still creating... [10s elapsed]
aws instance.guestbook: Still creating... [20s elapsed]
aws instance.guestbook: Still creating... [30s elapsed]
aws instance.guestbook: Creation complete after 31s [id=i-0388141702631a0cb]
```

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

Outputs:

```
ec2instance = "54.159.254.140"
[cloudshell-user@ip-10-0-25-123 tf]$
```

- Take a screenshot that includes the VM's IP addresses

VM's IP address is 54.159.254.140

**Instances (1) Info**

Name	Instance ID	Instance state	Instance type	Public IPv4 DNS	Public IPv4 IP	Elastic IP
-	i-0388141702631a0cb	Running	t2.micro	ec2-54-159-254-140.co...	54.159.254.140	-

**Instance summary for i-0388141702631a0cb**

Instance ID	i-0388141702631a0cb	Public IPv4 address	54.159.254.140   open address	Private IPv4 addresses	172.31.95.29
IPv6 address	-	Instance state	Running	Public IPv4 DNS	ec2-54-159-254-140.compute-1.amazonaws.com   open address
Hostname type	IP name: ip-172-31-95-29.ec2.internal	Private IP DNS name (IPv4 only)	ip-172-31-95-29.ec2.internal	Elastic IP addresses	-
Answer private resource DNS name	-	Instance type	t2.micro	AWS Compute Optimizer finding	Opt-in to AWS Compute Optimizer for recommendations.
Auto-assigned IP address	54.159.254.140 [Public IP]	VPC ID	vpc-01854a48b05941854	Learn more	-
IAM Role	-	Subnet ID	subnet-009f9671c6597529a	Auto Scaling Group name	-

The screenshot shows the AWS CloudWatch Metrics Insights interface. A search bar at the top contains the query: `subnet-009f9671c6597529a`. Below the search bar is a navigation bar with tabs: Details, Security, Networking, Storage, Status checks, Monitoring, and Tags. The Details tab is selected. Under the Details tab, there is a section titled "Instance details" with a "Info" button. The table below lists various instance details:

Platform	AMI ID	Monitoring
Ubuntu (Inferred)	<a href="#">ami-01d08089481510ba2</a>	disabled
Platform details	AMI name	Termination protection
Linux/UNIX	<a href="#">ubuntu/images/hvm-ssd/ubuntu-focal-20.04-amd64-server-20221018</a>	Disabled
Stop protection	Launch time	AMI location
Disabled	<a href="#">Thu Nov 10 2022 17:07:36 GMT-0800 (Pacific Standard Time) (8 minutes)</a>	<a href="#">amazon/ubuntu/images/hvm-ssd/ubuntu-focal-20.04-amd64-server-20221018</a>
Instance auto-recovery	Lifecycle	Stop-hibernate behavior
Default	normal	disabled
AMI Launch index	Key pair name	State transition reason
0	-	-
Credit specification	Kernel ID	State transition message
standard	-	-
Usage operation	RAM disk ID	Owner
-	-	<a href="#">voclabs/user2175716=vkarinje@pdx.edu</a>

## Adding ssh access

- Take a screenshot of the successful ssh login from Cloud Shell.

The screenshot shows the AWS CloudShell terminal. The command being run is `terraform apply`. The output shows the creation of a key pair and an EC2 instance, followed by a successful SSH connection to the instance.

```

aws | Services | Search
[Alt+S] | X | ▲ | ⓘ | N. Virginia | voclabs/user2175716=vkarinje@pdx.edu @ 8246-5946-6980 ▾
Actions ▾

☒ AWS CloudShell

us-east-1
+ public_key      = "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIEJLXDlcwOHmkBj+We32xnPP8QCikBJSfLcCdhcWOfE2 cloudshell-user@ip-10-0-25-123.ec2.internal"
+ tags_all        = "(known after apply)"

Plan: 2 to add, 0 to change, 1 to destroy.

Changes to Outputs:
~ ec2instance = "54.159.254.140" -> (known after apply)

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes

aws_instance.guestbook: Destroying... [id=i-0388141702631a0cb]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 10s elapsed]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 20s elapsed]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 30s elapsed]
aws_instance.guestbook: Destruction complete after 39s
aws_key_pair.kp: Creating...
aws_key_pair.kp: Creation complete after 1s [id=guestbook-key]
aws_instance.guestbook: Creating...
aws_instance.guestbook: Still creating... [10s elapsed]
aws_instance.guestbook: Still creating... [20s elapsed]
aws_instance.guestbook: Still creating... [30s elapsed]
aws_instance.guestbook: Creation complete after 31s [id=i-07b86b4140915174e]

Apply complete! Resources: 2 added, 0 changed, 1 destroyed.

Outputs:

ec2instance = "44.202.161.81"
[cloudshell-user@ip-10-0-25-123 tf]$ ssh ubuntu@54.159.254.140
[1]

```

The screenshot shows the AWS CloudShell interface. At the top, there are tabs for 'Services' and a search bar. The main area displays the output of a Terraform command:

```

aws
[Services] Search [Alt+S]
N. Virginia v vodabs/user2175716=vkarinje@pdx.edu @ 8246-5946-6980 ▾
Actions ▾ ⓘ

☒ AWS CloudShell

us-east-1
tags_all = (known after apply)

Plan: 2 to add, 0 to change, 1 to destroy.

Changes to Outputs:
- ec2instance = "54.159.254.140" -> (known after apply)

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes

aws_instance.guestbook: Destroying... [id=i-0388141702631a0cb]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 10s elapsed]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 20s elapsed]
aws_instance.guestbook: Still destroying... [id=i-0388141702631a0cb, 30s elapsed]
aws_instance.guestbook: Destruction complete after 39s
aws_key_pair.kp: Creating...
aws_key_pair.kp: Creation complete after 1s [id=guestbook-key]
aws_instance.guestbook: Creating...
aws_instance.guestbook: Still creating... [10s elapsed]
aws_instance.guestbook: Still creating... [20s elapsed]
aws_instance.guestbook: Still creating... [30s elapsed]
aws_instance.guestbook: Creation complete after 31s [id=i-07b86b4140915174e]

Apply complete! Resources: 2 added, 0 changed, 1 destroyed.

Outputs:

ec2instance = "44.202.161.81"
[cloudshell-user@ip-10-0-25-123 tf]$ ssh ubuntu@54.159.254.140
ssh: connect to host 54.159.254.140 port 22: Connection timed out
[cloudshell-user@ip-10-0-25-123 tf]$ 

```

## Adding the Guestbook application

The screenshot shows a terminal session on an AWS instance. The user runs a script to install dependencies and clone a GitHub repository:

```

[cLOUDSHELL-User@IP-10-0-25-123 TF]$ cat install.sh
#!/bin/bash
apt update
apt install -yq build-essential python3-pip gunicorn
pip install flask
git clone https://github.com/wu4f/cs430-src /root/cs430-src
cd /root/cs430-src/03_nginx_gunicorn_certbot
gunicorn --bind :80 --workers 1 --threads 8 app:app
[cLOUDSHELL-User@IP-10-0-25-123 TF]$ ssh ubuntu@3.92.217.3
The authenticity of host '3.92.217.3 (3.92.217.3)' can't be established.
ECDSA key fingerprint is SHA256:02gMdsTpLb07AY5Th/uIRMbTFUm/uywv5IcfroXkiI.
ECDSA key fingerprint is MD5:7a:a8:12:df:30:9e:6b:1d:1e:21:3b:78:17:3a:9f:d7.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '3.92.217.3' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1022-aws x86_64)

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

System information as of Fri Nov 11 02:43:06 UTC 2022

System load:  0.0          Processes:      99
Usage of /:   20.0% of 7.57GB  Users logged in:   0
Memory usage: 18%          IPv4 address for eth0: 172.31.82.224
Swap usage:   0%

* Ubuntu Pro delivers the most comprehensive open source security and
compliance features.

https://ubuntu.com/aws/pro

```

- Take a screenshot of the output of the command that includes the IP address of the instance

```

aws instance.guestbook: Creating...
aws instance.guestbook: Still creating... [10s elapsed]
aws instance.guestbook: Still creating... [20s elapsed]
aws instance.guestbook: Still creating... [30s elapsed]
aws instance.guestbook: Still creating... [40s elapsed]
aws instance.guestbook: Creation complete after 41s [id:i-054815d4798c3c0cf]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

Outputs:

ec2instance = "54.89.55.234"
[cloudshell-user@ip-10-0-25-123 tf]$ ssh ubuntu@54.89.55.234
The authenticity of host '54.89.55.234 (54.89.55.234)' can't be established.
EDSA key fingerprint is SHA256:bCTAf5jnsQKJtljpCyVsdnQdJcbLX0+kOnNx5Am7/0.
EDSA key fingerprint is MD5:8b:27:ea:1e:e3:dce2:a5:b7:0f:59:85:a5:0a:17:11.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '54.89.55.234' (EDSA) to the list of known hosts.
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1022-aws x86_64)

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

System information disabled due to load higher than 1.0

23 updates can be applied immediately.
15 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

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.

ec2instance = "54.89.55.234"
[cloudshell-user@ip-10-0-25-123 tf]$ ssh ubuntu@54.89.55.234
The authenticity of host '54.89.55.234 (54.89.55.234)' can't be established.
EDSA key fingerprint is SHA256:bCTAf5jnsQKJtljpCyVsdnQdJcbLX0+kOnNx5Am7/0.
EDSA key fingerprint is MD5:8b:27:ea:1e:e3:dce2:a5:b7:0f:59:85:a5:0a:17:11.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '54.89.55.234' (EDSA) to the list of known hosts.
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1022-aws x86_64)

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

System information disabled due to load higher than 1.0

23 updates can be applied immediately.
15 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

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-172-31-84-20:~$ ps auxww | grep gunicorn
root      1469  2.3  7.0  81352 69380 ?        S     02:46   0:00 apt install -yq build-essential python3-pip gunicorn
root      5580  0.0  0.0   6448   660 pts/1    S+    02:47   0:00 grep --color=auto gunicorn
ubuntu@ip-172-31-84-20:~$ 
```

## View the Guestbook

The screenshot shows a web browser window with the URL 54.89.55.234. The page title is "Guestbook". It has a "Sign here" button and a "Entries" section. The entries list a single entry from "Varsha Karinje <vkarinje@pdx.edu>" signed on "2022-11-11" with the message "Hello Terraform on AWS!".

## Clean Up

The screenshot shows the AWS CloudShell interface. The user is executing a Terraform destroy command. The output shows the plan, changes to outputs, and a confirmation prompt asking if they really want to destroy all resources. The user enters 'yes' and the resources are destroyed.

```

aws instance.guestbook: Destroying... [id=i-054815d4798c3c0cf]
aws instance.guestbook: Still destroying... [id=i-054815d4798c3c0cf, 10s elapsed]
aws instance.guestbook: Still destroying... [id=i-054815d4798c3c0cf, 20s elapsed]
aws instance.guestbook: Still destroying... [id=i-054815d4798c3c0cf, 30s elapsed]
aws instance.guestbook: Destruction complete after 40s
aws key_pair.kp: Destroying... [id=guestbook-key]
aws security group.sg-guestbook: Destroying... [id=sg-05f92c02194b7ec3c]
aws key_pair.kp: Destruction complete after 8s
aws security group.sg-guestbook: Destruction complete after 1s

Destroy complete! Resources: 3 destroyed.
[cloudshell-user@ip-10-0-25-123 tf]$ rm -r ~/tf
[cloudshell-user@ip-10-0-25-123 tf]$ cd tf
bash: cd: tf: No such file or directory
[cloudshell-user@ip-10-0-25-123 tf]$

```

## 07.1g: Terraform GCP Guestbook

## Setup

The screenshot shows a terminal session on a Linux AMD64 system. The user runs the command "terraform --version" which outputs "Terraform v1.3.4".

```

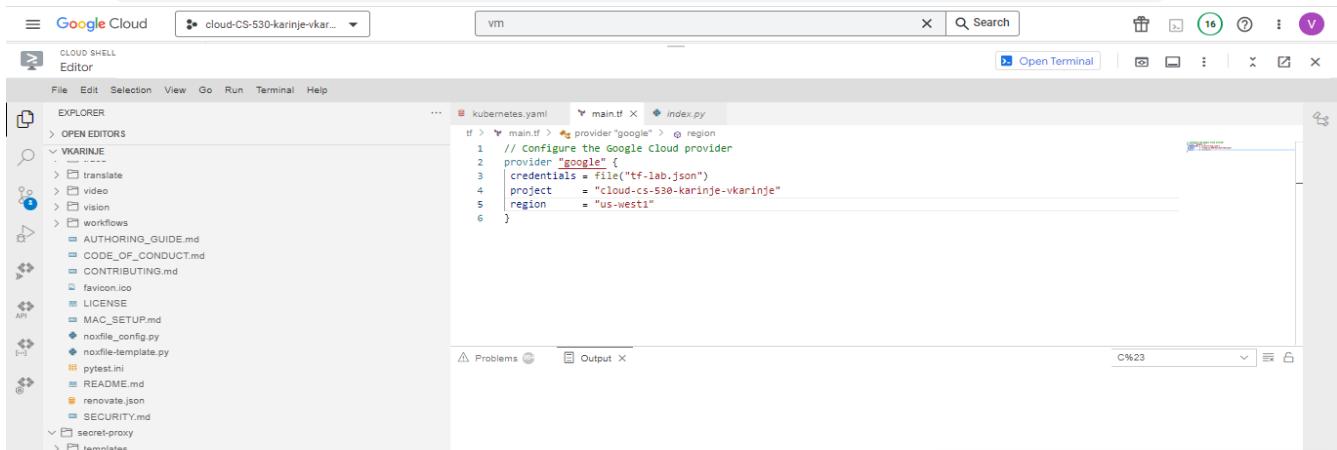
vkarinje@cloudshell:~ (cloud-es-530-karinje-vkarinje)$ terraform --version
Terraform v1.3.4
on linux_amd64
vkarinje@cloudshell:~ (cloud-es-530-karinje-vkarinje)$ |

```

```
vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ gcloud iam service-accounts create tf-lab
Created service account [tf-lab].
vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ gcloud projects add-iam-policy-binding ${GOOGLE_CLOUD_PROJECT} --member serviceAccount:tf-lab@${GOOGLE_CLOUD_PROJECT}.iam.gserviceaccount.com --role roles/owner
Updated IAM policy for project [cloud-es-530-karinje-vkarinje].
bindings:
- members:
  - serviceAccount:service-791612085972@gcp-gae-service.iam.gserviceaccount.com
    role: roles/appengine.serviceAgent
- members:
  - serviceAccount:service-791612085972@cloudbuild.gserviceaccount.com
    role: roles/cloudbuild.builds.builder
- members:
  - serviceAccount:service-791612085972@gcp-sa-cloudbuild.iam.gserviceaccount.com
    role: roles/cloudbuild.serviceAgent
- members:
  - serviceAccount:service-791612085972@gcf-admin-robot.iam.gserviceaccount.com
    role: roles/cloudfunctions.serviceAgent
- members:
  - serviceAccount:service-791612085972@gcp-sa-cloudscheduler.iam.gserviceaccount.com
    role: roles/cloudscheduler.serviceAgent
- members:
  - serviceAccount:service-791612085972@compute-system.iam.gserviceaccount.com
    role: roles/compute.serviceAgent
- members:
  - deleted:serviceAccount:gcs-lab@cloud-es-530-karinje-vkarinje.iam.gserviceaccount.com?uid=102296725729513422801
    role: roles/compute.viewer
- members:

VERSION. 1
vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ gcloud iam service-accounts keys create tf-lab.json --iam-account tf-lab@${GOOGLE_CLOUD_PROJECT}.iam.gserviceaccount.com
created key [0x408de363a105eb0e2901bd5e293ac0154elea0] of type [json] as [tf-lab.json] for [tf-lab@cloud-es-530-karinje-vkarinje.iam.gserviceaccount.com]
vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ |||
```

## Initial configuration



CLOUD SHELL

Terminal (cloud-cs-530-karinje-vkarinje) X + ▾

```
NAME: ubuntu-pro-2204-jammy-v20221108
PROJECT: ubuntu-os-pro-cloud
FAMILY: ubuntu-pro-2204-lts
DEPRECATED:
STATUS: READY

NAME: ubuntu-pro-fips-1804-bionic-v20221018
PROJECT: ubuntu-os-pro-cloud
FAMILY: ubuntu-pro-fips-1804-lts
DEPRECATED:
STATUS: READY

NAME: ubuntu-pro-fips-2004-focal-v20221018
PROJECT: ubuntu-os-pro-cloud
FAMILY: ubuntu-pro-fips-2004-lts
DEPRECATED:
STATUS: READY

NAME: ubuntu-2004-focal-arm64-v20221018
PROJECT: ubuntu-os-cloud
FAMILY: ubuntu-2004-lts-arm64
DEPRECATED:
STATUS: READY

NAME: ubuntu-2004-focal-v20221018
PROJECT: ubuntu-os-cloud
FAMILY: ubuntu-2004-lts
DEPRECATED:
STATUS: READY

NAME: ubuntu-2204-jammy-arm64-v20221101a
PROJECT: ubuntu-os-cloud
FAMILY: ubuntu-2204-lts-arm64
DEPRECATED:
STATUS: READY

NAME: ubuntu-2204-jammy-v20221101a
PROJECT: ubuntu-os-cloud
FAMILY: ubuntu-2204-lts
DEPRECATED:
STATUS: READY
```

The screenshot shows the Cloud Shell Editor interface. On the left is the Explorer sidebar with project files like VKARINJE, workflows, and a .tf directory containing main.tf and tf-lab.json. The main area displays the content of main.tf:

```

resource "google_compute_instance" "default" {
  name            = "tf-lab-vm"
  machine_type   = "f1-micro"
  zone           = "us-west1-b"

  boot_disk {
    initialize_params {
      image = "ubuntu-2004-focal-v20221018"
    }
  }

  network_interface {
    network = "default"
  }
}

```

Below the code editor are the Problems and Output panes. The status bar at the bottom indicates C%23.

## Launching configuration

```

vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/google...
- Installing hashicorp/google v4.43.0...
- Installed hashicorp/google v4.43.0 (signed by HashiCorp)

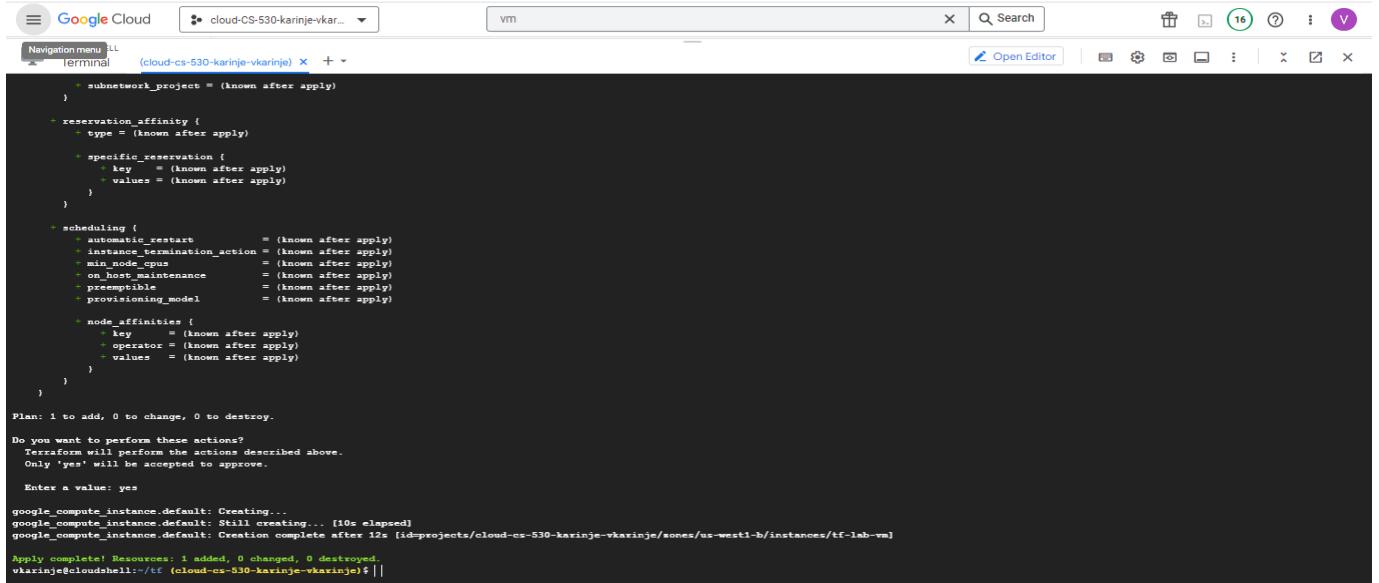
Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
vkarinje@cloudshell:~/tf (cloud-es-530-karinje-vkarinje)$ ||

```



```

Google Cloud cloud-CS-530-karinje-vkar... VM Search Open Editor
Navigation menu LL terminal (cloud-CS-530-karinje-vkarinje) + +
subnetwork_project = (known after apply)

+ reservation_affinity {
  - type = (known after apply)

  + specific_reservation {
    - key = (known after apply)
    + values = (known after apply)
  }
}

