# PROJECT REPORT

## Deploying ROS Noetic on Cloud (AWS EC2)

### 1. Introduction

Cloud computing enables developers to access scalable computing resources over the internet. In robotics development, cloud-based environments allow developers to run simulations, develop robotic software, and collaborate remotely.

This project focuses on deploying **ROS Noetic** on a **cloud-based Ubuntu server** using **Amazon Web Services (AWS)**. ROS (Robot Operating System) is a widely used framework for robot software development.

### 2. Objective

The objective of this project is to:

- Deploy ROS Noetic on a cloud platform
- Enable developers to run robotic simulations remotely
- Provide a stable and scalable ROS environment on the cloud

### 3. Tools and Technologies Used

- **Cloud Platform**: Amazon Web Services (AWS)
- **Service**: EC2 (Elastic Compute Cloud)
- **Operating System**: Ubuntu 24.04 LTS (Host)
- **Containerization**: Docker
- **Robot Framework**: ROS Noetic
- **Instance Type**: t2.micro
- **Storage**: 30 GB

### 4. System Architecture

The system uses a containerized approach:

- Ubuntu runs on AWS EC2
- Docker is installed on Ubuntu
- ROS Noetic runs inside a Docker container (Ubuntu 20.04 based)

This ensures compatibility and avoids dependency issues.

## 5. Implementation Steps

### 5.1 EC2 Instance Creation

- An EC2 instance was launched using Ubuntu.
- Instance type t2.micro was selected.
- Security and network configurations were properly set.

### 5.2 Docker Installation

Docker was installed to support containerized deployment:

```
sudo apt update
sudo apt install docker.io -y
```

### 5.3 ROS Noetic Deployment Using Docker

The official ROS Noetic Docker image was pulled:

```
docker pull ros:noetic-ros-base
```

The ROS container was started using:

```
docker run -it ros:noetic-ros-base bash
```

### 5.4 Testing ROS Installation

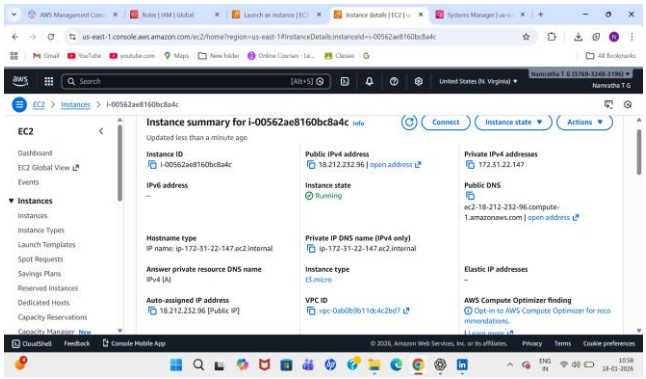
ROS core service was started:

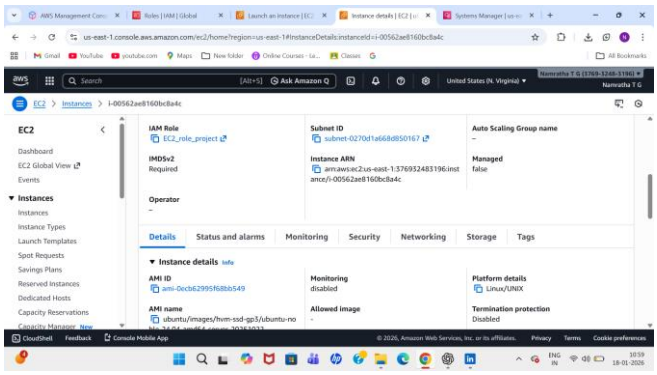
```
roscore
```

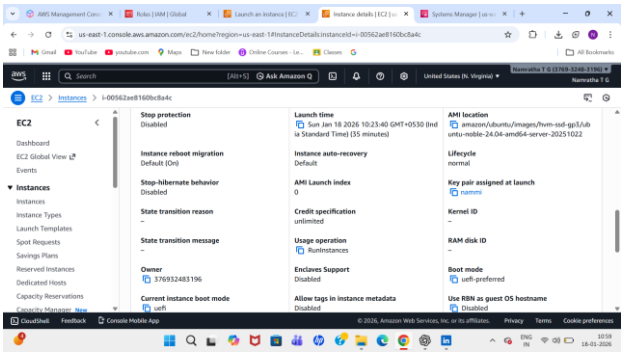
This confirmed that ROS Noetic was successfully deployed on the cloud.

