Automation with Python

Key Takeaways

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Automate Maintenance Tasks on AWS

HashiCorp Terraform

Automated Infrastructure **Provisioning**

- Automated **creating EC2 instances** with infrastructure resources
- Automated **EKS cluster creation**

With Python we now want to **automate repetitive tasks** like:

- doing regular **back-ups**
- doing regular **clean-ups**
- configuration on existing servers
- doing **health-checks/monitoring**

- In a big company with hundreds of servers, we would want to automate maintenance work for these servers

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Boto3 - AWS Library

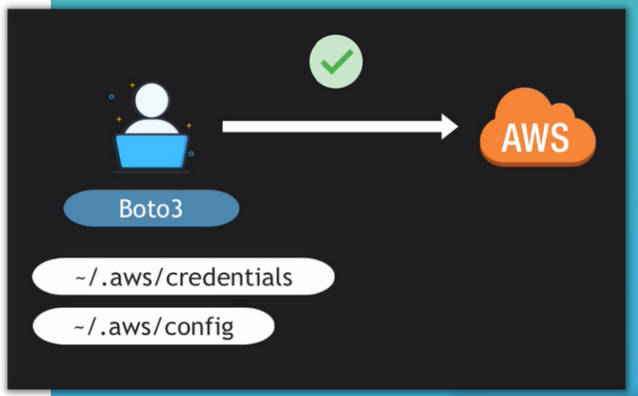
- A library or package is a reusable chunk of code that you can use in your own programs
- Boto3 specifically is the **AWS SDK to create, configure and manage AWS services**, like EC2, S3, etc.

- If you need to communicate with Azure or Google Cloud, there are different libraries specific to that cloud, which you can use

Connect to Boto3

- Before using Boto3, you need to **set up authentication credentials** for your AWS account
- The library provides an object-oriented API as well as low-level access to AWS services:

```
ec2_client = boto3.client('ec2', region_name="eu-central-1")
ec2_resource = boto3.resource('ec2', region_name="eu-central-1")
```



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Terraform vs Python

Python can also be used for infrastructure provisioning, but Terraform is much better for this use case

Terraform

- TF **manages state of the infrastructure**, so TF knows the current state
- TF knows the difference of current and your configured/desired state
- TF is **idempotent** (multiple execution of same config file, will aways result in same end result)

Python

- Python doesn't have a state and is not idempotent
- In TF you declare the end result, while in Python you need to **explicitly write what you want to do** (imperative)
- Python is **more low level, so it's more flexible and you can write very complex logic:**

Automation Tasks - 1

Demo Project: EC2 Status Checks

- To know which instances are in which state

```
Run:  main
/Users/nanajanashia/PycharmProjects/my-python-project/venv/bin/pytho
Instance i-0092fb0d1ea678c6f is terminated
Instance i-0de11486f87f9290a is running
Instance i-0936e85840d5d227f is running
Instance i-0de11486f87f9290a status is ok and system status is ok
Instance i-0936e85840d5d227f status is ok and system status is ok
```

Name	Instance ID	Instance state	Instance type	Status check
dev-server-three	i-0092fb0d1ea678c6f	Running	t2.micro	Initializing
dev-server	i-0de11486f87f9290a	Running	t2.micro	Initializing
dev-server-two	i-0936e85840d5d227f	Running	t2.micro	Initializing