+ scheduling {
  - automatic_restart = (known after apply)
  - instance_termination_action = (known after apply)
  - min_node_cpus = (known after apply)
  - on_host_maintenance = (known after apply)
  - preemptible = (known after apply)
  - provisioning_model = (known after apply)

  + node_affinities {
    - key = (known after apply)
    + operator = (known after apply)
    + values = (known after apply)
  }
}
}

Plan: 1 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

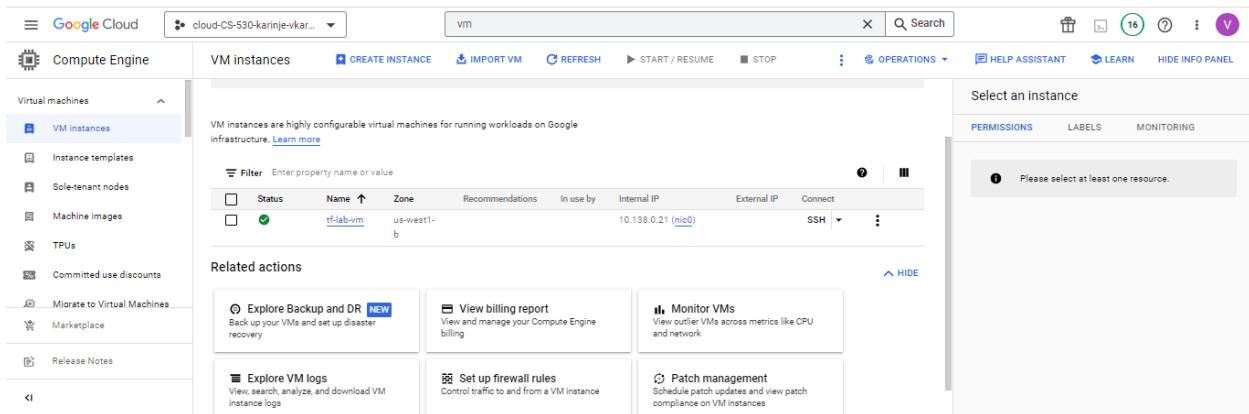
Enter a value: yes

google_compute_instance.default: Creating...
google_compute_instance.default: Still creating... [10s elapsed]
google_compute_instance.default: Creation complete after 12s [id=projects/cloud-CS-530-karinje-vkarinje/zones/us-west1-b/instances/tf-lab-vm]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
karinje@cloudshell:~/tf (cloud-CS-530-karinje-vkarinje)$ ||

```

- Take a screenshot that includes the VM's IP addresses



Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input checked="" type="checkbox"/>	tf-lab-vm	us-west1-b			10.138.0.21 (nic0)	34.231.131.120	SSH

## Adding an external IP address

```

main.tf
if > main.tf > output "ip" > ...
7 // A single IPv4 address
8 resource "google_compute_address" "static" {
9   name = "ipv4-address"
10 }
11 // A single Compute Engine instance
12 resource "google_compute_instance" "default" {
13   name        = "tf-lab-vn"
14   machine_type = "f1-micro"
15   zone        = "us-west1-b"
16
17 boot_disk {
18   initialize_params {
19     image = "ubuntu-2004-focal-v20221018"
20   }
21 }
22
23 network_interface {
24   network = "default"
25   access_config {
26     nat_ip = google_compute_address.static.address
27   }
28 }
29
30 // A variable for extracting the external IP address of the instance
31 output "ip" {
32   value = google_compute_instance.default.network_interface.0.access_config.0.nat_ip
33 }

```

- Take a screenshot showing the completion of the command including its output

```

CLOUD SHELL
Terminal (cloud-CS-530-karinje-vkarinje) x + *

~ resource "google_compute_instance" "default" {
  id          = "projects/cloud-CS-530-karinje-vkarinje/zones/us-west1-b/instances/tf-lab-vm"
  name        = "tf-lab-vm"
  tags        = []
  # (17 unchanged attributes hidden)

  ~ network_interface {
    name          = "nic0"
    # (6 unchanged attributes hidden)

    + access_config {
      + nat_ip = (known after apply)
    }
  }

  # (3 unchanged blocks hidden)
}

Plan: 1 to add, 1 to change, 0 to destroy.

Changes to Outputs:
+ ip = (known after apply)

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes

google_compute_address.static: Creating...
google_compute_address.static: Still creating... [10s elapsed]
google_compute_address.static: Creation complete after 11s [id=projects/cloud-CS-530-karinje-vkarinje/regions/us-west1/addresses/ipv4-address]
google_compute_instance.default: Modifying... [id=projects/cloud-CS-530-karinje-vkarinje/zones/us-west1-b/instances/tf-lab-vm]
google_compute_instance.default: Still modifying... [id=projects/cloud-CS-530-karinje-vkarinje/zones/us-west1-b/instances/tf-lab-vm, 10s elapsed]
google_compute_instance.default: Modifications complete after 11s [id=projects/cloud-CS-530-karinje-vkarinje/zones/us-west1-b/instances/tf-lab-vm]

Apply complete! Resources: 1 added, 1 changed, 0 destroyed.

Outputs:

ip = "34.105.1.162"
vkarinje@cloudshell:~/tf (cloud-CS-530-karinje-vkarinje)$ ||

```

- Take a screenshot that includes the VM's IP addresses

The screenshot shows the Google Cloud Platform Compute Engine VM instances page. On the left, there's a sidebar with options like Compute Engine, Virtual machines, VM instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Marketplace, Release Notes, and a CLOUD SHELL terminal at the bottom.

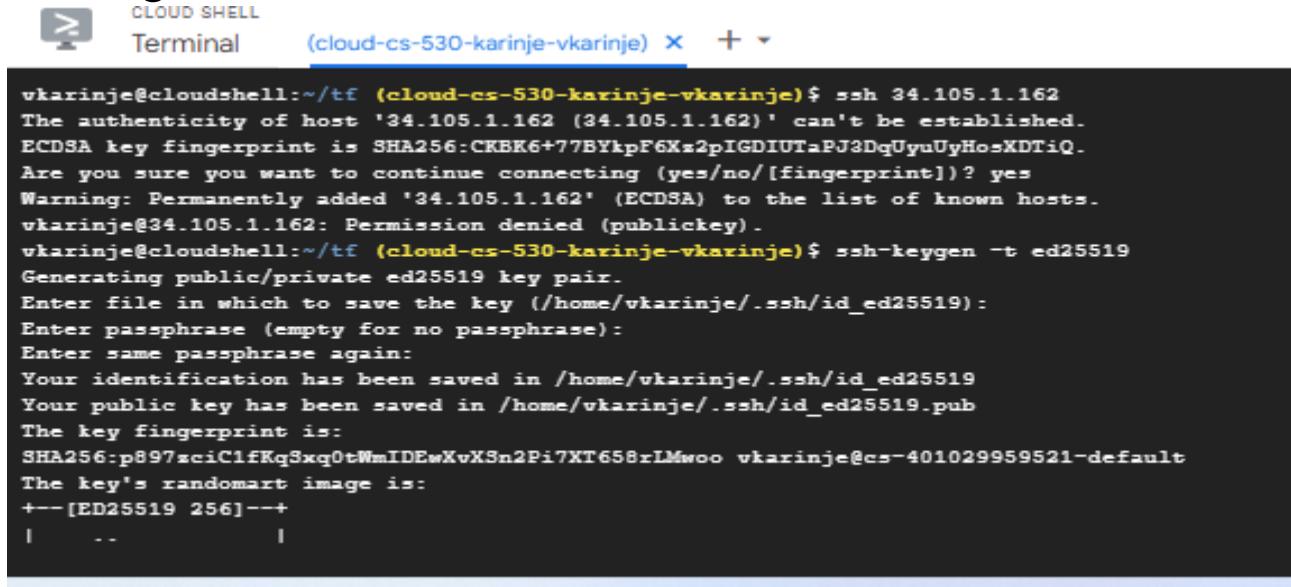
In the main area, under the 'VM instances' tab, the 'INSTANCES' section lists a single instance named 'tf-lab-vm'. The table shows the following details:

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<span style="color: green;">✓</span>	tf-lab-vm	us-west1-b			10.138.0.21 (nic0)	34.105.1.162 (nic0)	SSH

Below the table, there are related actions: 'Explore Backup and DR', 'View billing report', and 'Monitor VMs'.

The CLOUD SHELL terminal at the bottom shows the same Terraform output as the previous screenshot, confirming the creation of the VM and providing its IP address.

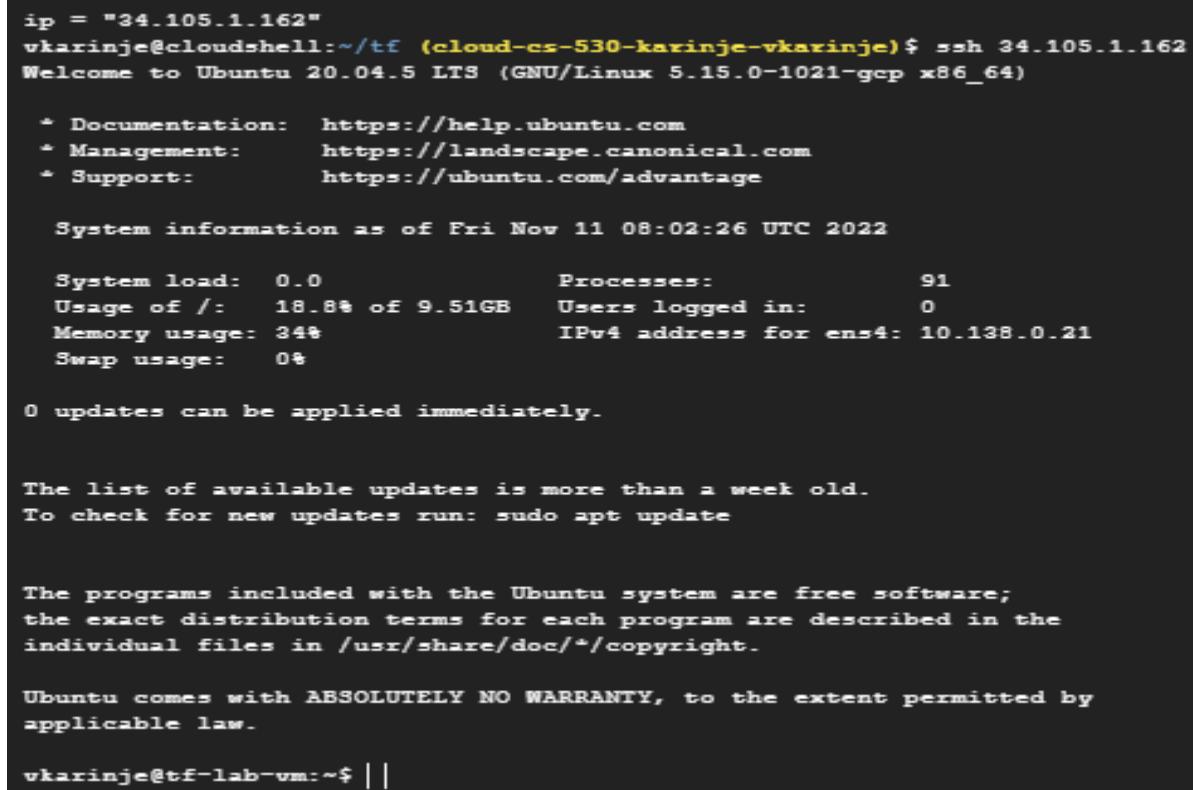
## Adding ssh access



The screenshot shows a Cloud Shell terminal window. The title bar says "Terminal (cloud-cs-530-karinje-vkarinje)". The terminal content shows the user generating an SSH key pair:

```
vkarinje@cloudshell:~/tf (cloud-cs-530-karinje-vkarinje)$ ssh 34.105.1.162
The authenticity of host '34.105.1.162 (34.105.1.162)' can't be established.
ECDSA key fingerprint is SHA256:CKBK6+77BYkpF6Xz2pIGDIUTaPJ3DqUyuUyHosXDTiQ.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '34.105.1.162' (ECDSA) to the list of known hosts.
vkarinje@34.105.1.162: Permission denied (publickey).
vkarinje@cloudshell:~/tf (cloud-cs-530-karinje-vkarinje)$ ssh-keygen -t ed25519
Generating public/private ed25519 key pair.
Enter file in which to save the key (/home/vkarinje/.ssh/id_ed25519):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/vkarinje/.ssh/id_ed25519
Your public key has been saved in /home/vkarinje/.ssh/id_ed25519.pub
The key fingerprint is:
SHA256:p897zciC1fKq3xq0tWmIDEwXvXSn2Pi7XT658rLMwoo vkarinje@cs-401029959521-default
The key's randomart image is:
+--[ED25519 256]--+
|   .. |
|
```

- Take a screenshot of the successful ssh login from Cloud Shell.



The screenshot shows a terminal session on an Ubuntu 20.04 LTS system. The user runs "ssh 34.105.1.162" and logs in successfully. The session then displays system information, including load average, memory usage, and swap usage. It also shows that no updates are available immediately. The user then runs "sudo apt update". Finally, the user exits the session.

```
ip = "34.105.1.162"
vkarinje@cloudshell:~/tf (cloud-cs-530-karinje-vkarinje)$ ssh 34.105.1.162
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1021-gcp x86_64)

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

 System information as of Fri Nov 11 08:02:26 UTC 2022

 System load:  0.0                  Processes:         91
 Usage of /:   18.8% of 9.51GB    Users logged in:     0
 Memory usage: 34%                IPv4 address for ens4: 10.138.0.21
 Swap usage:   0%

 0 updates can be applied immediately.

 The list of available updates is more than a week old.
 To check for new updates run: sudo apt update

 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.

vkarinje@tf-lab-vm:~$ ||
```

## Adding the Guestbook application

```
Terraform will perform the following actions:

# google_compute_instance.default must be replaced
resource "google_compute_instance" "default" {
  # (list of attributes and their values)

  EOT
  + reservation_affinity {
    + type = (known after apply)

    + specific_reservation {
      + key = (known after apply)
      + values = (known after apply)
    }
  }

  ~ scheduling {
    ~ automatic_restart = true -> (known after apply)
    ~ instance_termination_action = (known after apply)
    ~ min_node_cpus = 0 -> (known after apply)
    ~ on_host_maintenance = "MIGRATE" -> (known after apply)
    ~ preemptible = false -> (known after apply)
    ~ provisioning_model = "STANDARD" -> (known after apply)

    + node_affinities {
      + key = (known after apply)
      + operator = (known after apply)
      + values = (known after apply)
    }
  }

  - shielded_instance_config {
    - enable_integrity_monitoring = true -> null
    - enable_secure_boot = false -> null
    - enable_vtpm = true -> null
  }
}

Plan: 1 to add, 0 to change, 1 to destroy.
```

- What resources are being added, changed, or destroyed?

Metadata\_startup\_script,  
http-server,disk\_encryption\_key\_sha256,kms\_key\_self\_link,Ipv6\_access\_type,  
reservation\_affinity,node\_affinities were added.

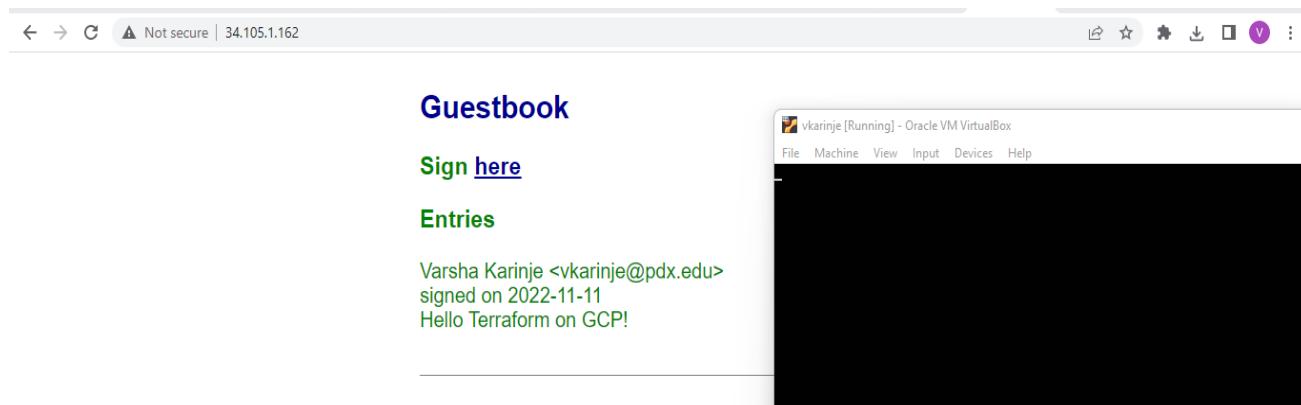
Enable\_display,labels,resource\_policies,queue-count were destroyed

Google\_compute\_intance default is replaced

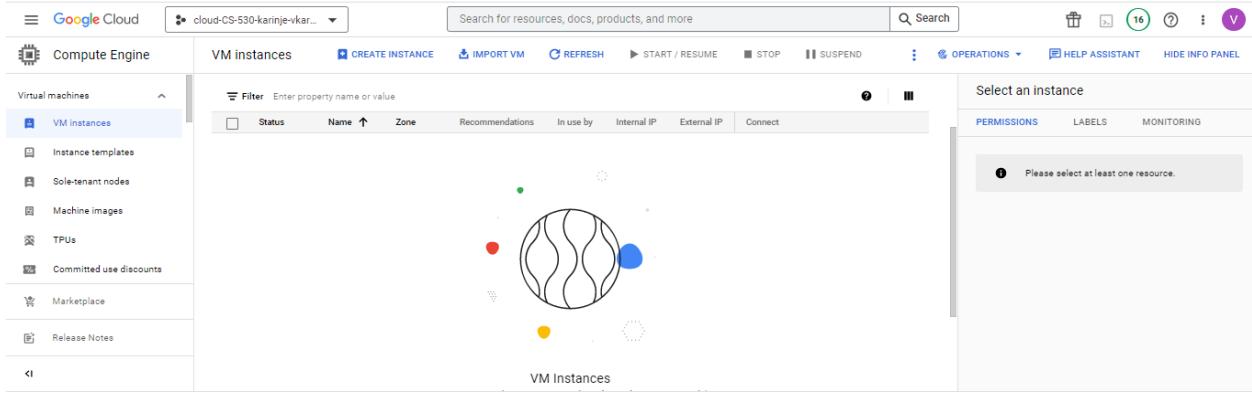
- What part of the configuration forces a replacement to occur?

Ans: Terraform plan and terraform apply will force these replacements to occur. EOT forces the replacement.

# View the Guestbook



## Clean Up



## 07.2g: Kubernetes Guestbook

### Setup

CLOUD SHELL

Terminal (cloud-cs-530-karinje-vkarinje) X + ▾

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to cloud-cs-530-karinje-vkarinje.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud services enable container.googleapis.com
Operation "operations/acf.p2-791612085972-7e62b82f-a061-48e4-b9d7-bb65159b8802" finished successfully.
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud services enable compute.googleapis.com
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud compute zones list
NAME: us-east1-b
REGION: us-east1
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-east1-c
REGION: us-east1
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-east1-d
REGION: us-east1
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-east4-c
REGION: us-east4
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-east4-b
REGION: us-east4
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-east4-a
REGION: us-east4
STATUS: UP
NEXT_MAINTENANCE:
TURNDOWN_DATE:

NAME: us-central1-c
REGION: us-central1
STATUS: UP

towdown_time.
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud config set compute/zone us-west1-b
Updated property [compute/zone].
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud config list
[accessibility]
screen_reader = True
[component_manager]
disable_update_check = True
[compute]
gce_metadata_read_timeout_sec = 30
zone = us-west1-b
[core]
account = vkarinje@pdx.edu
disable_usage_reporting = True
project = cloud-cs-530-karinje-vkarinje
[metrics]
environment = devshell

Your active configuration is: [cloudshell-18417]
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ | |
```

# Assigning privileges

The screenshot shows the Google Cloud IAM & Admin interface. On the left, there's a sidebar with various navigation options like Identity & Organization, Policy Troubleshooter, Policy Analyzer, Organization Policies, Service Accounts, Workload Identity Federation, Labels, Manage Resources, and Release Notes. The main area is titled 'PERMISSIONS' and shows a table of service accounts with their names, roles, and security insights. One account, 'gcs-lab@cloud-cs-530-karinje-vkarinje.iam.gserviceaccount.com', has 6070/6073 excess permissions. Another account, 'guestbook', has 12/16 excess permissions. The bottom of the screen shows a terminal window titled 'Terminal (cloud-cs-530-karinje-vkarinje)'.

# Create Kubernetes cluster

The screenshot shows the Google Cloud Compute Engine interface. On the left, there's a sidebar with options like VM Instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Manage Resources, Marketplace, and Release Notes. The main area shows 'VM instances' with two entries: 'gke-guestbook-default-pool-e1fc9f4c-vksp' and 'gke-guestbook-default-pool-e1fc9f4c-grp'. Both instances are running in the 'us-west1-b' zone. On the right, there's a 'PERMISSIONS' section with a message: 'Please select at least one resource.' Below it, there's a 'SELECT AN INSTANCE' dropdown and tabs for 'PERMISSIONS', 'LABELS', and 'MONITORING'.