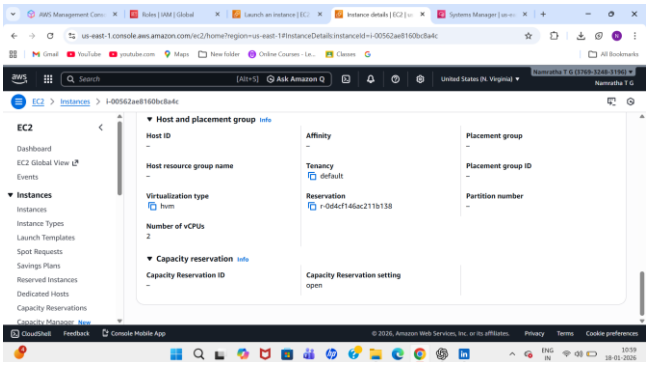
## 6. Results

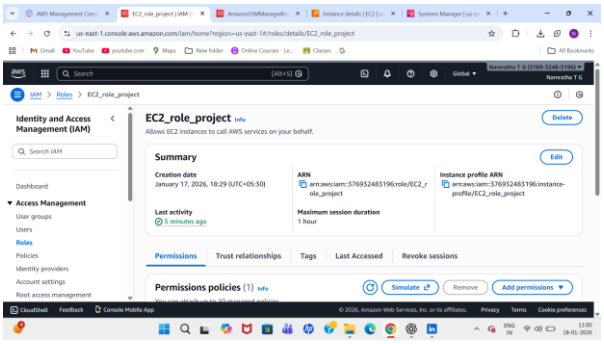
- ROS Noetic was successfully deployed on AWS Cloud.
- The ROS core service ran without errors.
- The cloud-based ROS environment is ready for robotic development and simulations.