Demo Project: Scheduling Status Checks

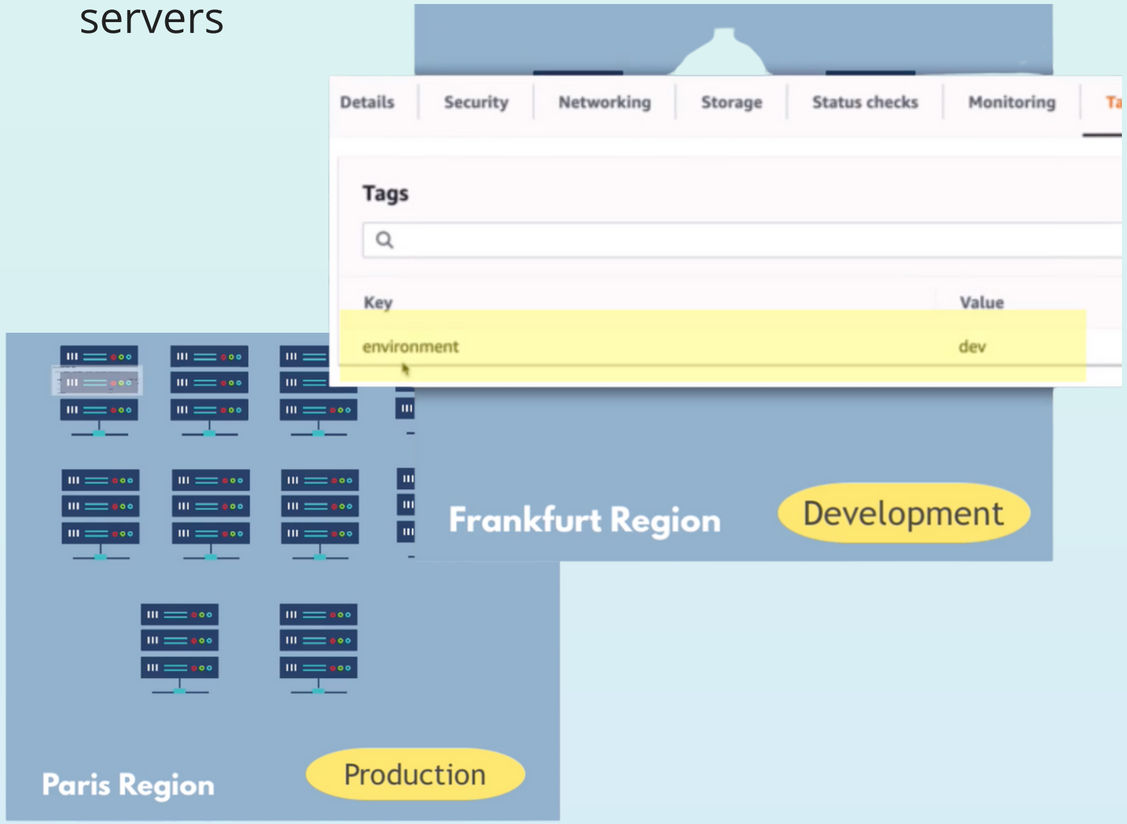
- To get live updates of the status checks
- We need a **scheduler,** that triggers the program automatically


```
main.py
11          ins_status = status['InstanceStatus']['Status']
12          sys_status = status['SystemStatus']['Status']
13          state = status['InstanceState']['Name']
14          print(f"Instance {status['InstanceId']} is {state} with ir
15
16
17  schedule.every(5).minutes.do(check_instance_status)
18
19  while True:
20      schedule.run_pending()
```

Automation Tasks - 2

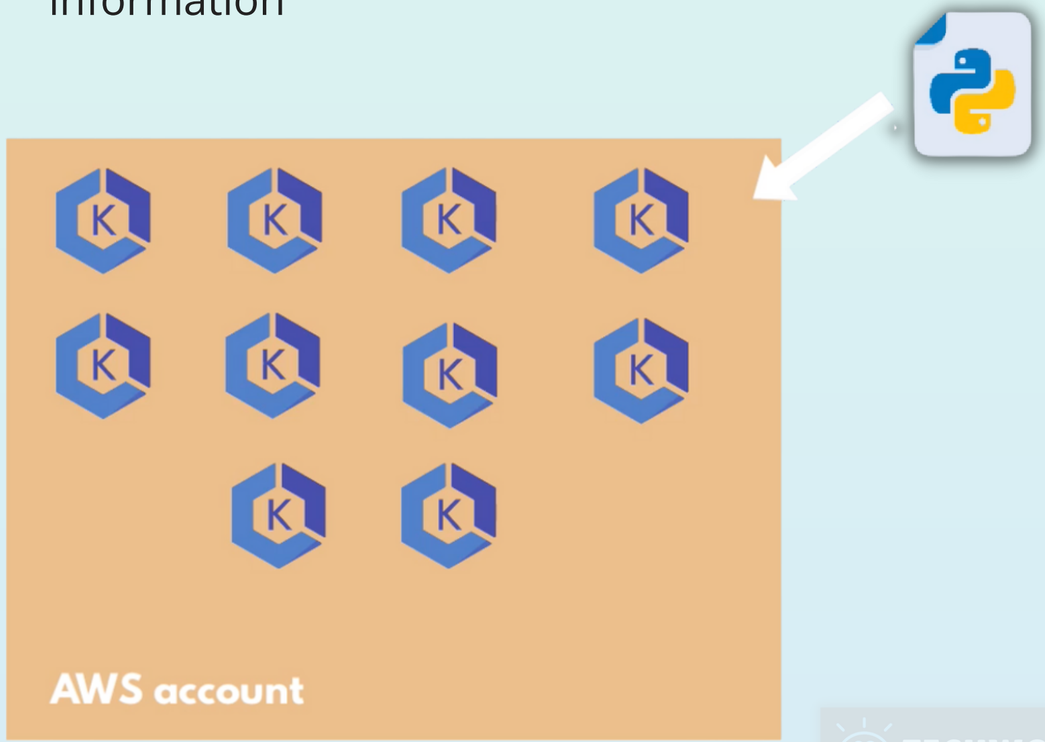
Demo Project: Add Tags to EC2 Instances

- Having hundreds of instances, you would want to automate adding environment tags for all these servers