**VM Instances**

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
Running	gke-guestbook-default-pool-e1fc9f4c-vksp	us-west1-b		gke-guestbook-default-pool-e1fc9f4c-vksp	10.138.0.19 (nic0)	34.127.69.216 (nic0)	SSH
Running	gke-guestbook-default-pool-e1fc9f4c-grp	us-west1-b		gke-guestbook-default-pool-e1fc9f4c-grp	10.138.0.20 (nic0)	35.197.118.143 (nic0)	SSH

**gke-guestbook... DETAILS**

**Basic information**

Name	gke-guestbook-default-pool-e1fc9f4c-vksp
Instance Id	661127454524361021
Description	None
Type	Instance
Status	Running
Creation time	Nov 10, 2022, 1:51:15 PM UTC-08:00
Zone	us-west1-b
Instance template	gke-guestbook-default-pool-e1fc9f4c
In use by	gke-guestbook-default-pool-e1fc9f4c-vksp
Reservations	Automatically choose (default)
Labels	announced=on

Go to Compute Engine and navigate around to answer the following questions in your lab notebook:

- **What is the name of the Instance Template dynamically generated to create the two nodes (VMs)?**

**Ans:** gke-guestbook-default-pool-e1fc9f4c is the name of the instance template dynamically generated to create the two nodes(VWs).

- **What is the name of the Instance Group dynamically generated that the two nodes belong to?**

**Ans:** gke-guestbook-default-pool-e1fc9f4c-grp is the name of the group dynamically generated that the two nodes belong to.

- **What are the names of the two nodes?**

**Ans:** gke-guestbook-default-pool-e1fc9f4c-vksp

gke-guestbook-default-pool-e1fc9f4c-rtp2

```
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ gcloud config set container/cluster guestbook
Updated property [container/cluster].
vkarinje@cloudshell:~ (cloud-cs-530-karinje-vkarinje)$ ||
```

## Prepare a container image

```
vkarinje@cloudshell:~/cs430-svc/05_gcp_datastore (cloud-cs-530-karinje-vkarinje)$ docker build -t gcr.io/${GOOGLE_CLOUD_PROJECT}/gcp_gb .
Sending build context to Docker daemon 45.32kB
Step 1/1 : FROM google/cloud-sdk
--> 17ec6141fdb: Pull complete
Digest: sha256:745f8385dbdd27720cd445eacd2c5f6fe59ebcbc99524bc30a52595194bbef59b
Status: Downloaded newer image for google/cloud-sdk:latest
--> 25a422551cd
Step 2/6 : MAINTAINER Your Name "yourname@pdx.edu"
--> Running in 3648a324921c
Removing intermediate container 3648a324921c
--> 8aa6599c1c166
Step 3/6 : COPY . /app
--> 6c2196f285f8a
Step 4/6 : WORKDIR /app
--> Running in 4bd845e5b1c5
Removing intermediate container 4bd845e5b1c5
--> 5f75f7dce9a6
Step 5/6 : RUN curl https://packages.cloud.google.com/apt/doc/sapt-key.gpg | apt-key add - && apt update --allow-releaseinfo-change && apt install -y python3-pip && pip3 install -r requirements.txt
--> Running in e528f9ae0a26
```

```

Collecting zipp==0.5
  Downloading zipp-0.5.0-py2-none-any.whl (6.2 kB)
Collecting MarkupSafe==2.0
  Downloading MarkupSafe-2.1.1-cp39-cp39-manylinux_2_17_x86_64_manylinux2014_x86_64.whl (25 kB)
Collecting pyasn1_modules>0.2.1
  Downloading pyasn1_modules-0.2.8-py2.py3-none-any.whl (155 kB)
    155.0/155.0 kB 17.4 MB/s eta 0:00:00

Collecting six>1.9.0
  Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)
Collecting cachetools<3.0,>=2.0
  Downloading cachetools-5.2.0-py3-none-any.whl (9.3 kB)
Collecting certifi>=2017.4.17
  Downloading certifi-2022.9.24-py3-none-any.whl (161 kB)
    161.1/161.1 kB 20.1 MB/s eta 0:00:00

Collecting idna<4,>=2.5
  Downloading idna-3.4-py3-none-any.whl (61 kB)
    61.5/61.5 kB 10.1 MB/s eta 0:00:00

Collecting charset-normalizer<3,>=2
  Downloading charset-normalizer-2.1.1-py3-none-any.whl (39 kB)
Collecting urllib3<1.26.12,>=1.26.12
  Downloading urllib3-1.26.12-py2.py3-none-any.whl (140 kB)
    140.4/140.4 kB 19.2 MB/s eta 0:00:00

Installing collected packages: pyasn1, zipp, six, rsa, pyasn1_modules, protobuf, MarkupSafe, itsdangerous, idna, unicorn, click, charset-normalizer, certifi, cachetools, Werkzeug, requests, proto-plus, Jinja2, importlib_metadata, gcpio, googleapis-common-protos, google-auth, grpcio-status, google-api-core, flask, google-cloud-core, google-cloud-firebase, google-cloud-database
Successfully installed Jinja2==2.1.2 MarkupSafe==2.1.1 Werkzeug==2.2.3 cachetools==5.2.0 certifi==2022.9.24 charset-normalizer==2.1.1 click==8.1.3 flask==2.2.2 google-api-core==3.10.2 google-auth==2.14.1 google-cloud-core==2.3.2 google-cloud-database==2.10.0 google-cloud-firebase==2.7.0 googleapis-common-protos==1.56.4 grpcio==1.50.0 grpcio-status==1.50.0 gunicorn==20.1.0 idna==3.4 importlib_metadata==5.0.0 itsdangerous==2.1.2 proto-plus==1.22.1 protobuf==4.21.0 pyasn1==0.4.8 pyasn1_modules==0.2.8 requests==2.28.1 rsa==4.9 six==1.16.0 urllib3==1.26.12 zipp==3.10.0

WARNING: Running pip as the root user can result in broken permissions and conflicting behavior with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings

q/venv
Removing intermediate container e528f9ae0aa6
--> 97db5ced14c
Step 1/6 : CMD ["gunicorn --bind :$PORT --workers 1 --threads 8 app:app"
--> 7fc942a654ad
Removing intermediate container 7fc942a654ad
--> bdbb22a4911e
Successfully built bdbb22a4911f
Successfully tagged gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb:latest
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ ||

vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ docker push gcr.io/${GOOGLE_CLOUD_PROJECT}/gcp_gb
Using default tag: latest
The push refers to repository [gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb]
f55f42b7521e: Pushed
12ac9ddaa578e: Pushed
00cc9b05elfd: Layer already exists
954779070d8a: Layer already exists
8987f9a6954c: Layer already exists
5ca806bbdfce: Layer already exists
1feade68f6ab: Pushed
d39561cc9f52: Layer already exists
a672a90a781f: Layer already exists
d9d07d703dd5: Layer already exists
latest: digest: sha256:8d9e811a5973edae219c9d5f864edd49a048267397aaa315152f76a9e92054d7 size: 2425
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ || |

```

- Take a screenshot of the container image created

Name	Tags	Virtual Size	Created	Uploaded
8d9e811a5973	latest	1.1 GB	8 minutes ago	3 minutes ago

## kubernetes.yaml

The screenshot shows the Google Cloud Shell interface. In the top bar, it says "cloud-CS-530-karinje-vkarinje". The main area is titled "CLOUD SHELL Editor". On the left, there's an "EXPLORER" sidebar showing a file tree with various project components like "01\_mvc\_pylist", "02\_mvc\_modules\_sqlite3", "03\_nginx\_gunicorn\_certbot", "04\_container\_dockerhub", "05\_aws\_dynamodb", and "05\_gcp\_datstore". The file "kubernetes.yaml" is selected in the tree and is displayed in the main editor area. The code in "kubernetes.yaml" defines a ReplicationController named "guestbook-replicas" with three replicas, each running a "guestbook" container on port 8000.

```

apiVersion: v1
kind: ReplicationController
metadata:
  name: guestbook-replicas
spec:
  replicas: 3
  template:
    metadata:
      labels:
        app: guestbook
        tier: frontend
    spec:
      containers:
        - name: guestbook-app
          image: gcr.io/cloud.cs-530-karinje-vkarinje/gcp_gb
          env:
            - name: PROCESSES
              value: guestbook
            - name: PORT
              value: "8000"
          ports:
            - containerPort: 8000
  ...
  apiVersion: v1
  kind: Service

```

## Deploy the configuration

- Take a screenshot of the output of the following command when all 3 replicas reach a "Running" state.

```
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-CS-530-karinje-vkarinje)$ kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
guestbook-replicas-lr8m9   1/1     Running   0          21m
guestbook-replicas-nwz7q   1/1     Running   0          21m
guestbook-replicas-xqr5r   1/1     Running   0          21m
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-CS-530-karinje-vkarinje)$ ||
```

- Take a screenshot of listing services with LoadBalancer indicating an external IP address that is ready for access.

```
guestbook-replicas-xqr5r   0/1   ContainerCreating   0          30s
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-CS-530-karinje-vkarinje)$ kubectl get services
NAME      TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
guestbook-lb   LoadBalancer   10.20.3.188   35.197.91.114   80:31503/TCP   5m53s
kubernetes   ClusterIP   10.20.0.1    <none>       443/TCP   42m
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-CS-530-karinje-vkarinje)$ ||
```

## View the Guestbook

The screenshot shows a web browser displaying the "Guestbook" application at the URL 35.197.91.114. The page title is "Guestbook". It features a "Sign here" button and a "Entries" section. The entries list four messages from "Varsha Karinje <vkarinje@pdx.edu>": one signed on 2022-10-31 21:23:02.741489+00:00, one for "Hello Docker Datastore", one for "Hello App Engine!", and one for "Hello Kubernetes!". To the right of the browser, a terminal window titled "vkarinje [Running] - Oracle VM VirtualBox" is open, showing the command "vkarinje@vkarinje-VirtualBox:~\$". The terminal also displays the Firefox icon.

- Take a screenshot of the managed guestbook pods and the service being exposed.

The screenshot shows the Google Cloud Platform Kubernetes interface. On the left, the navigation menu includes "Clusters", "Workloads" (which is selected), "Services & Ingress", "Applications", "Secrets & ConfigMaps", "Storage", "Object Browser", "Migrate to Containers", "Backup for GKE", "Config Management", and "Security Posture". The main content area shows "Replication Controller details" for "guestbook" in the "default" namespace. The "Pod specification" section includes labels "app: guestbook" and "tier: frontend", a termination grace period of 30 seconds, and a restart policy of "Always". The "Containers" field lists "guestbook-app". Below this, the "Managed pods" section shows three pods: "guestbook-replicas-xqr5" (Running, 0 restarts, created Nov 10, 2022, 2:30:06 PM), "guestbook-replicas-nwz7q" (Running, 0 restarts, created Nov 10, 2022, 2:30:06 PM), and "guestbook-replicas-lr8m9" (Running, 0 restarts, created Nov 10, 2022, 2:30:06 PM). A sidebar on the right provides links to "LEARN Tutorial", "Recommended for you" (including "ReplicationController", "Jobs", "CronJobs", "Adding and managing node pools", "Migrate workloads to different machine types", "Cluster autoscaler", and "Upgrading a cluster or node pool"), and "Cloud documentation".

The screenshot shows the Google Cloud Kubernetes Engine interface. The left sidebar lists various services like Clusters, Workloads, and Applications. The main panel displays the 'Replication Controller details' for a 'guestbook' replication controller. It shows labels (app: guestbook, tier: frontend), annotations (not set), logs (Container logs, Audit logs), and pods (3 current / 3 desired). The 'Pod specification' section includes labels, termination grace period (30s), restart policy (Always), and containers (guestbook-app). The 'Managed pods' section lists three pods: guestbook-replicas-xqr5, guestbook-replicas-nwz7q, and guestbook-replicas-lr8m9, all in Running status. The 'Exposing services' section shows a single load balancer named 'guestbook-lb' with IP 35.197.91.114:80. A right-hand sidebar titled 'LEARN Tutorial' provides links to 'ReplicationController', 'Jobs', 'CronJobs', 'Adding and managing node pools', 'Migrate workloads to different machine types', 'Cluster autoscaler', and 'Upgrading a cluster or node pool'.

- Take a screenshot of the load balancer and its details

The screenshot shows the Google Cloud Network services interface. The left sidebar lists services like Network services, Load balancing, Cloud DNS, Cloud CDN, Cloud NAT, Traffic Director, Service Directory, Cloud Domains, and Private Service Connect. The main panel displays 'Load balancer details' for a load balancer with ID adf21e9f5ce244bac910202d0d594de7. The 'Frontend' section shows settings for Protocol (TCP), IP version (IPv4), IP:Port (35.197.91.114:80), and Network Tier (Premium). The 'Backend' section shows a single backend named 'k8s-cd6b06ab29a7e4d5-node'. The 'ADVANCED CONFIGURATIONS' section lists two instances: 'gke-guestbook-default-pool-e1fc9f4c-rtp2' and 'gke-guestbook-default-pool-e1fc9f4c-vksp', both in Zone us-west1-b.

- Take a screenshot of the addresses allocated and indicate the ones associated with nodes versus the one associated with the load balancer.

Name	IP address	Access type	Region	Type	Version	In use by	Subnetwork
-	34.127.69.216	External	us-west1	Ephemeral	IPv4	VM instance gke-guestbook-default-pool-e1fcf9fd-ortp2 (Zone us-west1-b)	default
-	35.197.91.114	External	us-west1	Ephemeral	IPv4	Forwarding rule adf21a9f5ce24abac910202d0d594de7	
-	35.197.118.143	External	us-west1	Ephemeral	IPv4	VM instance gke-guestbook-default-pool-e1fcf9fd-otkq (Zone us-west1-b)	default

Select an address  
Labels help organize your resources (e.g., cost\_center=sales or env:prod).

No addresses selected.

The IP addresses 34.127.69.216 and 35.197.118.143 are associated with nodes and the IP address 35.197.91.114 is associated with the load balancer

## Clean Up

```
kubectl --cloud-shell=10.20.0.1 -n default get pods
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ kubectl delete -f kubernetes.yaml
replicationcontroller "guestbook-replicas" deleted
service "guestbook-lb" deleted
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ gcloud container clusters delete guestbook --zone us-west1-b
The following clusters will be deleted.
- [guestbook] in [us-west1-b]

Do you want to continue (Y/n)? Y

Deleting cluster guestbook...done.
Deleted [https://container.googleapis.com/v1/projects/cloud-es-530-karinje-vkarinje/zones/us-west1-b/clusters/guestbook].
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ gcloud container images delete gcr.io/${GOOGLE_CLOUD_PROJECT}/gcp_gb
WARNING: Implicit "-latest" tag specified: gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb
WARNING: Successfully resolved tag to sha256, but it is recommended to use sha256 directly.
Digests:
- gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb@sha256:8d9e511a5973edae219c9d5f864edd49a048267397aaa315152f76a9e92054d7
  Associated tags:
- latest
Tags:
- gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb:latest
This operation will delete the tags and images identified by the digests above.

Do you want to continue (Y/n)? Y

Deleted [gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb:latest].
Deleted [gcr.io/cloud-es-530-karinje-vkarinje/gcp_gb@sha256:8d9e511a5973edae219c9d5f864edd49a048267397aaa315152f76a9e92054d7].
vkarinje@cloudshell:~/cs430-src/05_gcp_datastore (cloud-es-530-karinje-vkarinje)$ ||
```

## 07.3a: APIs

### MoTD function

Successfully created the function lambda-vkarinje. You can now change its code and configuration. To invoke your function with a test event, choose "Test".

**lambda-vkarinje**

Description  
-

Last modified  
44 seconds ago

Function ARN  
[arn:aws:lambda:us-east-1:824659466980:function:lambda-vkarinje](#)

Function URL [Info](#)

## API integration

us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#functions/lambda-vkarinje?tab=configure

**API Gateway**

7 minutes ago

Function ARN  
[arn:aws:lambda:us-east-1:824659466980:function:lambda-vkarinje](#)

Function URL [Info](#)

**Configuration**

**Triggers (1)**

**Trigger**

**API Gateway: lambda-vkarinje-API**

arn:aws:execute-api:us-east-1:824659466980:e4rn8pu4n0/\*/\*/lambda-vkarinje

API endpoint: <https://e4rn8pu4n0.execute-api.us-east-1.amazonaws.com/default/lambda-vkarinje>

## Lambda code

File Edit Find View Go Tools Window Test Deploy Changes not deployed

lambda\_function

```

1 import json
2 import random
3 import urllib.request
4
5 def lambda_handler(event, context):
6     url=f"https://chi-ni.com/motd/{random.randint(0,19)}:02.html"
7     response=urllib.request.urlopen(url).read().decode('utf-8')
8     return{
9         'statusCode':200,
10        'headers': {
11            'Content-Type': 'text/html'
12        },
13        'body':response
14    }
15
16

```

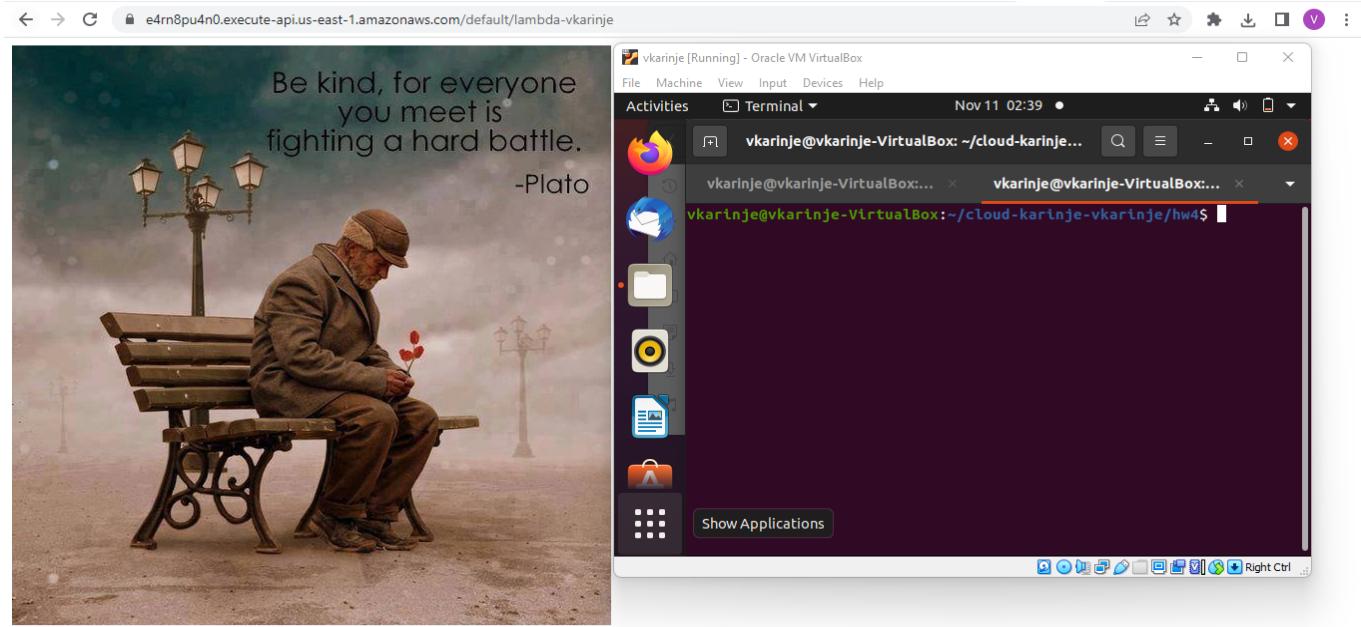
## Test code

The screenshot shows two AWS management console pages. The top page is the Lambda function configuration screen, specifically the 'Test' tab. It displays a successful execution result for a test event named 'test'. The response body contains an HTML img tag pointing to a URL. The bottom page is the API Gateway details screen for the 'lambda-vkarinje-API'. It shows the API ID (e4rn8pu4n0), protocol (HTTP), and a single stage named 'default' with its invoke URL.