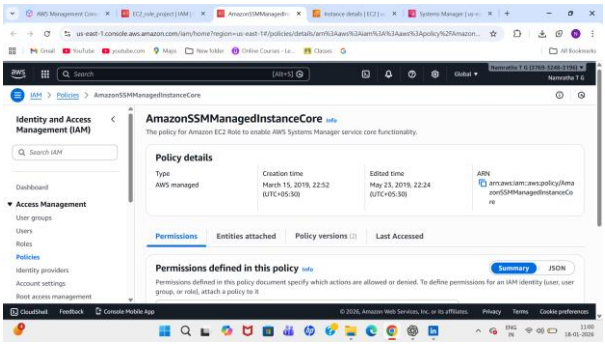


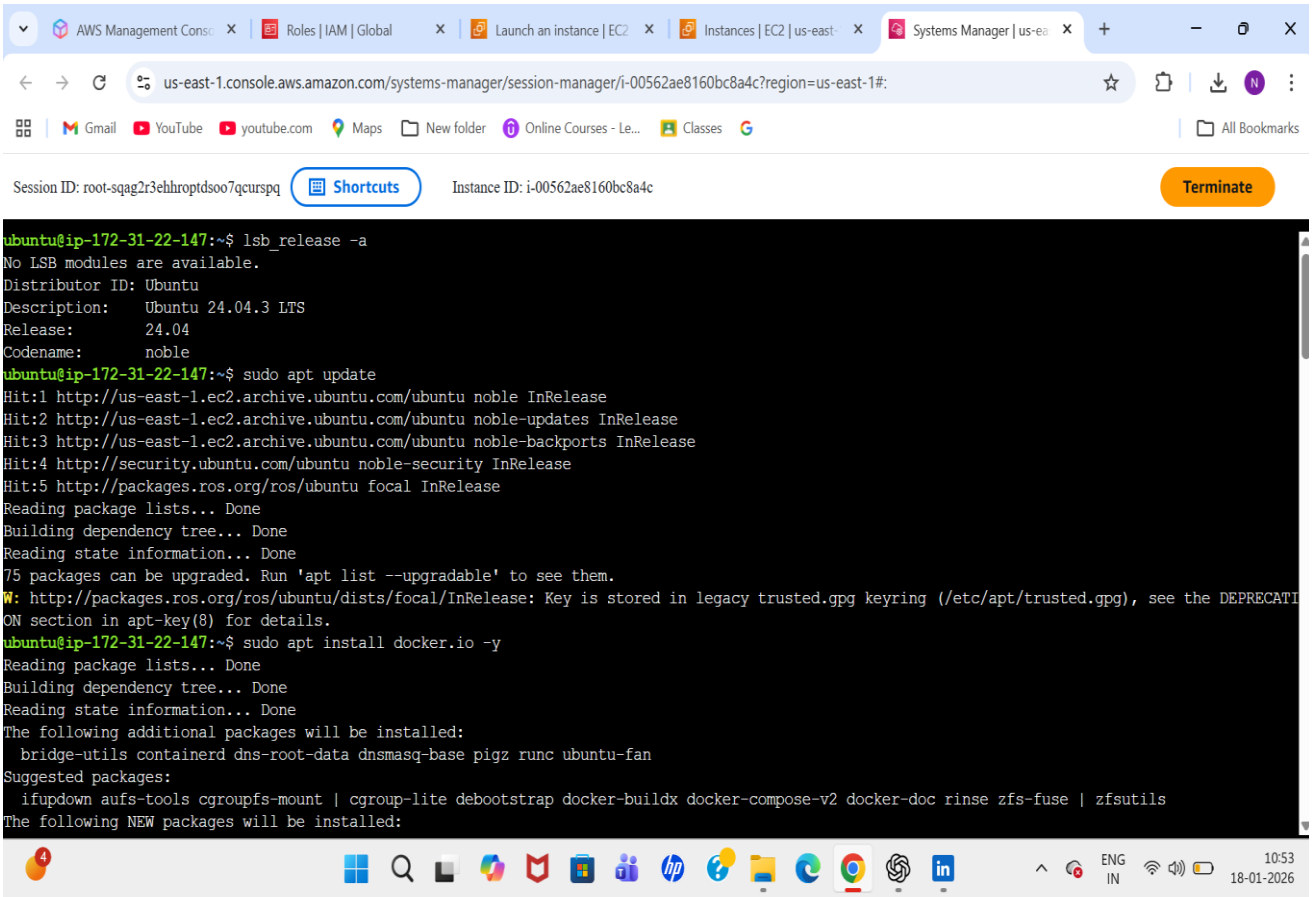












AWS Management Conso
Roles | IAM | Global
Launch an instance | EC2
Instances | EC2 | us-east-
Systems Manager | us-ea
us-east-1.console.aws.amazon.com/systems-manager/session-manager/i-00562ae8160bc8a4c?region=us-east-1#:
Gmail
YouTube
youtube.com
Maps
New folder
Online Courses - Le...
Classes
All Bookmarks
Session ID: root-sqag2r3ehhroptdsoo7qcurspq
Shortcuts
Instance ID: i-00562ae8160bc8a4c
Terminate
ubuntu@ip-172-31-22-147:~$ lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description: Ubuntu 24.04.3 LTS
Release: 24.04
Codename: noble
ubuntu@ip-172-31-22-147:~$ sudo apt update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:5 http://packages.ros.org/ros/ubuntu focal InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
75 packages can be upgraded. Run 'apt list --upgradable' to see them.
W: http://packages.ros.org/ros/ubuntu/dists/focal/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/apt/trusted.gpg), see the DEPRECATI
ON section in apt-key(8) for details.
ubuntu@ip-172-31-22-147:~$ sudo apt install docker.io -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
bridge-utils containerd dns-root-data dnsmasq-base pigz runc ubuntu-fan