Demo Project: Cluster Information

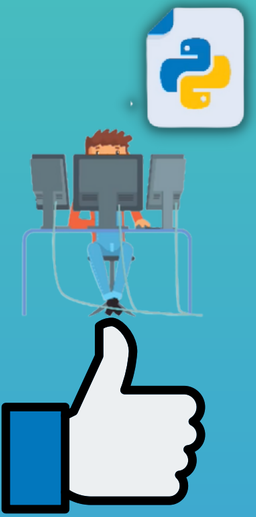
- If you have 10s or 100s of clusters to manage, you can write a script that gives you all cluster information



Automation Tasks - 3

Demo Project: Automate Data Backup

- Data is stored in AWS Volumes. Each instance has its own volume. To **backup the data, we create volume snapshots (copy of Volume)**.
- If you have hundreds of instances, you need an automated way to create snapshots:



➡ We can **schedule regular volume snapshots** with a Python program

➡ Now if volumes fail or the data in there gets corrupted, we have snapshots to recover

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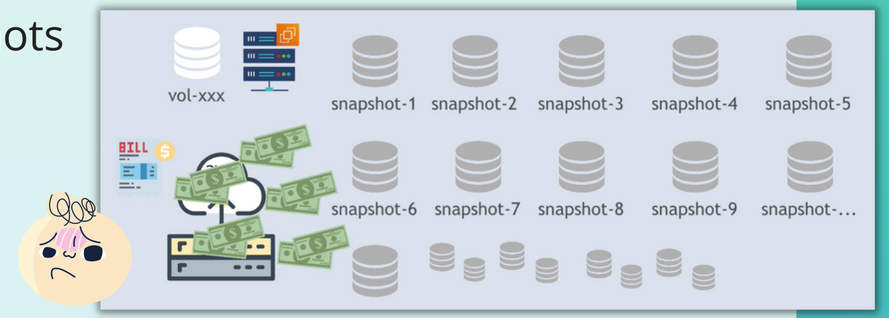
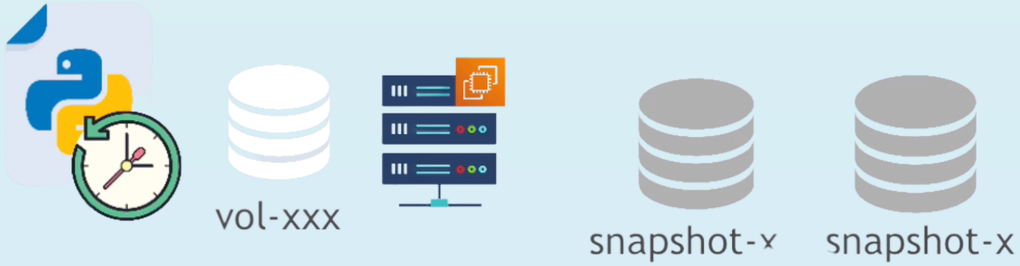
Automation Tasks - 4

Demo Project: Automate Snapshot Cleanup

- If Scheduler runs every day, we end up with a lots of snapshots



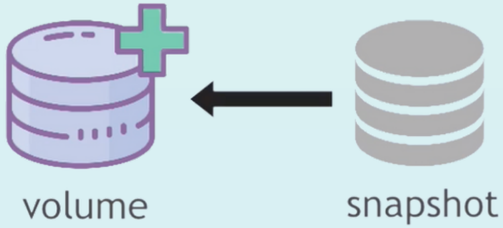
➡ We can write a program that **cleans up old snapshots regularly.** E.g. delete all snapshots but the recent 2 snapshots



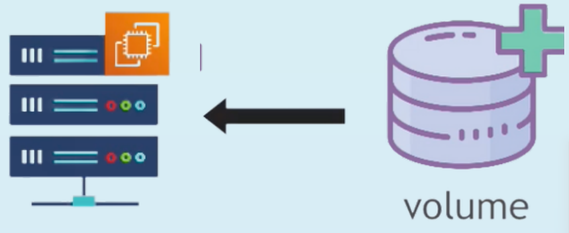
Demo Project: Automate Restoring EC2 Volumes