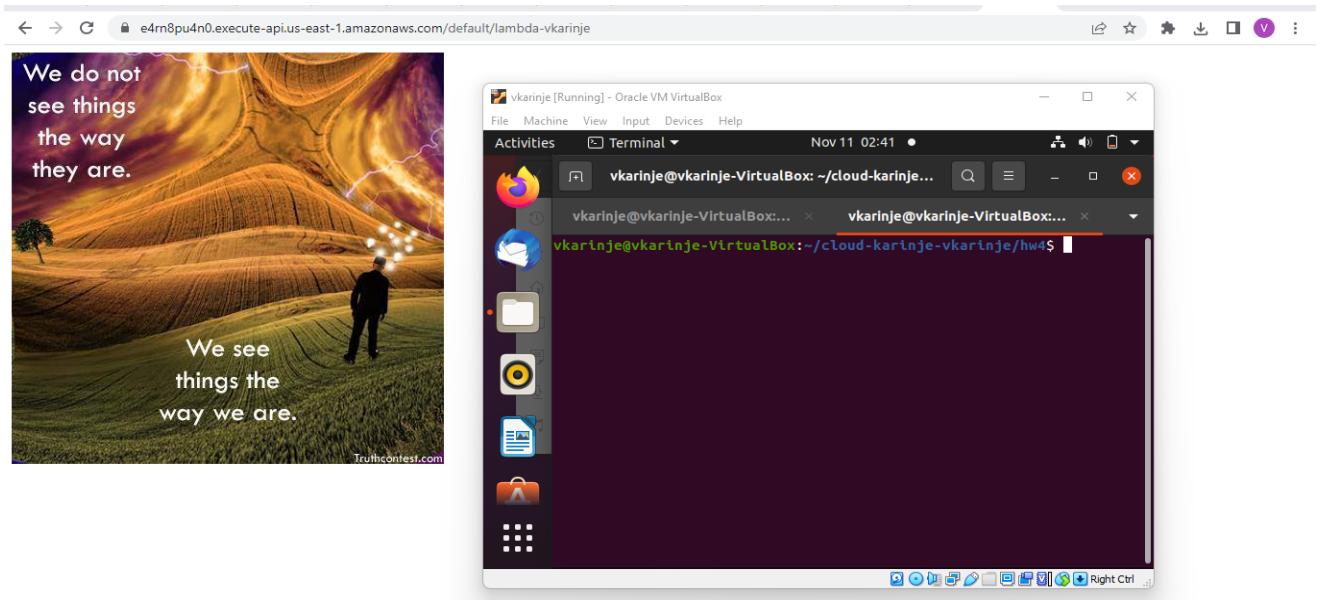
API ID	Protocol	Created
e4rn8pu4n0	HTTP	2022-11-11

Stage name	Invoke URL	Attached deployment	Auto deploy	Last updated
default	<a href="https://e4rn8pu4n0.execute-api.us-east-1.amazonaws.com/default">https://e4rn8pu4n0.execute-api.us-east-1.amazonaws.com/default</a>	0hf9vm	enabled	2022-11-11

- Take a screenshot of the resulting page including the URL bar.



- Click "Reload" in the browser and take another screenshot showing the image has changed:



Clean up

The screenshot shows the AWS Lambda Functions page. The left sidebar has 'Functions' selected. The main area displays a table of functions:

Function name	Description	Package type	Runtime	Last modified
MainMonitoringFunction	-	Zip	Python 3.8	last month
LightsailMonitoringFunction	-	Zip	Python 3.8	last month

## gettime API

The screenshot shows the AWS Lambda Function overview for 'gettime-vkarinje'. The left sidebar has 'Triggers' selected. The main area shows:

- Triggers (1)**: API Gateway: gettime-vkarinje-API
- Destinations**: None
- Function ARN**: arn:aws:lambda:us-east-1:824659466980:function:gettime-vkarinje
- Function URL**: <https://iv38wt0ly9.execute-api.us-east-1.amazonaws.com/default/gettime-vkarinje>

The screenshot shows the AWS Lambda Triggers configuration for 'gettime-vkarinje'. The left sidebar has 'Triggers' selected. The main area shows:

- Trigger**: API Gateway: gettime-vkarinje-API
- Details**:
  - API type: REST
  - Authorization: NONE
  - Method: ANY
  - Resource path: /gettime-vkarinje
  - Service principal: apigateway.amazonaws.com
  - Stage: default
  - Statement ID: lambda-4be57c9d-e456-46ae-8f9d-2c2b74871538

## Implement code

```

import json
import datetime

def lambda_handler(event, context):
    current_time=datetime.now()
    body = { 'currentTime': str(current_time) }

    response = {
        'statusCode' : 200,
        'headers' : {
            'Content-Type' : 'application/json'
        },
        'body' : json.dumps(body)
    }

    return response

```

## Test code

Successfully updated the function gettime-vkarinje.

Execution results		
Test Event Name	Status	Time
test	Succeeded	1.10 ms
	Max memory used: 36 MB	

**Response**

```
{
  "statusCode": 200,
  "headers": {
    "Content-Type": "application/json"
  },
  "body": "{\"currentTime\": \"2022-11-11 11:05:52.944883\"}"
}
```

**Function Logs**

```

START RequestId: 216ae811-eee7-4971-9f57-c17a502bfa85 Version: $LATEST
END RequestId: 216ae811-eee7-4971-9f57-c17a502bfa85
REPORT RequestId: 216ae811-eee7-4971-9f57-c17a502bfa85 Duration: 1.10 ms Billed Duration: 2 ms Memory Size: 128 MB Max Memory Used: 36 MB
Request ID
216ae811-eee7-4971-9f57-c17a502bfa85

```

- Use curl on your Linux VM to access the API endpoint and show the results. Take a screenshot for your lab notebook.

```
vkarinje@vkarinje-VirtualBox:~$ curl https://iv38wt0ly9.execute-api.us-east-1.amazonaws.com/default/gettime-vkarinje
{"currentTime": "2022-11-11 11:10:53.383356"}vkarinje@vkarinje-VirtualBox:~$
```

## Clean up

The screenshot shows the AWS Lambda Functions page. The left sidebar has 'AWS Lambda' selected under 'Functions'. The main area shows a table with two rows:

Function name	Description	Package type	Runtime	Last modified
MainMonitoringFunction	-	Zip	Python 3.8	last month
LightsailMonitoringFunction	-	Zip	Python 3.8	last month

## 07.3g: APIs (Slack, Knowledge Graph)

### Code

Answer the following question for your lab notebook:

- Could we have used the API Discovery package to interact with the Vision API?

Ans: Yes, we could have used the API Discovery package to interact with the Vision API as it can be used with any backend API.

- Does Google provide a Python package specifically for accessing the Knowledge Graph API?

Ans: No, Google does not provide a Python package specifically for accessing the Knowledge Graph API.

### Code

Visit the file and perform the following for your lab notebook:

- Show the source line that constructs the query we wish to send to the Knowledge Graph API.

Ans: Line 86

```

84  # [START functions_slack_request]
85  def make_search_request(query):
86      req = kgsearch.entities().search(query=query, limit=1)
87      res = req.execute()
88      return format_slack_message(query, res)
89  # [END functions_slack_request]

```

- Show the source line that then executes the query and saves the response. What is the name of the method that sends the query to the Knowledge Graph API?

Ans:

```

```
84  # [START functions_slack_request]
85  def make_search_request(query):
86      req = kgsearch.entities().search(query=query, limit=1)
87      res = req.execute()
88      return format_slack_message(query, res)
89  # [END functions_slack_request]
```

```

The line `res = req.execute()` is the line that executes the query and saves the response. The method that sends the query to the Knowledge Graph API is `make_search_request`.

```

92  # [START functions_slack_search]
93  @functions_framework.http
94  def kg_search(request):
95      if request.method != 'POST':
96          return 'Only POST requests are accepted', 405
97
98      verify_signature(request)
99      kg_search_response = make_search_request(request.form['text'])
100     return jsonify(kg_search_response)
101 # [END functions_slack_search]
```

```

Visit the file and answer the following questions:

- What is the Python data type that is used to represent the formatted message?

Ans: text

- What are the three main attributes of the formatted message passed back to Slack?

`title,title_link,image_url`

```

47      entity = response['itemListElement'][0]['res']
48
49      message = {
50          'response_type': 'in_channel',
51          'text': 'Query: {}'.format(query),
52          'attachments': []
53      }
54
```

```

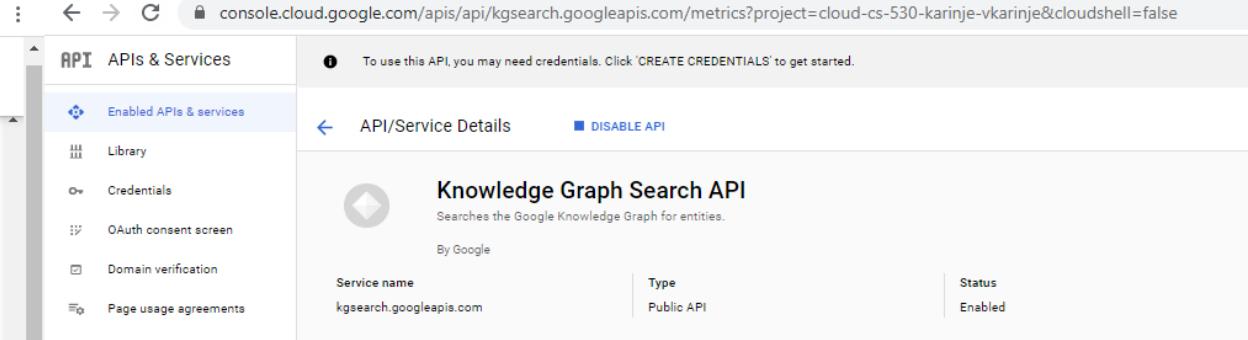


```

main.py X
python-docs-samples > functions > slack > main.py
57     name = entity.get('name', '')
58     description = entity.get('description', '')
59     detailed_desc = entity.get('detailedDescription', {})
60     url = detailed_desc.get('url')
61     article = detailed_desc.get('articleBody')
62     image_url = entity.get('image', {}).get('contentUrl')
63
64     attachment['color'] = '#3367d6'
65     if name and description:
66         attachment['title'] = '{}: {}'.format(entity["name"],
67                                              entity["description"])
68     elif name:
69         attachment['title'] = name
70     if url:
71         attachment['title_link'] = url
72     if article:
73         attachment['text'] = article
74     if image_url:
75         attachment['image_url'] = image_url

```

## Knowledge Graph setup



The screenshot shows the Google Cloud Platform API library interface. On the left, there's a sidebar with 'API' selected, followed by 'Enabled APIs & services'. Under this, there are several options: 'Library', 'Credentials', 'OAuth consent screen', 'Domain verification', and 'Page usage agreements'. The 'Knowledge Graph Search API' is listed under 'Enabled APIs & services'. To its right, there's a 'API/Service Details' section with a play button icon. It displays the service name as 'kgsearch.googleapis.com', type as 'Public API', and status as 'Enabled'. There's also a note: 'To use this API you may need credentials. Click CREATE CREDENTIALS to get started.' and a 'DISABLE API' button.

## Create a Slack workspace

Answer the following questions:

- What would be the difference between an adversary finding out YOUR\_SLACK\_SIGNING\_SECRET versus finding out YOUR\_KG\_API\_KEY?

Ans: If an adversary finds out my YOUR\_SLACK\_SIGNING\_SECRET they can hack my slack app to control and interact with the slack api. Whereas, if they find out my YOUR\_KG\_API\_KEY they can interact with the Google Knowledge Search API as if it is me interacting with the API using my identities.

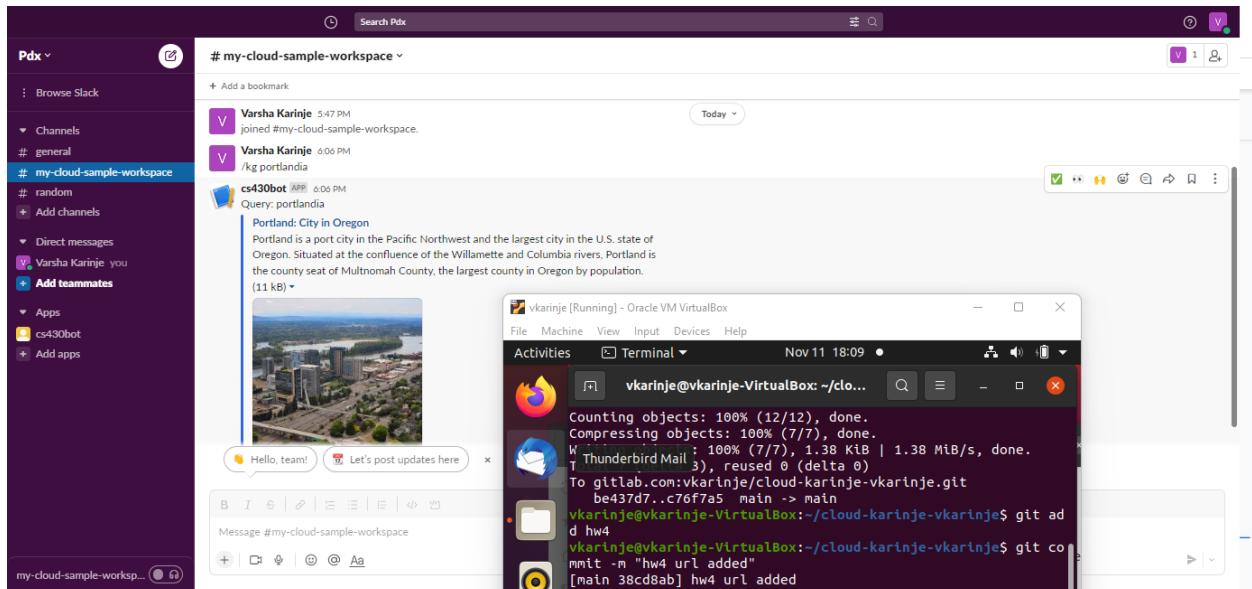
# Configure and Deploy

Note the URL of the function endpoint.

```
vkarinje@cloudshell:~/python-docs-samples/functions/slack (cloud-cs-530-karinje-vkarinje)$ gcloud functions deploy kg_search \
--runtime python37 \
--trigger-http \
--set-env-vars "SLACK_SECRET=cfe22634dfc305140371f6fe3ab5dedf,KG_API_KEY=AIsaSyA9snjrac2oA7DNvH6CRocsKb5DgvtGibQ" \
--allow-unauthenticated
Deploying function (may take a while - up to 2 minutes)...working.
For Cloud Build Logs, visit: https://console.cloud.google.com/cloud-build/builds;region=us-central1/e0cff51d8-07a4-4e16-a03a-64b14c66249e?project=791612085972
Deploying function (may take a while - up to 2 minutes)...done.
availableMemoryMb: 256
buildId: e0cff51d8-07a4-4e16-a03a-64b14c66249e
buildName: projects/791612085972/locations/us-central1/builds/e0cff51d8-07a4-4e16-a03a-64b14c66249e
dockerRegistry: CONTAINER_REGISTRY
entryPoint: kg_search
environmentVariables:
  KG_API_KEY: AIsaSyA9snjrac2oA7DNvH6CRocsKb5DgvtGibQ
  SLACK_SECRET: cfe22634dfc305140371f6fe3ab5dedf
httpsTrigger:
  securityLevel: SECURE_ALWAYS
  url: https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/kg_search
ingressSettings: ALLOW_ALL
labels:
  deployment-tool: cloudbuild
name: projects/cloud-cs-530-karinje-vkarinje/locations/us-central1/functions/kg_search
runtime: python37
serviceAccountEmail: cloud-cs-530-karinje-vkarinje@appspot.gserviceaccount.com
sourceUploadUrl: https://storage.googleapis.com/uploads-742570563969.us-central1.cloudfunctions.appspot.com/fde939be-a582-4362-a665-a309779f52c.sip
status: ACTIVE
timeout: 60s
updateTime: '2022-11-12T02:00:54.307Z'
versionId: '1'
vkarinje@cloudshell:~/python-docs-samples/functions/slack (cloud-cs-530-karinje-vkarinje)$ ||
```

## Test the command

- Take a screenshot of its response for your lab notebook.



The image shows two screenshots of the Google Cloud Platform interface.

**Top Screenshot:** A screenshot of the "Function details" page for a function named "kg\_search". The "LOGS" tab is selected. It shows log entries from November 11, 2022. The logs include:

- Cloud Functions CreateFunction us-central1:kg\_search vkarinje@pdx.edu (@type: type.googleapis.com/google.cloud.audit.AuditLog, authenticationInfo: {}, authorizationInfo: {}, methodName: google.cloud.functions.v1.cloudFunctionsCreateFunction)
- Cloud Functions SetIamPolicy us-central1:kg\_search vkarinje@pdx.edu (@type: type.googleapis.com/google.cloud.audit.AuditLog, authenticationInfo: {}, authorizationInfo: {}, methodName: google.cloud.functions.v1.cloudFunctionsSetIamPolicy)
- Cloud Functions CreateFunction us-central1:kg\_search vkarinje@pdx.edu (@type: type.googleapis.com/google.cloud.audit.AuditLog, authenticationInfo: {}, authorizationInfo: {}, methodName: google.cloud.functions.v1.cloudFunctionsCreateFunction)
- kg\_search 8xld6gzbfxbp Function execution started
- kg\_search 8xld6gzbfxbp Function execution took 387 ms. Finished with status code: 200

**Bottom Screenshot:** The "Cloud Functions" landing page. It features a "Welcome to Cloud Functions!" message and links to "CREATE FUNCTION", "TAKE A QUICK START", "Develop functions locally", "Testing Cloud Functions", "How-to Guides", "Tips and Tricks", "Tutorials", and "Billing and Product Resources".

## 07.4a: Lambda, API Gateway Guestbook

Obtain AWS account ID

The screenshot shows the AWS Cloud9 IDE interface. On the left, there's a file browser with 'Lambda - /home/vkarinje' selected, containing files 'c9' and 'README.md'. The main area is a terminal window titled 'bash - [ip-172-31-92-229]' with the tab 'Immediate' selected. The terminal output shows the deployment of a Lambda function, including package extraction and configuration steps. At the bottom of the terminal, it says 'voclabs:/environment \$'. To the right of the terminal, there's a smaller window titled 'vkarinje [Running] - Oracle VM VirtualBox' showing a terminal session with the command 'create\_mode 100644 hw4/obmodel/model\_datastore.nv'.

```

Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu bionic/universe amd64 libonig4 amd64 6.7.0-1 [119 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu bionic/universe amd64 libjq1 amd64 1.5+dfsg-2 [111 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu bionic/universe amd64 jq amd64 1.5+dfsg-2 [45.6 kB]
Fetched 276 kB in 10.2 MB/s
Selecting previously unselected package libonig4:amd64.
(Reading database ... 77781 files and directories currently installed.)
Preparing to unpack .../libonig4_6.7.0-1_amd64.deb ...
Unpacking libonig4:amd64 (6.7.0-1) ...
Selecting previously unselected package libjq1:amd64.
Preparing to unpack .../libjq1_1.5+dfsg-2_amd64.deb ...
Unpacking libjq1:amd64 (1.5+dfsg-2) ...
Selecting previously unselected package jq.
Preparing to unpack .../jq_1.5+dfsg-2_amd64.deb ...
Unpacking jq (1.5+dfsg-2) ...
Setting up libonig4:amd64 (6.7.0-1) ...
Setting up libjq1:amd64 (1.5+dfsg-2) ...
Setting up jq (1.5+dfsg-2) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...
voclabs:/environment $ aws sts get-caller-identity
{
    "UserId": "AROA4AM13L5GMY5KCKJS:user2175716=vkarinje@pdx.edu",
    "Account": "624659466980",
    "Arn": "arn:aws:sts::624659466980:assumed-role/voclabs/user2175716=vkarinje@pdx.edu"
}
voclabs:/environment $ export aws_account_id=$(aws sts get-caller-identity | jq '.Account | tonumber')
voclabs:/environment $ echo $aws_account_id
624659466980
voclabs:/environment $ 
```

## REST API Code

Answer the following questions:

- What might go wrong when we call scan? Think about the way DynamoDB works, and look at the scan documentation for a hint. What could be done to address this problem?

Ans: Scan operations will always return one or more items and item attributes by accessing every item in a table or a secondary index. To give us the result that we want it will filter out the values by adding the extra step of removing data from the result set. The scan operation will slow down as the table size grows. Scan request can retrieve a maximum of 1MB of data.

To address the problem DynamoDB can filter the results thus reducing the number of results that will be returned to the user. Some ways of doing this is by using a query or for items in tables we can use getitem and batchitem APIs.

## Deploy the Lambda for viewing entries

us-east-1.console.aws.amazon.com/cloud9/ide/0a7c8b93129a41bc8155da70470465ef

```

File Edit Find View Go Run Tools Window Support Preview Run
Share
Go to Anything (Ctrl-P)
Lambda - /home/vkarinje
  cs430-src
    01_mvc_pylist
    02_mv_modules_s
    03_nginx_unicorn
    04_container_docker
    05_aws_dynamodb
    06_gcp_datastore
  06_aws_restapi_lambda
    frontend
    restapi
      lambda
        function.zip
        get_entries.py
        sign.py
        app.py
        cdk.json
        README.md
        requirements.txt
    06_gcp_restapi_client
    07_oauth
    LICENSE
    README.md
    README.md
AWS profile: default

bash - ip-172-31-92-229 x Immediate x +
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda create-function --function-name vkarinje-gb-lambda \
> --zip-file file:///function.zip \
> --handler get_entries.handler \
> --runtime python3.7 \
> --environment Variables='TABLE="guestbook"' \
> --role arn:aws:iam::824659466980:role/LabRole
{
  "FunctionName": "vkarinje-gb-lambda",
  "FunctionArn": "arn:aws:lambda:us-east-1:824659466980:function:vkarinje-gb-lambda",
  "Runtime": "python3.7",
  "Role": "arn:aws:iam::824659466980:role/LabRole",
  "Handler": "get_entries.handler",
  "CodeSize": 305,
  "Description": "",
  "Timeout": 3,
  "MemorySize": 128,
  "LastModified": "2022-11-12T05:27:21.492+0000",
  "CodeSha256": "174e8b0Bu1j7OS0CptSNGU1d86SrdfAA/rToJSXg=",
  "Version": "$LATEST",
  "Environment": {
    "Variables": {
      "TABLE": "guestbook"
    }
  },
  "TracingConfig": {
    "Mode": "PassThrough"
  },
  "RevisionId": "c6fb79c3-2c2a-496d-93a3-2fbe63c646e6",
  "State": "Pending".
}

vkarinje [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Nov 11 21:27 •
vkarinje@vkarinje-virtualbox: ~/cloud-karinje-vkarinje$ create mode 100644 hw4/gbmodel/model datastore.py
[...]