Suggested packages:
ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-buildx docker-compose-v2 docker-doc rinse zfs-fuse | zfsutils
The following NEW packages will be installed:
ENG
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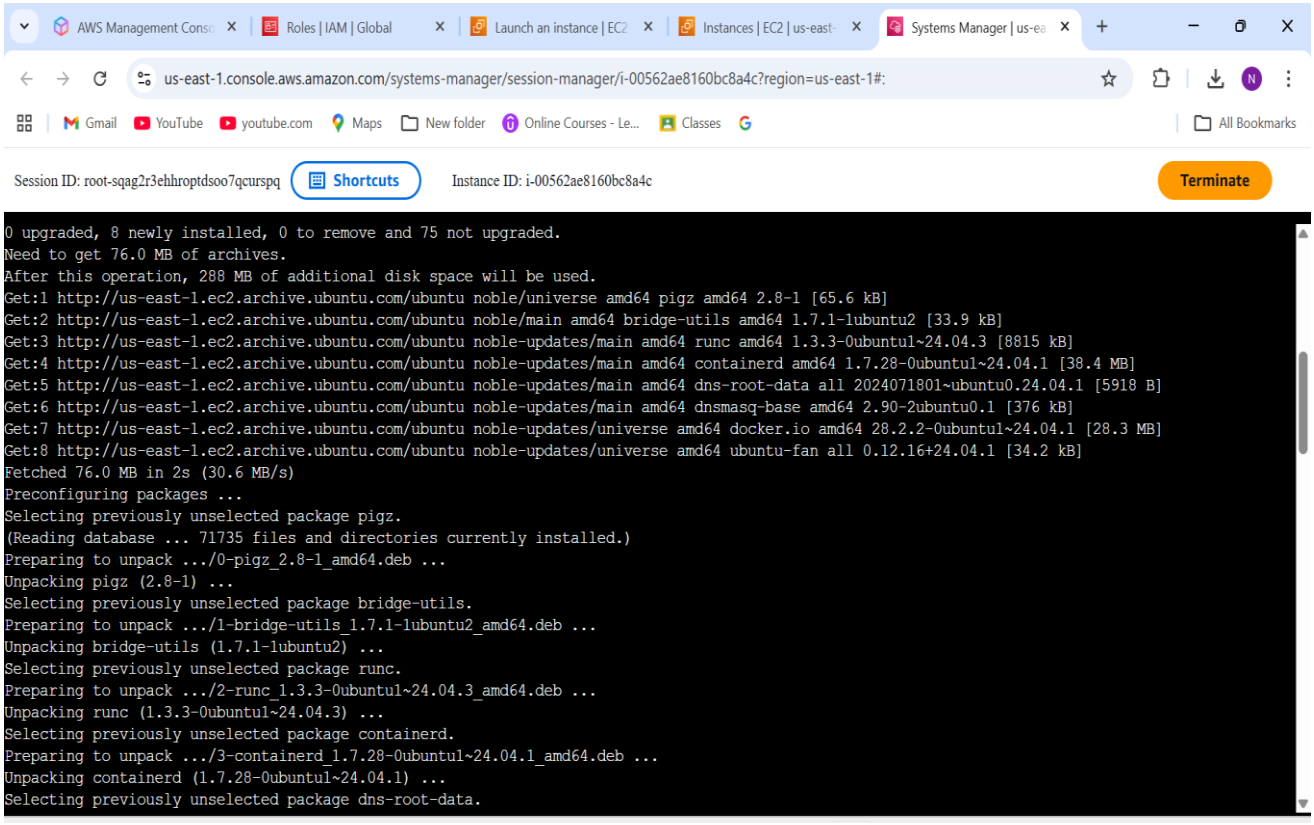
-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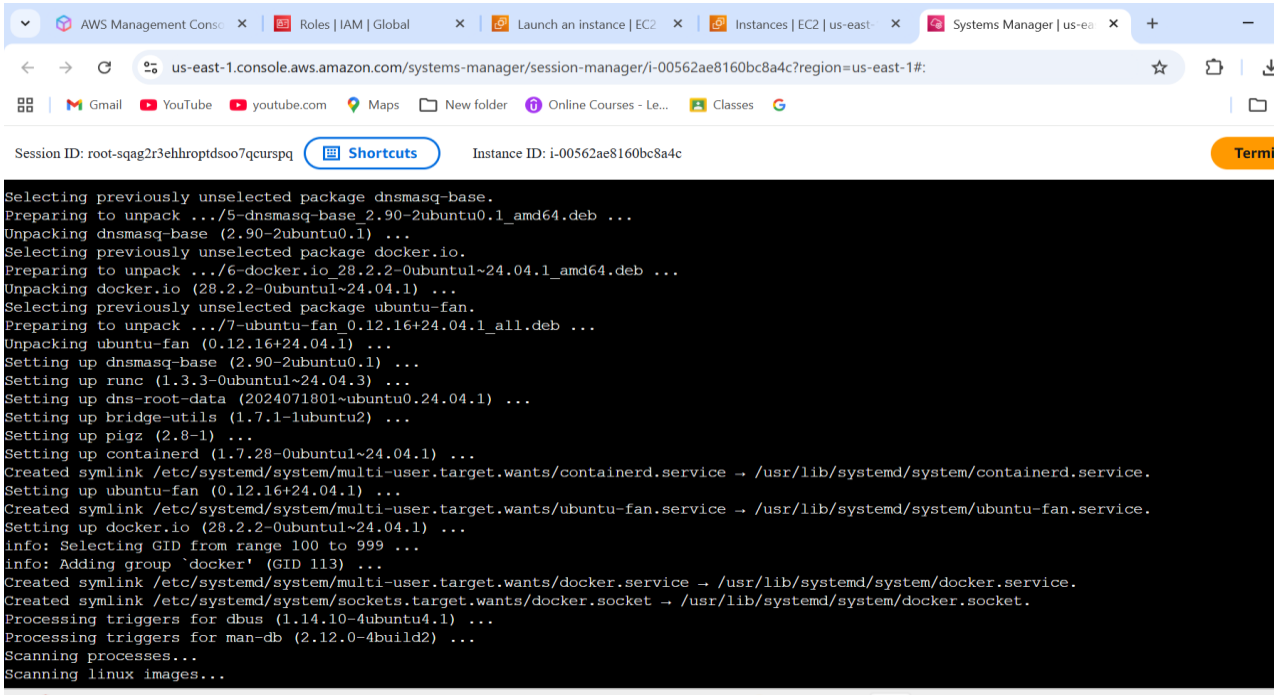
us-east-1.console.aws.amazon.com/systems-manager/session-manager/i-00562ae8160bc8a4c?region=us-east-1#:
Gmail
YouTube
youtube.com
Maps
New folder
Online Courses - Le...
Classes
All Bookmarks
Session ID: root-sqag2r3ehhroptdsoo7qcurspq
Shortcuts
Instance ID: i-00562ae8160bc8a4c
Terminate
0 upgraded, 8 newly installed, 0 to remove and 75 not upgraded.
Need to get 76.0 MB of archives.
After this operation, 288 MB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 pigz amd64 2.8-1 [65.6 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 bridge-utils amd64 1.7.1-1ubuntu2 [33.9 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 runc amd64 1.3.3-0ubuntu1~24.04.3 [8815 kB]