- Again if 100s of volumes fail, you **don't want to restore all manually**. So an automated python script is a great use case to recover the latest working state

1) Create new Volume from the snapshot



2) Attach new Volume to EC2 instance



Automation Tasks - 5

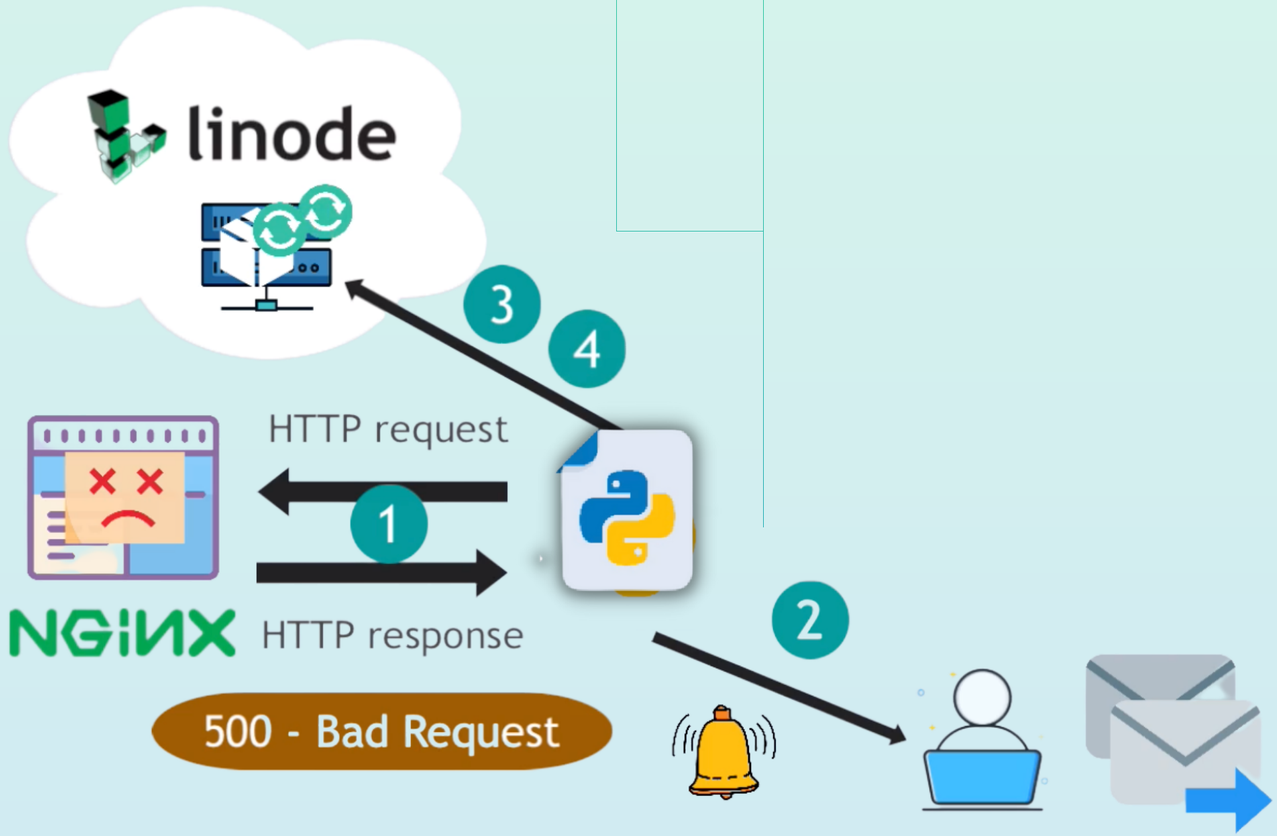
Demo Project: Website Monitoring

Write Automation Program for monitoring:

1) Write Python program that checks application
2) Send email, when website is down

Write Automation Program to fix the problem:

3) Re-start Docker container
4) Re-start server



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Handling Errors in Python Scripts - 1

- It's important to handle possible errors in your Python programs properly, because much can go wrong
- If errors are not handled correctly, it can lead to data loss, corrupt data etc.

- Snapshot creation failed
- Volume Attachment failed
- Volume Creation from Snapshot failed
- ...

- Handle the error specific to the task
- Log the error for debugging

Snapshot Creation Failure:

  - **Good solution**: Delete Snapshot and re-try
  - **Bad**: Keep it

- Generally good practice to **completely roll back** and clean up half-created resources

Handling Errors in Python Scripts - 2

Another difference

Python doesn't have a state, so we need to take care of that ourselves

Terraform takes care of that automatically