```

vclabs:~/environment/cs430-src/06\_aws\_restapi\_lambda/restapi/lambda (master) \$ aws lambda invoke --function-name \${odin\_id}-gb-lambda gb-lambda.out

An error occurred (UnrecognizedClientException) when calling the Invoke operation: The security token included in the request is invalid.

```

vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure
AWS Access Key ID [*****QCP*]:
AWS Secret Access Key [*****Y1vE*]:
Default region name [us-east-1]:
Default output format [None]:
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure set aws_access_token "FwoGZXIVYXdxEOX//////////wEaDPxg/BCGS8oNnu5KSLBAAd5qWkPnulQe2YAgug6d5G/UtrwQ/P1xWQgVSpItaiA9Mo5HzUYPE4SWZBGTtx8yKp58EuhmSl/TyDUifKj/w1c0+D8ePu8wTJAzymQJw7oW4UZUiAgtp3YyOmXUdhC0nkyYtj7C58ihEtqYaqG47iotochEFB560KqsEv1UgaigSek8kwliwzLD2PeG5XgIPystP+04reWQxPwE37FuHwGuUL1lllFURNLmJqBB916TfIGwJ34PhD0UmPvQfJH0/eDGmwYyLS1J4aBpuFh0wZ+j2ugy9C9NtdsEikhZzGe6Up70Jj8glCgtYhoMi10YBYfnA=="
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda invoke --function-name ${odin_id}-gb-lambda gb-lambda.out
An error occurred (UnrecognizedClientException) when calling the Invoke operation: The security token included in the request is invalid.
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure set aws_session_token "FwoGZXIVYXdxEOX//////////wEaDPxg/BCGS8oNnu5KSLBAAd5qWkPnulQe2YAgug6d5G/UtrwQ/P1xWQgVSpItaiA9Mo5HzUYPE4SWZBGTtx8yKp58EuhmSl/TyDUifKj/w1c0+D8ePu8wTJAzymQJw7oW4UZUiAgtp3YyOmXUdhC0nkyYtj7C58ihEtqYaqG47iotochEFB560KqsEv1UgaigSek8kwliwzLD2PeG5XgIPystP+04reWQxPwE37FuHwGuUL1lllFURNLmJqBB916TfIGwJ34PhD0UmPvQfJH0/eDGmwYyLS1J4aBpuFh0wZ+j2ugy9C9NtdsEikhZzGe6Up70Jj8glCgtYhoMi10YBYfnA=="
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda invoke --function-name ${odin_id}-gb-lambda gb-lambda.out
{
  "StatusCode": 200,
  "ExecutedVersion": "$LATEST"
}
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $
```

vkarinje [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Nov 13 19:31 •
vkarinje@vkarinje-virtualbox: ~/cloud-karinje-vkarinje\$

An error occurred (UnrecognizedClientException) when calling the Invoke operation: The security token included in the request is invalid.

```

vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure
AWS Access Key ID [*****QCP*]:
AWS Secret Access Key [*****Y1vE*]:
Default region name [us-east-1]:
Default output format [None]:
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure set aws_access_token "FwoGZXIVYXdxEOX//////////wEaDPxg/BCGS8oNnu5KSLBAAd5qWkPnulQe2YAgug6d5G/UtrwQ/P1xWQgVSpItaiA9Mo5HzUYPE4SWZBGTtx8yKp58EuhmSl/TyDUifKj/w1c0+D8ePu8wTJAzymQJw7oW4UZUiAgtp3YyOmXUdhC0nkyYtj7C58ihEtqYaqG47iotochEFB560KqsEv1UgaigSek8kwliwzLD2PeG5XgIPystP+04reWQxPwE37FuHwGuUL1lllFURNLmJqBB916TfIGwJ34PhD0UmPvQfJH0/eDGmwYyLS1J4aBpuFh0wZ+j2ugy9C9NtdsEikhZzGe6Up70Jj8glCgtYhoMi10YBYfnA=="
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda invoke --function-name ${odin_id}-gb-lambda gb-lambda.out
An error occurred (UnrecognizedClientException) when calling the Invoke operation: The security token included in the request is invalid.
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws configure set aws_session_token "FwoGZXIVYXdxEOX//////////wEaDPxg/BCGS8oNnu5KSLBAAd5qWkPnulQe2YAgug6d5G/UtrwQ/P1xWQgVSpItaiA9Mo5HzUYPE4SWZBGTtx8yKp58EuhmSl/TyDUifKj/w1c0+D8ePu8wTJAzymQJw7oW4UZUiAgtp3YyOmXUdhC0nkyYtj7C58ihEtqYaqG47iotochEFB560KqsEv1UgaigSek8kwliwzLD2PeG5XgIPystP+04reWQxPwE37FuHwGuUL1lllFURNLmJqBB916TfIGwJ34PhD0UmPvQfJH0/eDGmwYyLS1J4aBpuFh0wZ+j2ugy9C9NtdsEikhZzGe6Up70Jj8glCgtYhoMi10YBYfnA=="
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda invoke --function-name ${odin_id}-gb-lambda gb-lambda.out
{
  "StatusCode": 200,
  "ExecutedVersion": "$LATEST"
}
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ cat gb-lambda.out
{"statusCode": 200, "headers": {"Access-Control-Allow-Origin": "*"}, "body": "[{"message": "Hello DynamoDB", "date": "2022-10-30 06:08:47.837999"}, {"message": "Hello Docker DynamoDB", "date": "2022-10-30 13:33:21.969328"}, {"message": "Hello Cloud9!", "date": "2022-10-30 14:06:25.364282"}, {"message": "Hello EC2!", "date": "2022-10-31 02:35:01.889722"}, {"message": "Hello Elastic Beanstalk!", "date": "2022-11-02 08:25:36.879805"}]}vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $
```

vkarinje [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Nov 13 19:32 •
vkarinje@vkarinje-virtualbox: ~/cloud-karinje-vkarinje\$

System program problem detected

## Create API in API Gateway

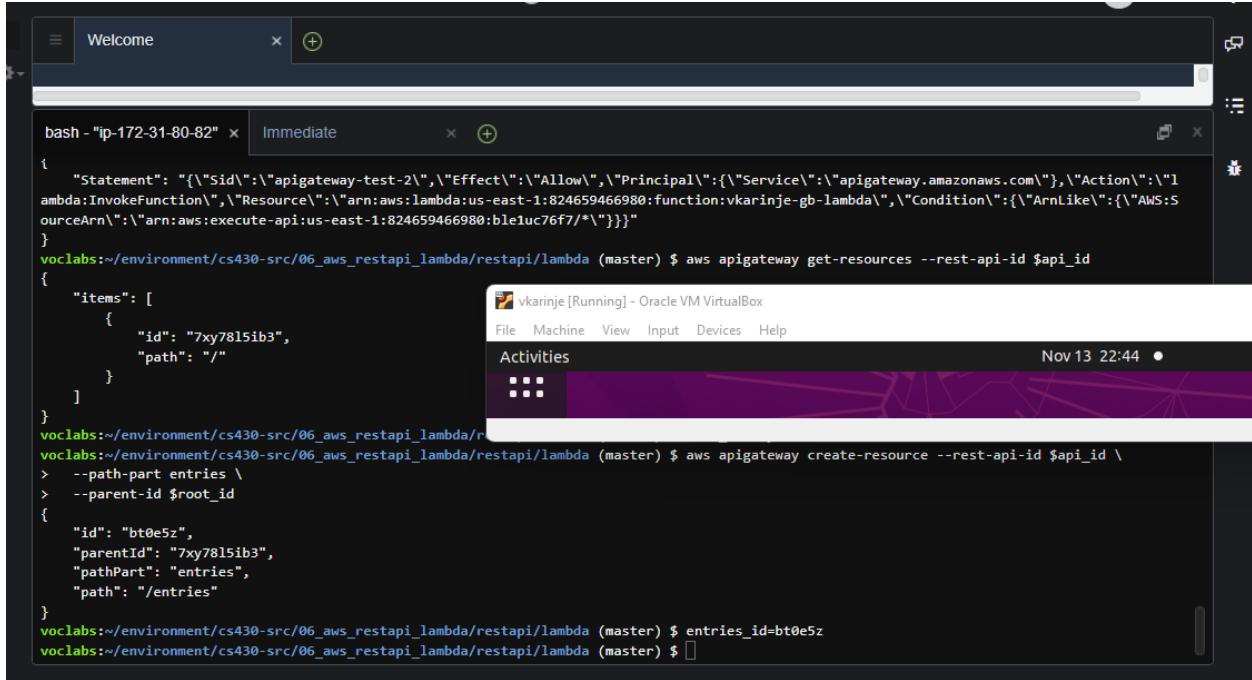
```
voclabs:~/environment/cs430-src/06 aws_restapi_lambda/restapi/lambda (master) $ cat gb-lambda.out
{"statusCode": 200, "headers": {"Access-Control-Allow-Origin": ""}, "body": "[{"message": "Hello DynamoDB", "date": "2022-10-30 06:08:47.837999"}, {"email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Docker DynamoDB", "date": "2022-10-30 13:33:21.969328"}, {"email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Cloud9!", "date": "2022-10-30 14:06:25.364282"}, {"email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello EC2", "date": "2022-10-31 02:35:01.889722"}, {"email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Elastic Beanstalk!", "date": "2022-11-02 08:25:36.879805"}, {"email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}]"}voclabs:~/environment/cs430-src/06_aws_restapi_lambda/r
estapi/lambda (master) $ aws apigateway create-rest-api --name ${odin_id}-gb-restapi
{
  "id": "ble1uc76f7",
  "name": "vkarinje-gb-restapi",
  "createdDate": 1668408068,
  "apiKeySource": "HEADER",
  "endpointConfiguration": {
    "types": [
      "EDGE"
    ]
  },
  "disableExecuteApiEndpoint": false
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/r
estapi/lambda (master) $ api_id=ble1uc76f7
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/r
estapi/lambda (master) $ 
```

The screenshot shows a terminal window with the command `aws apigateway create-rest-api` being run, creating a new REST API named `ble1uc76f7`. Below the terminal, a system notification window titled 'System program problem detected' is visible, indicating a system issue.

## Enable API to invoke Lambda function

```
voclabs:~/environment/cs430-src/06 aws_restapi_lambda/restapi/lambda (master) $ cat gb-lambda.out
{"name": "vkarinje-gb-restapi", "createdDate": 1668396887, "apiKeySource": "HEADER", "endpointConfiguration": { "types": [ "EDGE" ] }, "disableExecuteApiEndpoint": false }
voclabs:~/environment/cs430-src/06 aws_restapi_lambda/restapi/lambda (master) $ api_id=04zpg39av2
voclabs:~/environment/cs430-src/06 aws_restapi_lambda/restapi/lambda (master) $ aws lambda add-permission --function-name ${odin_id}-gb-lambda \
> --statement-id apigateway-test-2 \
> --action lambda:InvokeFunction \
> --principal apigateway.amazonaws.com \
> --source-arn "arn:aws:execute-api:us-east-1:${aws_account_id}:$api_id/*"
{
  "Statement": "{\"Sid\":\"apigateway-test-2\",\"Effect\":\"Allow\",\"Principal\":{\"Service\":\"apigateway.amazonaws.com\"},\"Action\":\"lambda:InvokeFunction\",\"Resource\":\"arn:aws:lambda:us-east-1:824659466980:function:vkarinje-gb-lambda\",\"Condition\":{\"ArnLike\":{\"AWS:SourceArn\":\"arn:aws:execute-api:us-east-1::04zpg39av2/*\"}}}"
}
voclabs:~/environment/cs430-src/06 aws_restapi_lambda/restapi/lambda (master) $ 
```

## API endpoint for viewing entries (1)

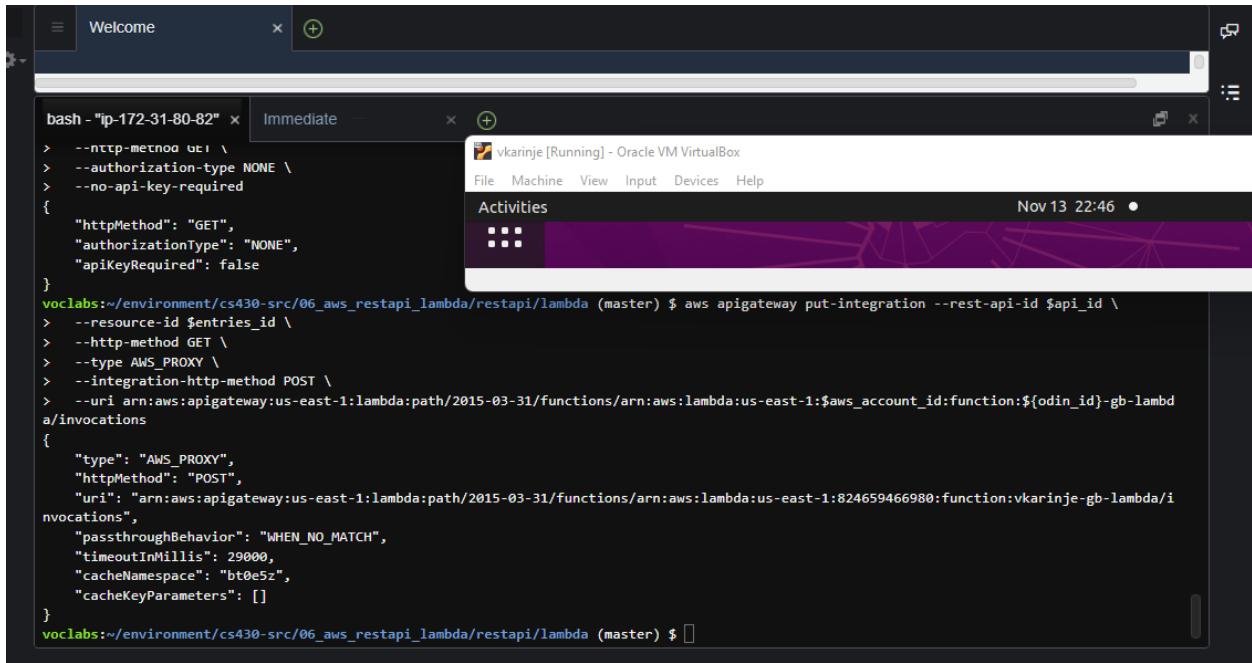


```

bash - "ip-172-31-80-82" x Immediate x +
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway get-resources --rest-api-id $api_id
{
  "Statement": "{\"Sid\":\"apigateway-test-2\",\"Effect\":\"Allow\",\"Principal\":{\"Service\":\"apigateway.amazonaws.com\"},\"Action\":\"lambda:InvokeFunction\",\"Resource\":\"arn:aws:lambda:us-east-1:824659466980:function:vkarinje-gb-lambda\",\"Condition\":{\"ArnLike\":{\"AWS:SourceArn\":\"arn:aws:execute-api:us-east-1:824659466980:ble1uc76f7/*\"}}}"
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway create-resource --rest-api-id $api_id \
{
  "items": [
    {
      "id": "7xy78l5ib3",
      "path": "/"
    }
  ]
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/r
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway create-resource --rest-api-id $api_id \
> --path-part entries \
> --parent-id $root_id \
{
  "id": "bt0e5z",
  "parentId": "7xy78l5ib3",
  "pathPart": "entries",
  "path": "/entries"
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ entries_id=bt0e5z
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ 

```

## API endpoint for viewing entries (2)



```

bash - "ip-172-31-80-82" x Immediate x +
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-integration --rest-api-id $api_id \
> --resource-id $entries_id \
> --http-method GET \
> --type AWS_PROXY \
> --integration-http-method POST \
> --uri arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:$aws_account_id:function:${odin_id}-gb-lambda/invocations
{
  "type": "AWS_PROXY",
  "httpMethod": "POST",
  "uri": "arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:824659466980:function:vkarinje-gb-lambda/invocations",
  "passthroughBehavior": "WHEN_NO_MATCH",
  "timeoutInMillis": 29000,
  "cacheNamespace": "bt0e5z",
  "cacheKeyParameters": []
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ 

```

The screenshot shows the AWS API Gateway Method Execution page for the /entries - GET method. The left sidebar shows the resources structure: / > /entries > GET. The main panel has the title "Method Execution /entries - GET - Method Test". A note says: "Make a test call to your method. When you make a test call, API Gateway skips authorization and directly invokes your method." Below it, "Path" is defined as "/entries". "Request: /entries" shows the URL. "Status: 200" and "Latency: 2033 ms" are listed. "Response Body" shows a JSON array of messages:

```
[{"message": "Hello DynamoDB", "date": "2022-10-30 06:08:47.837999", "email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Docker DynamoDB", "date": "2022-10-30 13:33:21.969328", "email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Cloud 9!", "date": "2022-10-30 14:06:25.364282", "email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello EC2", "date": "2022-10-31 02:35:01.889722", "email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}, {"message": "Hello Elastic BeanStalk!", "date": "2022-11-02 08:45:01.900000", "email": "vkarinje@pdx.edu", "name": "Varsha Karinje"}]
```

## CORS setup for viewing entries

```
bash - "ip-172-31-80-82" x Immediate x + 
authorizationType : NONE ,
"apiKeyRequired": false
}
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-method-response --rest-api-id $api_id \
> --resource-id $entries_id \
> --http-method OPTIONS \
> --status-code 204 \
> --response-parameters '{"method.response.header.Access-Control-Allow-Origin": true, "method.response.header.Access-Control-Allow-Methods": true, "method.response.header.Access-Control-Allow-Headers": true}'
{
    "statusCode": "204",
    "responseParameters": {
        "method.response.header.Access-Control-Allow-Headers": true,
        "method.response.header.Access-Control-Allow-Methods": true,
        "method.response.header.Access-Control-Allow-Origin": true
    }
}
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-integration --rest-api-id $api_id \
> --resource-id $entries_id \
> --type MOCK \
> --http-method OPTIONS \
> --request-templates '{ \"application/json\" : \"{\\\"statusCode\\\": 200}\" }'
{
    "type": "MOCK",
    "requestTemplates": {
        "application/json": "{\"statusCode\": 200}"
    }
}
```

bash - "ip-172-31-80-82" x Immediate x +

```

}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-integration --rest-api-id $api_id \
> --resource-id $entries_id \
> --type MOCK \
> --http-method OPTIONS \
> --request-templates '{ "application/json" : "{\"statusCode": 200}" }'
{
  "type": "MOCK",
  "requestTemplates": {
    "application/json": "{\"statusCode\": 200}"
  },
  "passthroughBehavior": "WHEN_NO_MATCH",
  "timeoutInMillis": 29000,
  "cacheNamespace": "bt0e5z",
  "cacheKeyParameters": []
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-integration-response --rest-api-id $api_id \
\
> --resource-id $entries_id \
> --http-method OPTIONS \
> --status-code 204 \
> --selection-pattern "-" \
> --response-templates "{\"application/json\": \"Empty\"}" \
> --response-parameters '{"method.response.header.Access-Control-Allow-Headers" : "Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent", "method.response.header.Access-Control-Allow-Methods": "GET,POST", "method.response.header.Access-Control-Allow-Origin": "*"}'
cacnekeyparameters : LJ
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway put-integration-response --rest-api-id $api_id \
\
> --resource-id $entries_id \
> --http-method OPTIONS \
> --status-code 204 \
> --selection-pattern "-" \
> --response-templates "{\"application/json\": \"Empty\"}" \
> --response-parameters '{"method.response.header.Access-Control-Allow-Headers" : "Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent", "method.response.header.Access-Control-Allow-Methods": "GET,POST", "method.response.header.Access-Control-Allow-Origin": "*"}'
{
  "statusCode": "204",
  "selectionPattern": "-",
  "responseParameters": {
    "method.response.header.Access-Control-Allow-Headers": "Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent",
    "method.response.header.Access-Control-Allow-Methods": "GET,POST",
    "method.response.header.Access-Control-Allow-Origin": "*"
  },
  "responseTemplates": {
    "application/json": "Empty"
  }
}
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ 
```

vkarinje [Running] - Oracle VM VirtualBox  
File Machine View Input Devices Help  
Activities Nov 13 22:49 ●  
Laptop battery low

View Go Run Tools Window Support Preview Run Share

Welcome vkarinje [Running] - Oracle VM VirtualBox  
File Machine View Input Devices Help Activities Nov 13 22:50 ● Laptop battery low

APIs > vkarinje-gb-restapi (ble1uc76f7) > Resources > /entries > OPTIONS

**/entries - OPTIONS - Method Test**

Path: Request: /entries  
Status: 204  
Latency: 6 ms  
Response Body: no data

Query Strings: {entries} param1=value1&param2=value2

Headers: {entries} Use a colon (:) to separate header name and value, and new lines to

Response Headers: {"Access-Control-Allow-Headers": ["Content-Type, X-Amz-Date, Authorization, X-Api-Key, X-Amz-Security-Token, X-Amz-User-Agent"], "Access-Control-Allow-Methods": ["GET, POST"], "Access-Control-Allow-Origin": ["\*"], "Content-Type": ["application/json"]}

## Deploy API to production and view entries

Services APIs > vkarinje-gb-restapi (ble1uc76f7) > Stages > prod > /entries > GET

**prod - GET - /entries**

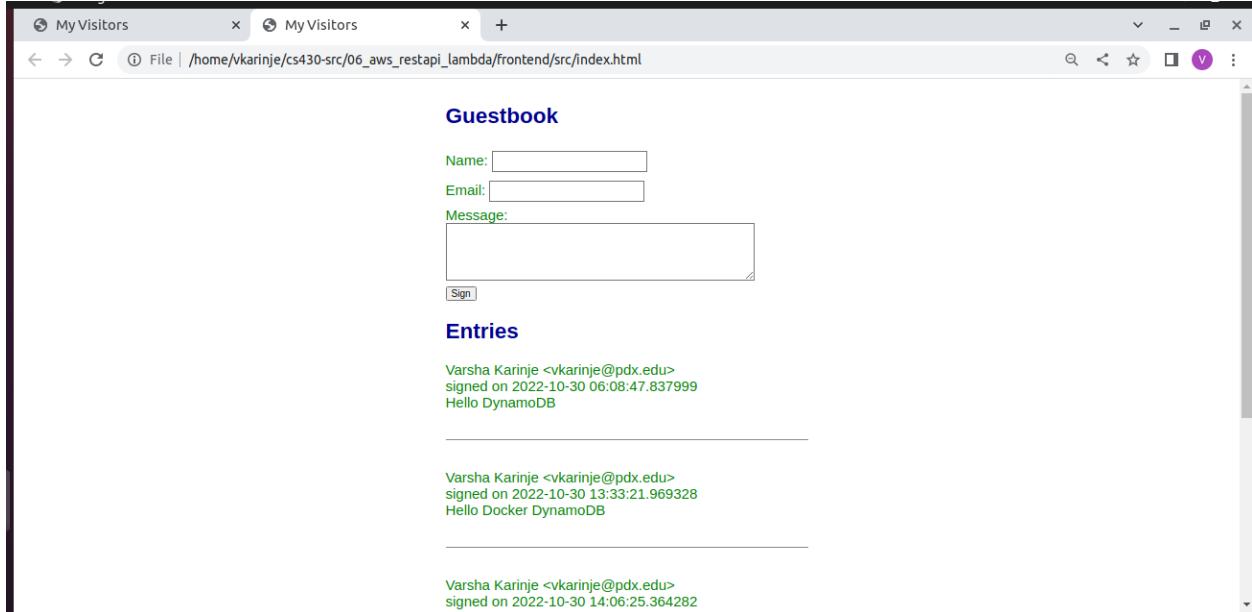
Invoke URL: <https://ble1uc76f7.execute-api.us-east-1.amazonaws.com/prod/entries>

Use this page to override the prod stage settings for the GET to /entries method.