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 containerd amd64 1.7.28-0ubuntu1~24.04.1 [38.4 MB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 dns-root-data all 2024071801~ubuntu0.24.04.1 [5918 B]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 dnsmasq-base amd64 2.90-2ubuntu0.1 [376 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 docker.io amd64 28.2.2-0ubuntu1~24.04.1 [28.3 MB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 ubuntu-fan all 0.12.16+24.04.1 [34.2 kB]
Fetched 76.0 MB in 2s (30.6 MB/s)
Preconfiguring packages ...
Selecting previously unselected package pigz.
(Reading database ... 71735 files and directories currently installed.)
Preparing to unpack .../0-pigz_2.8-1_amd64.deb ...
Unpacking pigz (2.8-1) ...
Selecting previously unselected package bridge-utils.
Preparing to unpack .../1-bridge-utils_1.7.1-1ubuntu2_amd64.deb ...
Unpacking bridge-utils (1.7.1-1ubuntu2) ...
Selecting previously unselected package runc.
Preparing to unpack .../2-runc_1.3.3-0ubuntu1~24.04.3_amd64.deb ...
Unpacking runc (1.3.3-0ubuntu1~24.04.3) ...
Selecting previously unselected package containerd.
Preparing to unpack .../3-containerd_1.7.28-0ubuntu1~24.04.1_amd64.deb ...
Unpacking containerd (1.7.28-0ubuntu1~24.04.1) ...
Selecting previously unselected package dns-root-data.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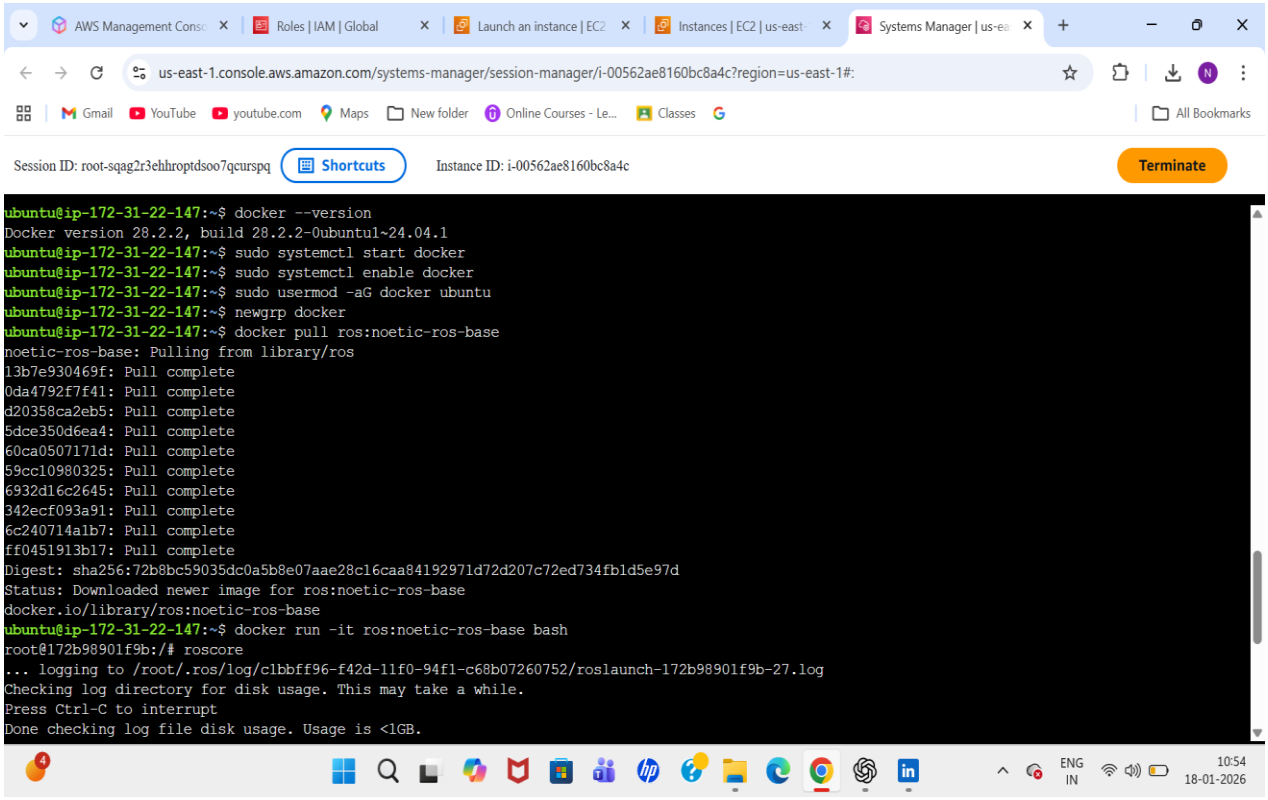