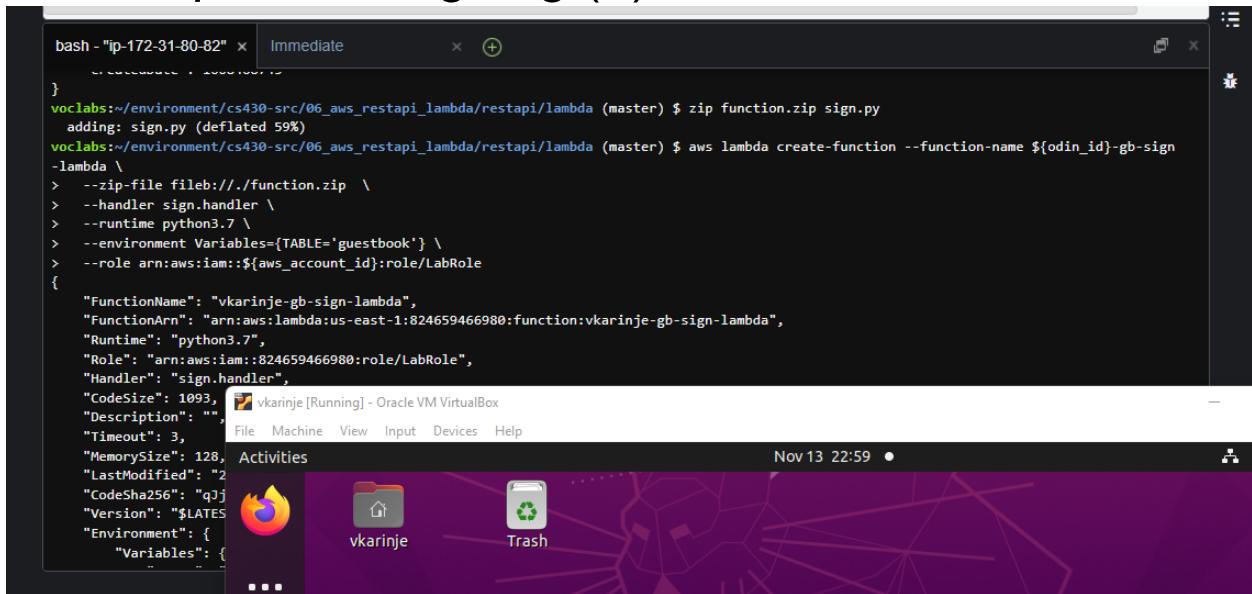
Settings:  Inherit from stage  Override for this method

**Save Changes**

- Take a screenshot that shows that you can view the entries in the backend database.



## API endpoint for signing (1)



```
bash - "ip-172-31-80-82" x Immediate x +  
  tpnemeraistorage : i  
    "Size": 512  
}  
}  
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws lambda add-permission --function-name ${odin_id}-gb-sign-lambda \  
>   --statement-id apigateway-test- vkarinje [Running] - Oracle VM VirtualBox  
>   --action lambda:InvokeFunction File Machine View Input Devices Help  
>   --principal apigateway.amazonaws.com Activities Nov 13 23:00 ●  
>   --source-arn "arn:aws:execute-a Nov 13 23:00 ●  
{  
  "Statement": "{\"Sid\":\"apigat File Machine View Input Devices Help  
ambla:InvokeFunction\",\"Resource\ Nov 13 23:00 ●  
AWS:SourceArn\":\"arn:aws:execute-a Nov 13 23:00 ●  
}  
}  
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ aws apigateway create-resource --rest-api-id $api_id \  
>   --path-part entry\  
>   --parent-id $root_id Activities Nov 13 23:00 ●  
{  
  "id": "fkgwhs", Nov 13 23:00 ●  
  "parentId": "xxy7815ib3", Nov 13 23:00 ●  
  "pathPart": "entry", Nov 13 23:00 ●  
  "path": "/entry" Nov 13 23:00 ●  
}  
}  
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $ entry_id=fkgwhs  
voclabs:~/environment/cs430-src/06_aws_restapi_lambda/restapi/lambda (master) $
```

The screenshot shows a terminal window titled "python3 - "ip-172-31-80-8 x" running in an Oracle VM VirtualBox environment. The terminal displays a command-line session where a user is configuring an AWS API Gateway integration. The command used is:

```
aws apigateway put-integration --rest-api-id $api_id \
--resource-id $entry_id \
--http-method POST \
--type AWS_PROXY \
--integration-http-method POST \
--uri arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws:lambda:us-east-1:${aws_account_id}:function:${odin_id}-gb-sign-lambda/invocations
```

This command creates a new integration for a specific API endpoint, using the Lambda proxy integration type and specifying the Lambda function's ARN.

## API endpoint for signing (2)

- Take a screenshot showing that the submission worked.

The screenshot shows the AWS API Gateway Method Execution interface for a POST request to the '/entry' resource. The request body contains a JSON array with five entries, each containing a message, date, email, and name. The response body shows the same JSON array. The logs panel displays execution logs for the request.

## CORS setup for signing

```

python3 -> [ip-172-31-80-8] Immediate > 
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ aws apigateway put-method --rest-api-id $api_id \
> --resource-id $entry_id \
> --http-method OPTIONS \
> --authorization-type NONE \
> --no-api-key-required
{
  "httpMethod": "OPTIONS",
  "authorizationType": "NONE",
  "apiKeyRequired": false
}
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ aws apigateway put-method-response --rest-api-id $api_id \
> --resource-id $entry_id \
> --http-method OPTIONS \
> --status-code 204 \
> --response-parameters {"method.response.header.Access-Control-Allow-Origin": true, "method.response.header.Access-Control-Allow-Methods": true, "method.response.header.Access-Control-Allow-Headers": true}
{
  "statusCode": "204",
  "responseParameters": {
    "method.response.header.Access-Control-Allow-Headers": true,
    "method.response.header.Access-Control-Allow-Methods": true,
    "method.response.header.Access-Control-Allow-Origin": true
  }
}
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ 

```

```

python3 -> [ip-172-31-80-8] Immediate > 
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ aws apigateway put-integration --rest-api-id $api_id \
> --resource-id $entry_id \
> --type MOCK \
> --http-method OPTIONS \
> --request-templates { "application/json": "{\"statusCode\": 200}" }
{
  "type": "MOCK",
  "requestTemplates": {
    "application/json": "{\"statusCode\": 200}"
  },
  "passthroughBehavior": "WHEN_NO_MATCH",
  "timeoutInMillis": 29000,
  "cacheNamespace": "fkgwhs",
  "cacheKeyParameters": []
}
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ aws apigateway put-integration-response --rest-api-id $api_id \
> --resource-id $entry_id \
> --http-method OPTIONS \
> --status-code 204 \
> --selection-pattern "-" \
> --response-templates {"application/json": "\\"Empty\\""} \
> --response-parameters {"method.response.header.Access-Control-Allow-Headers": \"Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent\", "method.response.header.Access-Control-Allow-Methods": \"GET,POST\", \"method.response.header.Access-Control-Allow-Origin\" : \"*\""}
{
  "statusCode": "204",
  "selectionPattern": "-",
  "responseParameters": {
    "method.response.header.Access-Control-Allow-Headers": "Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent",
    "method.response.header.Access-Control-Allow-Methods": "GET,POST",
    "method.response.header.Access-Control-Allow-Origin": "*"
  },
  "responseTemplates": {
    "application/json": "Empty"
  }
}
voclabs:/environment/cs430-src/06_aws_restapi_lambda/restapi/lambd (master) $ 

```

The screenshot shows the AWS API Gateway console. The left sidebar has sections for 'Names', 'Responses', 'Policy', and 'Ion'. The main area shows a tree view of resources under 'APIs > vkarinje-gb-restapi (ble1uc76f7) > Resources > /entry (fgwhs) > OPTIONS'. A 'Method Execution' card for '/entry - OPTIONS - Method Test' is displayed. It includes fields for 'Path' (Request: /entry, Status: 204), 'Query Strings' (param1=value1&param2=value2), 'Headers' (Content-Type: application/json), 'Response Body' (no data), 'Response Headers' (Access-Control-Allow-Headers: Content-Type,X-Amz-Date,Authorization,X-Api-Key,X-Amz-Security-Token,X-Amz-User-Agent, Access-Control-Allow-Methods: GET,POST,OPTIONS, Access-Control-Allow-Origin: \*, Content-Type: application/json), and a 'Logs' section with an execution log entry.

## Deploy API to production and sign

The screenshot shows a web browser displaying a guestbook application. The page title is 'File | /home/vkarinje/cs430-src/06\_aws\_restapi\_lambda/frontend/src/index.html'. The page content includes a 'Guestbook' form with fields for Name, Email, and Message, and a 'Submit' button. Below the form is a 'Entries' section listing five entries:

- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-10-30 10:08:47.837998 Hello DynamoDB
- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-10-30 14:06:25.364282 Hello Docker
- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-10-11 02:35:01.889722 Hello EC2
- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-11-02 09:25:36.879805 Hello Elastic Beanstalk
- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-11-14 07:20:36.140982 Hello API Gateway
- Vasha Karinje <vkarinje@pdx.edu> signed on 2022-11-14 07:12:33.029704 Hello API Gateway from local vPC

## Frontend Code

A screenshot of a terminal window titled "vkarinje [Running] - Oracle VM VirtualBox". The prompt shows "vkarinje@vkarinje-VirtualBox:~\$". Below the terminal window is a status bar with the date "Nov 13 23:18" and a file path "1.1".

```

Go to Anything (Ctrl-P)   Welcome   index.html   JS guestbook.js
Lab7 - /home/ubuntu
  cs430-src
    01_mvc_pylist
    02_mvp_modules_s
    03_nginx_gunicorn_
    04_container_docker
    05_aws_dynamodb
    06_gcp_datastore
    08_aws_restapi_lam
      frontend
        static
          JS guestbook
            style.css
            index.html
            app.py
            odk.json
            README.md
            requirements.txt
        restapi
        06_gcp_restapi_dox
JS guestbook.js
52  request: {
53    Accept: "application/json",
54    "Content-Type": "application/json"
55  },
56  method: "POST",
57  body: JSON.stringify({ name: name, email: email, message: message })
58 });
59 const gbentries = await response.json();
60 viewEntries(gbentries);
61 };

62 /**
63 * GET the guestbook entries from the REST API
64 */
65 /**
66 * Display them on the page once they arrive.
67 */
68 const getEntries = async () => {
69   const response = await fetch(baseApiUrl + "entries", {
70     headers: {
71       Accept: "application/json",
72       "Content-Type": "application/json"
73     },
74     method: "GET"
75   });
76   const gbentries = await response.json()
77   viewEntries(gbentries);
78 };
79 // initialize the entries when a new guest arrives
80 getEntries();
81

```

## Configure and Deploy the Frontend

Using the same endpoint as we entered in our local copy of `static/guestbook.js`, replace <FMI> with your endpoint prefix.

A screenshot of a terminal window titled "vkarinje [Running] - Oracle VM VirtualBox". The prompt shows "vkarinje@vkarinje-VirtualBox:~\$". Below the terminal window is a status bar with the date "Nov 13 23:23".

```

Go to Anything (Ctrl-P)   Welcome   index.html   JS guestbook.js
Lab7 - /home/ubuntu/environment
  cs430-src
    01_mvc_pylist
    02_mvp_modules_s
    03_nginx_gunicorn_
    04_container_docker
    05_aws_dynamodb
    06_gcp_datastore
    08_aws_restapi_lam
      frontend
        static
          JS guestbook
            style.css
            index.html
            app.py
            odk.json
            README.md
            requirements.txt
        restapi
        06_gcp_restapi_dox
JS guestbook.js
2  "use strict";
3  // fill in your API Gateway endpoint here
4  const baseApiUrl = "https://ble1uc76f7.execute-api.us-east-1.amazonaws.com/prod/";
5  /**
6   * Display the guestbook entries
7   *
8   * Builds up the webpage by manipulating the DOM.
9   * Clears the children of the div with the id "entries", then adds the new entries
10  * to it. We call this to initialize the page and update when entries are added.
11  */
12  const viewEntries = entries => {
13    const entriesNode = document.getElementById("entries");
14
15    while (entriesNode.firstChild) {
16      entriesNode.firstChild.remove();
17    }
18
19    entries.map(entry => {
20      const nameAndEmail = document.createElement("p");
21      nameAndEmail.innerHTML = entry.name + " <" + entry.email + ">";
22    });
23    const signedOn = document.createElement("p");
24    const message = document.createElement("p");
25    const br = document.createElement("br");
26    const br2 = document.createElement("br");

```

A screenshot of a terminal window titled "vkarinje [Running] - Oracle VM VirtualBox". The prompt shows "vkarinje@vkarinje-VirtualBox:~\$". Below the terminal window is a status bar with the date "Nov 13 23:38".

```

vclabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master)$ aws s3 mb s3://${odin_id}-frontend
make_bucket: vkarinje-Frontend
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master)$ aws s3 sync . s3://${odin_id}-frontend/ --acl public-read
upload: ./index.html to s3://vkarinje-Frontend/index.html
upload: static/style.css to s3://vkarinje-Frontend/static/style.css
upload: static/guestbook.js to s3://vkarinje-Frontend/static/guestbook.js
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master)$ aws s3 website s3://${odin_id}-Frontend/ --index-document index.html
vclabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master)$

```

Not secure | vkarinje-frontend.s3-website-us-east-1.amazonaws.com

## Guestbook

Name:

Email:

Message:  
Hello S3, API Gateway, Lambda!

## Entries

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-10-30 06:08:47.837999  
Hello DynamoDB

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-10-30 13:33:21.969328  
Hello Docker DynamoDB

Not secure | vkarinje-frontend.s3-website-us-east-1.amazonaws.com

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-02 08:25:36.879805  
Hello Elastic Beanstalk!

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-14 07:04:50.140582  
Hello API Gateway

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-14 07:12:33.038704  
Hello API Gateway from local HTML

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-14 07:38:41.211733  
Hello S3, API Gateway, Lambda!

---

## Clean up

```

python3 - *p-172-31-80-8 x | Immediate x ⓘ
vocabs:~/environment/cs430-src/06_aws_restapi_lambda (master) $ cd ..
vocabs:~/environment/cs430-src (master) $ cd..
cd..: command not found
vocabs:~/environment/cs430-src (master) $ cd ..
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/cdk/frontend/src
bash: cd: 06_aws_restapi_lambda/cdk/frontend/src: No such file or directory
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src
bash: cd: 06_aws_restapi_lambda/frontend/src: No such file or directory
vocabs:~/environment/cs430-src (master) $ cd 06_aws_restapi_lambda/frontend/src (master) $ aws
make bucket: vkarinje-frontend
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws upload: ./index.html to s3://vkarinje-frontend/index.html
aws: static/style.css to s3://vkarinje-frontend/static/style.css
upload: static/guestbook.js to s3://vkarinje-frontend/static/guestbook.js
aws: static/guestbook.js to s3://vkarinje-frontend/static/guestbook.js
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws s3 website s3://${odin_id}-frontend --index-document index.html
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws lambda delete-function --function-name ${odin_id}-gb-lambda
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws lambda delete-function --function-name ${odin_id}-gb-sign-lambda
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws apigateway delete-rest-api --rest-api-id $api_id
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws s3 rm --recursive s3://${odin_id}-frontend/
delete: s3://vkarinje-frontend/index.html
delete: s3://vkarinje-frontend/get_entries.py
delete: s3://vkarinje-frontend/function.zip
delete: s3://vkarinje-frontend/gb-lambda.out
delete: s3://vkarinje-frontend/static/guestbook.js
delete: s3://vkarinje-frontend/static/style.css
delete: s3://vkarinje-frontend/sign.py
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ aws s3 rb s3://${odin_id}-frontend
remove_bucket: vkarinje-frontend
vocabs:~/environment/cs430-src/06_aws_restapi_lambda/frontend/src (master) $ 

```

## 07.4g: Cloud Functions API Guestbook

### REST API (GET)

The screenshot shows the Google Cloud Platform Cloud Shell interface. The left sidebar displays a file tree with projects like 'cloud-CS-530-karinje-vkar...' and 'VKARINJE'. The main area is a code editor with 'model\_datastore.py' open. The code defines a class 'model' with methods 'select' and 'isinstance'. The right side of the interface includes a terminal tab, a search bar, and various status indicators.

```

File Edit Selection View Go Run Terminal Help
EXPLORER > OPEN EDITORS
VKARINJE > 04_container_dockerhub
> 05_aws_dynamodb
> 05_gcp_datstore
> 06_aws_restapi_lambda
> 06_gcp_restapi_cloudfunciton
> dm
> frontend-src
gbmodel > model_datastore.py M
model_datastore.py
model_pylist.py
model_sqlite3.py
Model.py
main.py

```

```

model_datastore.py x
33     if isinstance(entity, list):
34         entity = entity.pop()
35     return [entity['name'],entity['email'],entity['date'],entity['message']]
36
37 class model(Model):
38     def __init__(self):
39         self.client = datastore.Client('cloud-CS-530-karinje-vkarinje')
40
41     def select(self):
42         query = self.client.query(kind = 'Review')
43         entities = list(map(from_datastore,query.fetch()))
44
45         return entities

```

### Deploy the API

The screenshot shows the Google Cloud Platform Cloud Functions interface. The top navigation bar includes 'Cloud Functions', 'Functions', '+ CREATE FUNCTION', and 'REFRESH'. Below is a table listing deployed functions:

	Environment	Name	Last deployed	Region	Trigger	Runtime	Memory allocated	Executed function	Authentication	Actions	
<input type="checkbox"/>	<input checked="" type="radio"/>	1st gen	<a href="#">entries</a>	Nov 12, 2022, 2:16:27 AM	us-central1	HTTP	Python 3.7	256 MB	entries	Allow unauthenticated	<span>⋮</span>
<input type="checkbox"/>	<input checked="" type="radio"/>	1st gen	<a href="#">entry</a>	Nov 12, 2022, 2:20:29 AM	us-central1	HTTP	Python 3.7	256 MB	entry	Allow unauthenticated	<span>⋮</span>

```
vkarinje@cloudshell:~/cs430-src/06_gcp_restapi_cloudfunctions (cloud-cs-530-karinje-vkarinje)$ gcloud functions describe entries
availableMemoryMb: 256
buildId: 5380e144-13dc-4d92-9663-cd4c458ef1af
buildName: projects/791612085972/locations/us-central1/builds/5380e144-13dc-4d92-9663-cd4c458ef1af
dockerRegistry: CONTAINER_REGISTRY
entryPoint: entries
httpsTrigger:
  securityLevel: SECURE_ALWAYS
  url: https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entries
ingressSettings: ALLOW_ALL
labels:
  deployment-tool: cli-gcloud
name: projects/cloud-cs-530-karinje-vkarinje/locations/us-central1/functions/entries
runtime: python37
serviceAccountEmail: guestbook@cloud-cs-530-karinje-vkarinje.iam.gserviceaccount.com
sourceUploadUrl: https://storage.googleapis.com/uploads-742570563963.us-central1.cloudfunctions.appspot.com/ae546f62-5910-4b4f-848c-cd6dd112464f.zip
status: ACTIVE
timeout: 60s
updateTime: '2022-11-14T07:54:47.972Z'
versionId: '1'
vkarinje@cloudshell:~/cs430-src/06_gcp_restapi_cloudfunctions (cloud-cs-530-karinje-vkarinje)$ gcloud functions describe entry
availableMemoryMb: 256
buildId: 0da08ae0-34b6-4915-b264-2fc8285d2542
buildName: projects/791612085972/locations/us-central1/builds/0da08ae0-34b6-4915-b264-2fc8285d2542
dockerRegistry: CONTAINER_REGISTRY
entryPoint: entry
httpsTrigger:
  securityLevel: SECURE_ALWAYS
  url: https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entry
ingressSettings: ALLOW_ALL
labels:
  deployment-tool: cli-gcloud
name: projects/cloud-cs-530-karinje-vkarinje/locations/us-central1/functions/entry
runtime: python37
serviceAccountEmail: guestbook@cloud-cs-530-karinje-vkarinje.iam.gserviceaccount.com
sourceUploadUrl: https://storage.googleapis.com/uploads-742570563963.us-central1.cloudfunctions.appspot.com/a29dad3f-6fa2-4954-b389-4eefdb8ed32e4.zip
status: ACTIVE
timeout: 60s
updateTime: '2022-11-14T07:57:24.300Z'
versionId: '1'
vkarinje@cloudshell:~/cs430-src/06_gcp_restapi_cloudfunctions (cloud-cs-530-karinje-vkarinje)$ |||
```

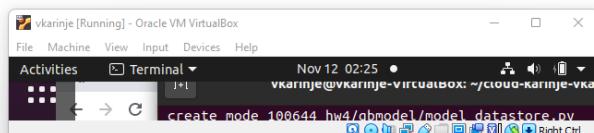
## Test the API via Cloud Functions (POST)

```
CLOUD SHELL
Terminal (cloud-cs-530-karinje-vkarinje) X + ▾
```

```
vkarinje@cloudshell:~/cs430-src/06_gcp_restapi_cloudfunctions (cloud-cs-530-karinje-vkarinje)$ gcloud functions describe entries
availableMemoryMb: 256
buildId: fc73a1cb-515b-47bb-acb3-7ad0f76b9d95
buildName: projects/791612085972/locations/us-central1/builds/fc73a1cb-515b-47bb-acb3-7ad0f76b9d95
dockerRegistry: CONTAINER_REGISTRY
entryPoint: entries
httpsTrigger:
  securityLevel: SECURE_ALWAYS
  url: https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entries
ingressSettings: ALLOW_ALL
labels:
  deployment-tool: cli-gcloud
name: projects/cloud-cs-530-karinje-vkarinje/locations/us-central1/functions/entries
runtime: python37
serviceAccountEmail: guestbook@cloud-cs-530-karinje-vkarinje.iam.gserviceaccount.com
sourceUploadUrl: https://storage.googleapis.com/uploads-742570563963.us-central1.cloudfunctions.appspot.com/55d5da89-9cc9-49c7-a945-04d4f98b280a.zip
status: ACTIVE
timeout: 60s
updateTime: '2022-11-12T10:16:27.806Z'
versionId: '1'
vkarinje@cloudshell:~/cs430-src/06_gcp_restapi_cloudfunctions (cloud-cs-530-karinje-vkarinje)$ gcloud functions describe entry
availableMemoryMb: 256
buildId: b3035854-063b-4e58-9709-98d0878ed217
buildName: projects/791612085972/locations/us-central1/builds/b3035854-063b-4e58-9709-98d0878ed217
dockerRegistry: CONTAINER_REGISTRY
entryPoint: entry
httpsTrigger:
  securityLevel: SECURE_ALWAYS
  url: https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entry
```

```
us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entries
```

```
[{"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-31 21:23:02.741489+00:00", "message": "Hello Docker Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-30 20:44:34.033277+00:00", "message": "Hello App Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-07 09:41:40.034509+00:00", "message": "Hello Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-30 22:41:20.147125+00:00", "message": "Hello Kubernetes!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-31 23:54:31.594049+00:00", "message": "Hello Cloud Shell!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-04 23:37:31.845408+00:00", "message": "Hello Cloud Run!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-01 00:38:56.618939+00:00", "message": "Hello Compute Engine!"}]
```



The screenshot shows the Google Cloud Functions testing interface. At the top, it says "Function details" and "Version 1, deployed at Nov 12, 2022, 2:20:29 AM". Below that, there are tabs for METRICS, DETAILS, SOURCE, VARIABLES, TRIGGER, PERMISSIONS, LOGS, and TESTING. The TESTING tab is selected. On the left, under "Configure Triggering Event", there is a code editor with the following JSON:

```

1  {
2    "name": "Varsha Karinje",
3    "email": "vkarinje@pdx.edu",
4    "message": "Hello Cloud Functions!"
5  }

```

On the right, under "Test Command TEST IN CLOUD SHELL", there is a terminal window showing the command to run the function and its output:

```

curl -X POST https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entry \
-H "Authorization: bearer $(gcloud auth print-identity-token)" \
-H "Content-Type: application/json" \
-d '{"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "message": "Hello Cloud Functions!"}'

```

Below the terminal, a button says "[...] TEST THE FUNCTION". A note below it says "Testing in the Cloud Console has a 5 minute timeout. Note that this is different from the limit set in the function configuration." In the bottom left, there is an "Output" section with the text "Complete" and the output of the function calls.

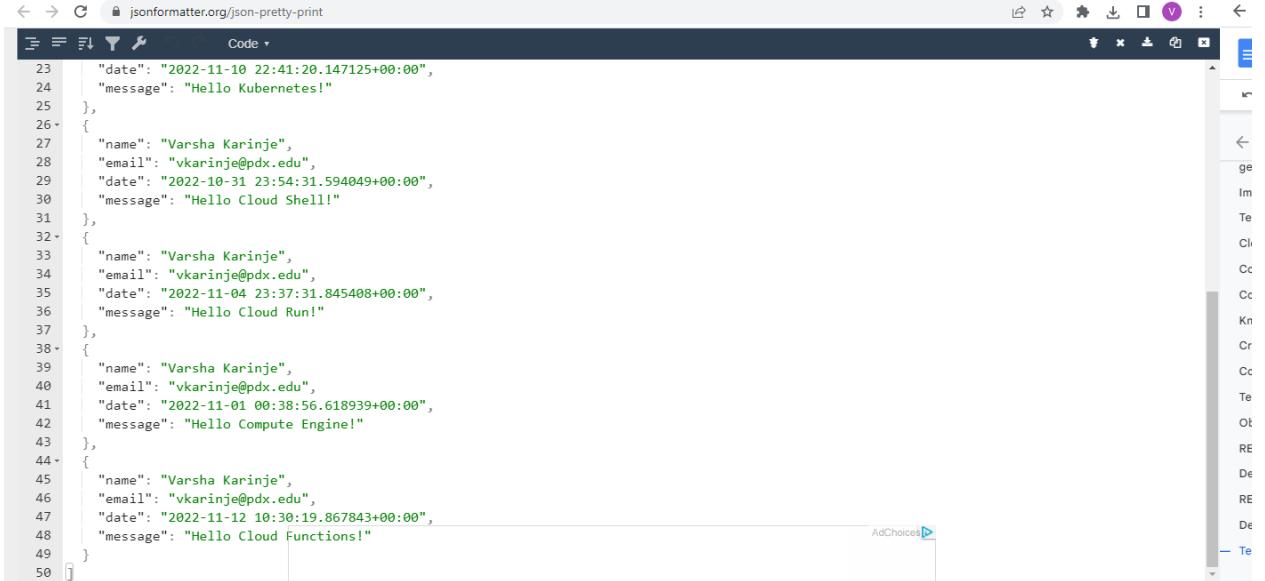
- Take a screenshot of the output for your lab notebook.

The screenshot shows a browser window displaying the JSON output from the Cloud Function tests on jsonformatter.org. The JSON is pretty-printed with line numbers on the left:

```

1  [
2    {
3      "name": "Varsha Karinje",
4      "email": "vkarinje@pdx.edu",
5      "date": "2022-10-31 21:23:02.741489+00:00",
6      "message": "Hello Docker Datastore!"
7    },
8    {
9      "name": "Varsha Karinje",
10     "email": "vkarinje@pdx.edu",
11     "date": "2022-11-07 09:41:40.034509+00:00",
12     "message": "Hello App Engine!"
13   },
14   {
15     "name": "Varsha Karinje",
16     "email": "vkarinje@pdx.edu",
17     "date": "2022-10-30 20:44:34.033277+00:00",
18     "message": "Hello Datastore!"
19   },
20   {
21     "name": "Varsha Karinje",
22     "email": "vkarinje@pdx.edu",
23     "date": "2022-11-10 22:41:20.147125+00:00",
24     "message": "Hello Kubernetes!"
25   }
]

```

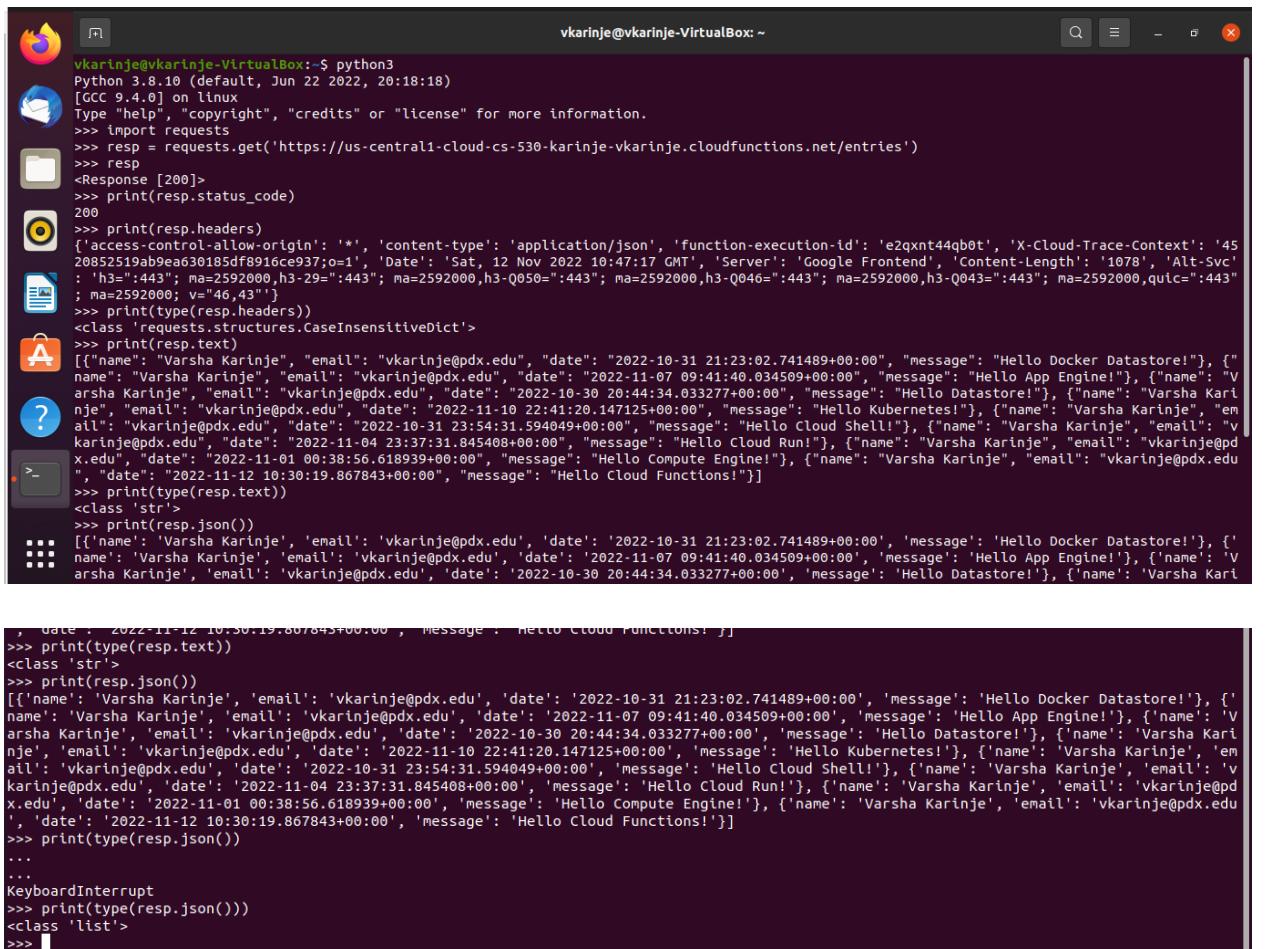


```

23   "date": "2022-11-10 22:41:20.147125+00:00",
24   "message": "Hello Kubernetes!"
25 },
26 {
27   "name": "Varsha Karinje",
28   "email": "vkarinje@pdx.edu",
29   "date": "2022-10-31 23:54:31.594049+00:00",
30   "message": "Hello Cloud Shell!"
31 },
32 {
33   "name": "Varsha Karinje",
34   "email": "vkarinje@pdx.edu",
35   "date": "2022-11-04 23:37:31.845408+00:00",
36   "message": "Hello Cloud Run!"
37 },
38 {
39   "name": "Varsha Karinje",
40   "email": "vkarinje@pdx.edu",
41   "date": "2022-11-01 00:38:56.618939+00:00",
42   "message": "Hello Compute Engine!"
43 },
44 {
45   "name": "Varsha Karinje",
46   "email": "vkarinje@pdx.edu",
47   "date": "2022-11-12 10:30:19.867843+00:00",
48   "message": "Hello Cloud Functions!"
49 }
50

```

## Test the API via Python Requests (GET)

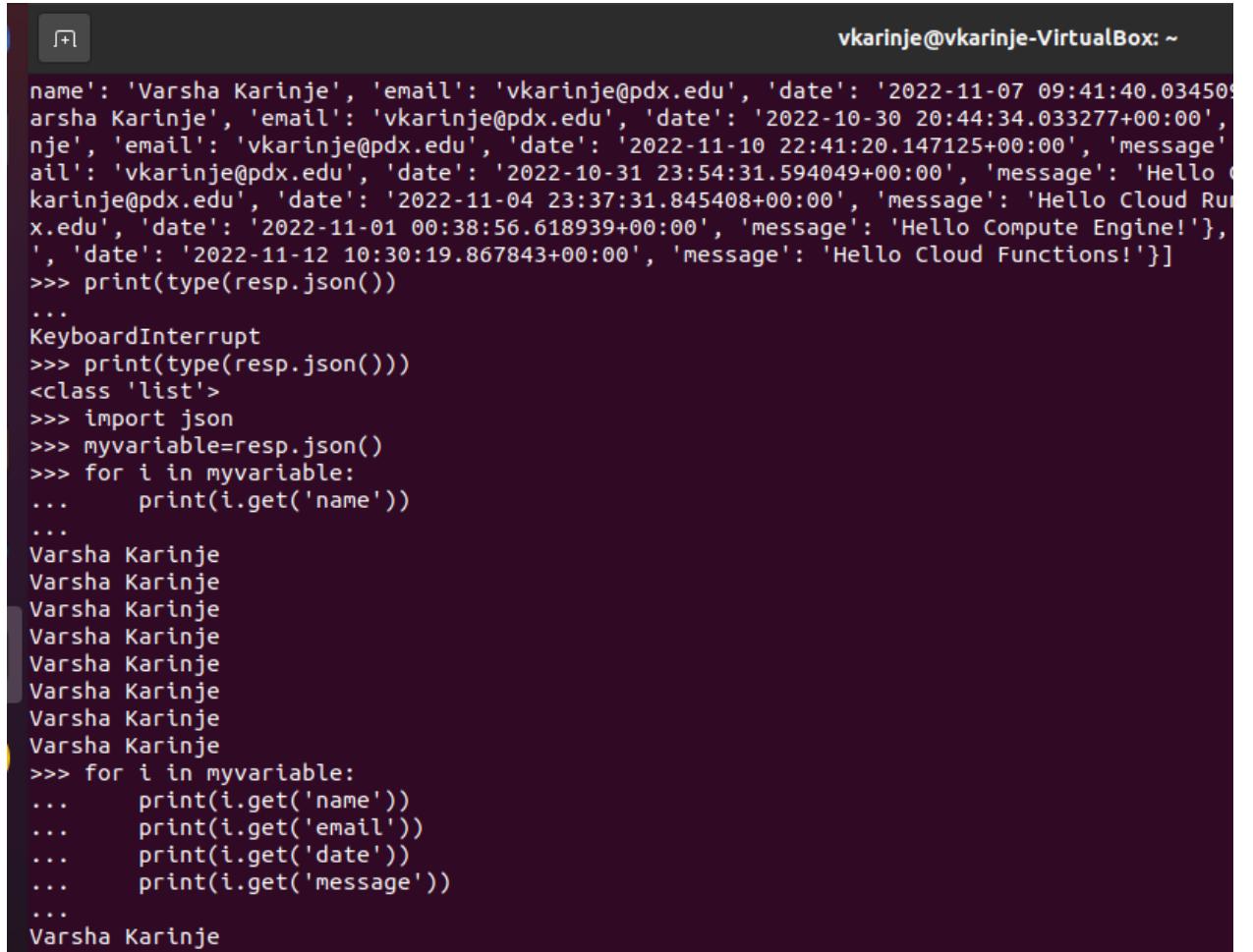


```

vkarinje@vkarinje-VirtualBox:~$ python3
Python 3.8.10 (default, Jun 22 2022, 20:18:18)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import requests
>>> resp = requests.get('https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entries')
>>> resp
<Response [200]>
>>> print(resp.status_code)
200
>>> print(resp.headers)
{'access-control-allow-origin': '*', 'content-type': 'application/json', 'function-execution-id': 'e2qxnt44qb0t', 'X-Cloud-Trace-Context': '45 20852519ab9ea630185df8916ce937;o=1', 'Date': 'Sat, 12 Nov 2022 10:47:17 GMT', 'Server': 'Google Frontend', 'Content-Length': '1078', 'Alt-Svc': ':h3=":443"; ma=2592000,h3-29=:443'; ma=2592000,h3-Q050=:443'; ma=2592000,h3-Q046=:443'; ma=2592000,h3-Q043=:443'; ma=2592000,quic=:443'; ma=2592000; v="46,43"'}
>>> print(type(resp.headers))
<class 'requests.structures.CaseInsensitiveDict'>
>>> print(resp.text)
[{"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-31 21:23:02.741489+00:00", "message": "Hello Docker Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-07 09:41:40.034509+00:00", "message": "Hello App Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-30 20:44:34.033277+00:00", "message": "Hello Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-10 22:41:20.147125+00:00", "message": "Hello Kubernetes!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-04 23:37:31.845408+00:00", "message": "Hello Cloud Shell!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-01 00:38:56.618939+00:00", "message": "Hello Compute Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-12 10:30:19.867843+00:00", "message": "Hello Cloud Functions!"}]
>>> print(type(resp.text))
<class 'str'>
>>> print(resp.json())
[{"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-31 21:23:02.741489+00:00", "message": "Hello Docker Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-07 09:41:40.034509+00:00", "message": "Hello App Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-30 20:44:34.033277+00:00", "message": "Hello Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-10 22:41:20.147125+00:00", "message": "Hello Kubernetes!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-04 23:37:31.845408+00:00", "message": "Hello Cloud Shell!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-01 00:38:56.618939+00:00", "message": "Hello Compute Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-12 10:30:19.867843+00:00", "message": "Hello Cloud Functions!"}]
>>> print(type(resp.json()))
<class 'list'>
>>> 

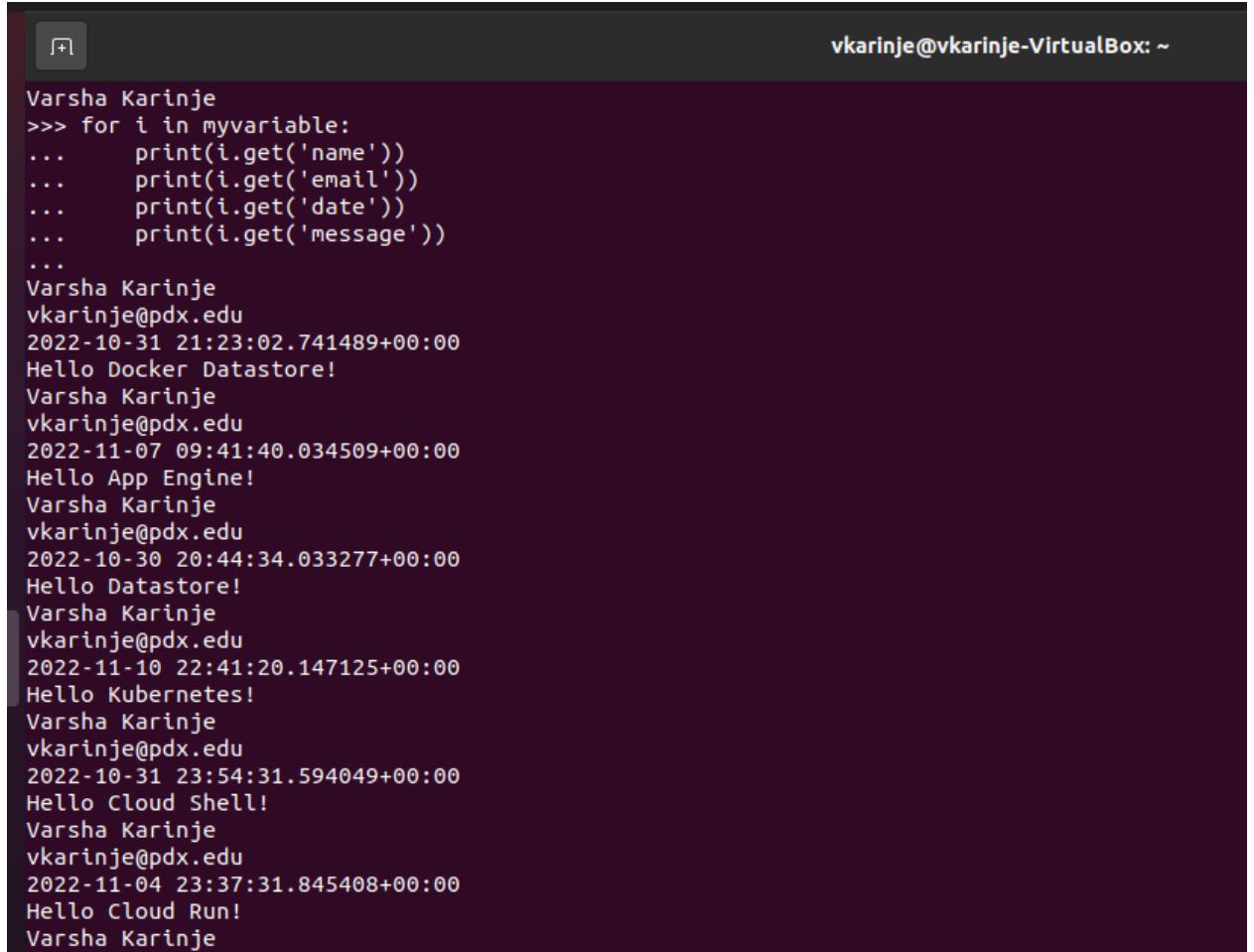
```

- Take a screenshot of the loop and its output



A screenshot of a terminal window titled 'vkarinje@vkarinje-VirtualBox: ~'. The terminal displays a Python script. The script starts by printing a list of dictionaries, each containing 'name', 'email', 'date', and 'message' fields. It then prints the type of the list, imports the 'json' module, and loops through the list to print each item's 'name'. It then loops through the list again, printing 'name', 'email', 'date', and 'message' for each item. The output shows the repeated names and the final 'Varsha Karinje'.

```
vkarinje@vkarinje-VirtualBox: ~
[+]
vkarinje@vkarinje-VirtualBox: ~
name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-07 09:41:40.034509',
arsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-10-30 20:44:34.033277+00:00',
nje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-10 22:41:20.147125+00:00', 'message':
all': 'vkarinje@pdx.edu', 'date': '2022-10-31 23:54:31.594049+00:00', 'message': 'Hello C
karinje@pdx.edu', 'date': '2022-11-04 23:37:31.845408+00:00', 'message': 'Hello Cloud Run
x.edu', 'date': '2022-11-01 00:38:56.618939+00:00', 'message': 'Hello Compute Engine!'},
', 'date': '2022-11-12 10:30:19.867843+00:00', 'message': 'Hello Cloud Functions!']
>>> print(type(resp.json()))
...
KeyboardInterrupt
>>> print(type(resp.json()))
<class 'list'>
>>> import json
>>> myvariable=resp.json()
>>> for i in myvariable:
...     print(i.get('name'))
...
Varsha Karinje
>>> for i in myvariable:
...     print(i.get('name'))
...     print(i.get('email'))
...     print(i.get('date'))
...     print(i.get('message'))
...
Varsha Karinje
```

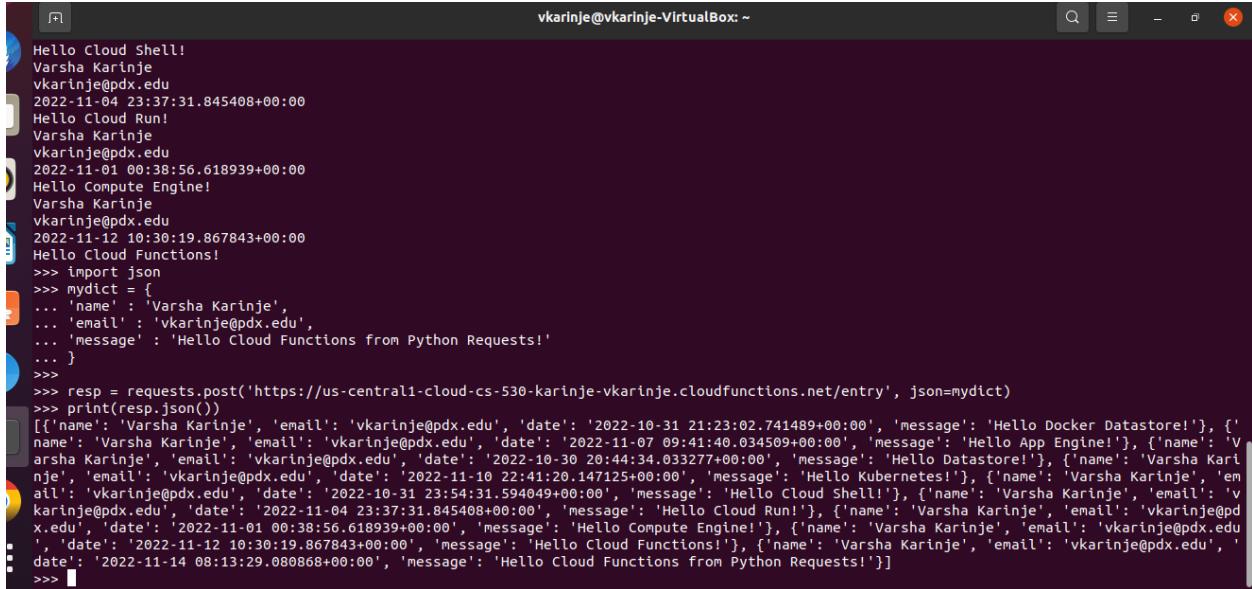


The screenshot shows a terminal window with a dark background. In the top right corner, the text "vkarinje@vkarinje-VirtualBox: ~" is visible. The terminal displays the following Python code and its execution output:

```
Varsha Karinje
>>> for i in myvariable:
...     print(i.get('name'))
...     print(i.get('email'))
...     print(i.get('date'))
...     print(i.get('message'))
...
Varsha Karinje
vkarinje@pdx.edu
2022-10-31 21:23:02.741489+00:00
Hello Docker Datastore!
Varsha Karinje
vkarinje@pdx.edu
2022-11-07 09:41:40.034509+00:00
Hello App Engine!
Varsha Karinje
vkarinje@pdx.edu
2022-10-30 20:44:34.033277+00:00
Hello Datastore!
Varsha Karinje
vkarinje@pdx.edu
2022-11-10 22:41:20.147125+00:00
Hello Kubernetes!
Varsha Karinje
vkarinje@pdx.edu
2022-10-31 23:54:31.594049+00:00
Hello Cloud Shell!
Varsha Karinje
vkarinje@pdx.edu
2022-11-04 23:37:31.845408+00:00
Hello Cloud Run!
Varsha Karinje
```

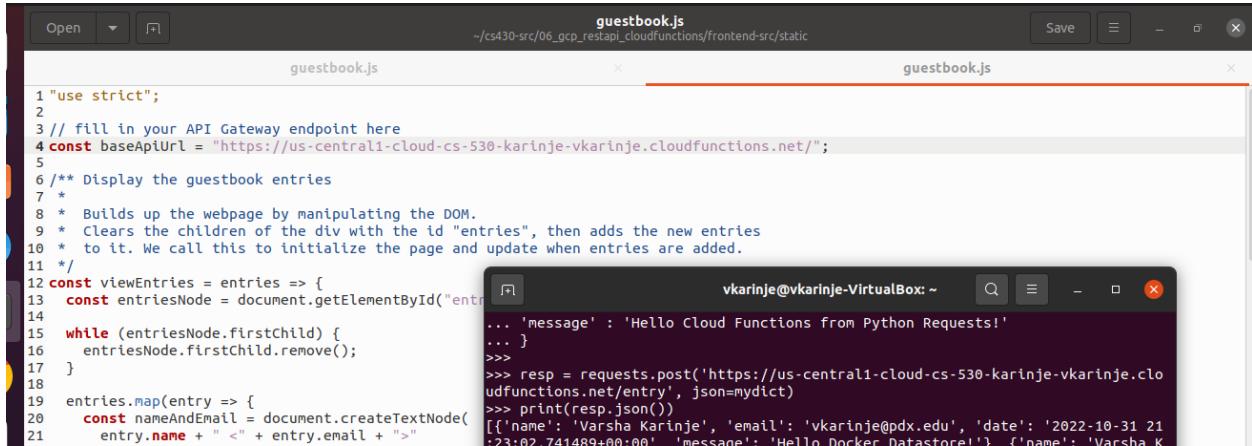
## Test the API via Python Requests (POST)

- Take a screenshot of the output for your lab notebook



```
vkarinje@vkarinje-VirtualBox: ~
Hello Cloud Shell!
Varsha Karinje
vkarinje@pdx.edu
2022-11-04 23:37:31.845408+00:00
Hello Cloud Run!
Varsha Karinje
vkarinje@pdx.edu
2022-11-01 00:38:56.618939+00:00
Hello Compute Engine!
Varsha Karinje
vkarinje@pdx.edu
2022-11-12 10:30:19.867843+00:00
Hello Cloud Functions!
>>> import json
>>> mydict = [
... 'name' : 'Varsha Karinje',
... 'email' : 'vkarinje@pdx.edu',
... 'message' : 'Hello Cloud Functions from Python Requests!'
... ]
>>>
>>> resp = requests.post('https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entry', json=mydict)
>>> print(resp.json())
[{'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-10-31 21:23:02.741489+00:00', 'message': 'Hello Docker Datastore!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-07 09:41:40.034509+00:00', 'message': 'Hello App Engine!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-10-30 20:44:34.033277+00:00', 'message': 'Hello Datastore!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-10 22:41:20.147125+00:00', 'message': 'Hello Kubernetes!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-10-31 23:54:31.594049+00:00', 'message': 'Hello Cloud Shell!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-04 23:37:31.845408+00:00', 'message': 'Hello Cloud Run!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-01 00:38:56.618939+00:00', 'message': 'Hello Compute Engine!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-12 10:30:19.867843+00:00', 'message': 'Hello Cloud Functions!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-14 08:13:29.080868+00:00', 'message': 'Hello Cloud Functions from Python Requests!'}]
>>>
```

## Guestbook.js



```
guestbook.js
~/cs430-src/06_gcp_restapi_cloudfunctions/foreground-src/static
Open Save guestbook.js
guestbook.js
1 "use strict";
2
3 // fill in your API Gateway endpoint here
4 const baseApiUrl = "https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/";
5
6 /** Display the guestbook entries
7 */
8 * Builds up the webpage by manipulating the DOM.
9 * Clears the children of the div with the id "entries", then adds the new entries
10 * to it. We call this to initialize the page and update when entries are added.
11 */
12 const viewEntries = entries => {
13   const entriesNode = document.getElementById("entries");
14
15   while (entriesNode.firstChild) {
16     entriesNode.firstChild.remove();
17   }
18
19   entries.map(entry => {
20     const nameAndEmail = document.createTextNode(
21       entry.name + " <" + entry.email + ">"
```

```
vkarinje@vkarinje-VirtualBox: ~
...
'message' : 'Hello Cloud Functions from Python Requests!'
...
>>>
>>> resp = requests.post('https://us-central1-cloud-cs-530-karinje-vkarinje.cloudfunctions.net/entry', json=mydict)
>>> print(resp.json())
[{'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-10-31 21:23:02.741489+00:00', 'message': 'Hello Docker Datastore!'}, {'name': 'Varsha Karinje', 'email': 'vkarinje@pdx.edu', 'date': '2022-11-07 09:41:40.034509+00:00', 'message': 'Hello App Engine!'}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-30 20:44:34.033277+00:00", "message": "Hello Datastore!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-10 22:41:20.147125+00:00", "message": "Hello Kubernetes!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-10-31 23:54:31.594049+00:00", "message": "Hello Cloud Shell!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-04 23:37:31.845408+00:00", "message": "Hello Cloud Run!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-01 00:38:56.618939+00:00", "message": "Hello Compute Engine!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-12 10:30:19.867843+00:00", "message": "Hello Cloud Functions!"}, {"name": "Varsha Karinje", "email": "vkarinje@pdx.edu", "date": "2022-11-14 08:13:29.080868+00:00", "message": "Hello Cloud Functions from Python Requests!"}]
```

## Version #1: Local file system

- Take a screenshot of the Guestbook including the URL.

Environment	Code Sample
Cloud Functions	<pre>const https = require('https'); const functions = require('firebase-functions');  // Create and Deploy Your First Cloud Functions // https://firebase.google.com/docs/functions/write-firebase-functions exports.helloCloudFunctions = functions.https.onRequest((request, response) =&gt; {   response.send("Hello Cloud Functions from SPA!"); });</pre>
Kubernetes	<pre>apiVersion: apps/v1 kind: Deployment metadata:   name: helloworld-deployment spec:   selector:     matchLabels:       app: helloworld   replicas: 3   template:     metadata:       labels:         app: helloworld     spec:       containers:         - name: helloworld           image: gcr.io/quickstart/helloworld:1.0           ports:             - containerPort: 8080</pre>
App Engine	<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;appengine-web&gt;   &lt;application&gt;06_gcp_restapi_cloudfunctions&lt;/application&gt;   &lt;version&gt;1&lt;/version&gt;   &lt;url-mapping url="/" method="GET" path="/index.html" /&gt; &lt;/appengine-web&gt;</pre> <p>signed on 2022-11-10 22:41:20.147125+00:00 Hello App Engine!</p> <hr/> <pre>-----BEGIN PGP SIGNED MESSAGE-----</pre> <p>Varsha Karinje &lt;vkarinje@pdx.edu&gt; signed on 2022-10-30 20:44:34.033277+00:00 Hello Datastore!</p> <hr/> <pre>-----BEGIN PGP SIGNED MESSAGE-----</pre> <p>Varsha Karinje &lt;vkarinje@pdx.edu&gt; signed on 2022-11-14 08:30:03.857231+00:00 Hello Cloud Functions from SPA!</p> <hr/> <pre>-----BEGIN PGP SIGNED MESSAGE-----</pre> <p>Varsha Karinje &lt;vkarinje@pdx.edu&gt; signed on 2022-11-10 22:41:20.147125+00:00 Hello Kubernetes!</p>

The screenshot shows a browser window with three distinct signed messages from "Varsha Karinje <vkarinje@pdx.edu>" displayed sequentially. Each message includes a timestamp and a "Hello Cloud Functions!" greeting.

```

    File | /home/vkarinje/cs430-src/06_gcp_restapi_cloudfunctions/frontend-src/index.html
          Hello Cloud Run!
          Hello Compute Engine!
          Hello Cloud Functions!
          Hello Cloud Functions from Python Requests!
  
```

## Version #2: Google Cloud Storage bucket

The screenshot shows the Google Cloud Shell interface. The left sidebar displays a file tree for a project named "06\_gcp\_restapi\_cloudfunctions". The "frontend-src" directory contains files like "model\_datastore.py", "guestbook.js", "style.css", and "index.html". The terminal at the bottom shows commands for creating a Cloud Storage bucket and uploading files to it.

```

    Google Cloud cloud-CS-530-karinje-vkar...
    Search for resources, docs, products, and more Search
    CLOUD SHELL Editor Open Terminal
    File Edit Selection View Go Run Terminal Help
    EXPLORE model_datastore.py guestbook.js ...
    OPEN EDITORS
    VKARINJE
    cs430-src
    01_mvc_pylist
    02_mvp_modules_sqlite3
    03_nginx_gunicorn_heartbeat
    04_container_dockerhub
    05_aws_dynamodb
    06_gcp_datastore
    07_aws_restapi_lambda
    08_gcp_restapi_cloudfunctions
    dm
    frontend-src
    static
    guestbook.js
    style.css
    index.html
    gbmmodel
    __init__.py
    Problems Output
    bash: syntax error near unexpected token `newline'
    vkarinje@cloudshell:~/cs430-sx0/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gsutil mb gs://restapi-vkarinje
    Creating gs://restapi-vkarinje...
    vkarinje@cloudshell:~/cs430-sx0/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gsutil iam ch allUsers:objectViewer gs://restapi-vkarinje
    vkarinje@cloudshell:~/cs430-sx0/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gsutil cp -r . gs://restapi-vkarinje
    Copying file:./index.html [Content-Type=text/html]...
    Copying file:./static/style.css [Content-Type=text/css]...
    Copying file:./static/guestbook.js [Content-Type=application/javascript]...
    [3 files][ 3.7 KiB/ 3.7 KiB]
    Operation completed over 3 objects/3.7 KiB.
    vkarinje@cloudshell:~/cs430-sx0/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ ||
  
```

- Take a screenshot of the Guestbook including the URL.

[storage.googleapis.com/restapi-vkarinje/index.html](https://storage.googleapis.com/restapi-vkarinje/index.html)

## Guestbook

Name:

Email:

Message:  
Hello Cloud Functions from SPA in GCS!

 vkarinje [Running] - Oracle VM VirtualBox

Activities Terminal Nov 14 00:37 • vkarinje@vkarinje-VirtualBox: ~

Varsha signed  
Hello Docker Datastore!

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-07 09:41:40.034509+00:00  
Hello App Engine!

---

[storage.googleapis.com/restapi-vkarinje/index.html](https://storage.googleapis.com/restapi-vkarinje/index.html)

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-10 22:41:20.147125+00:00  
Hello Kubernetes!

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-10-31 23:54:31.594049+00:00  
Hello Cloud Shell!

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-14 08:37:19.519895+00:00  
Hello Cloud Functions from SPA in GCS!

---

Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-04 23:37:31.845408+00:00  
Hello Cloud Run!

 vkarinje [Running] - Oracle VM VirtualBox

Activities Terminal Nov 14 00:38 • vkarinje@vkarinje-Vir

Varsha Karinje signed on 2022-11-04 23:37:31.845408+00:00 Hello Cloud Run!

The screenshot shows a web browser window with four signed messages from Varsha Karinje. Each message includes a timestamp, a signature, and a greeting.

- Message 1:** Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-04 23:37:31.845408+00:00  
Hello Cloud Run!
- Message 2:** Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-01 00:38:56.618939+00:00  
Hello Compute Engine!
- Message 3:** Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-12 10:30:19.867843+00:00  
Hello Cloud Functions!
- Message 4:** Varsha Karinje <vkarinje@pdx.edu>  
signed on 2022-11-14 08:13:29.080868+00:00  
Hello Cloud Functions from Python Requests!

## Clean up

```
vkarinje@cloudshell:~/cs430-svc/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gsutil rm -r gs://restapi-vkarinje
Removing gs://restapi-vkarinje/index.html#1668414960628214...
Removing gs://restapi-vkarinje/static/guestbook.js#1668414961198117...
Removing gs://restapi-vkarinje/static/style.css#1668414960905784...
/ [3 objects]
Operation completed over 3 objects.
Removing gs://restapi-vkarinje/...
vkarinje@cloudshell:~/cs430-svc/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gcloud functions delete entries
Resource [projects/cloud-es-530-karinje-vkarinje/locations/us-central1/functions/entries] will be deleted.

Do you want to continue (Y/n)? Y

Waiting for operation to finish...done.
Deleted [projects/cloud-es-530-karinje-vkarinje/locations/us-central1/functions/entries].
vkarinje@cloudshell:~/cs430-svc/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ gcloud functions delete entry
Resource [projects/cloud-es-530-karinje-vkarinje/locations/us-central1/functions/entry] will be deleted.

Do you want to continue (Y/n)? Y

Waiting for operation to finish...done.
Deleted [projects/cloud-es-530-karinje-vkarinje/locations/us-central1/functions/entry].
vkarinje@cloudshell:~/cs430-svc/06_gcp_restapi_cloudfunctions/frontend-src (cloud-es-530-karinje-vkarinje)$ ||
```