Gmail
YouTube
youtube.com
Maps
New folder
Online Courses - Le...
Classes
Session ID: root-sqag2r3ehhroptdsoo7qcurspq
Shortcuts
Instance ID: i-00562ae8160bc8a4c
Selecting previously unselected package dnsmasq-base.
Preparing to unpack .../5-dnsmasq-base_2.90-2ubuntu0.1_amd64.deb ...
Unpacking dnsmasq-base (2.90-2ubuntu0.1) ...
Selecting previously unselected package docker.io.
Preparing to unpack .../6-docker.io_28.2.2-0ubuntu1~24.04.1_amd64.deb ...
Unpacking docker.io (28.2.2-0ubuntu1~24.04.1) ...
Selecting previously unselected package ubuntu-fan.
Preparing to unpack .../7-ubuntu-fan_0.12.16+24.04.1_all.deb ...
Unpacking ubuntu-fan (0.12.16+24.04.1) ...
Setting up dnsmasq-base (2.90-2ubuntu0.1) ...
Setting up runc (1.3.3-0ubuntu1~24.04.3) ...
Setting up dns-root-data (2024071801~ubuntu0.24.04.1) ...
Setting up bridge-utils (1.7.1-1ubuntu2) ...
Setting up pigz (2.8-1) ...
Setting up containerd (1.7.28-0ubuntu1~24.04.1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /usr/lib/systemd/system/containerd.service.
Setting up ubuntu-fan (0.12.16+24.04.1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service → /usr/lib/systemd/system/ubuntu-fan.service.
Setting up docker.io (28.2.2-0ubuntu1~24.04.1) ...
info: Selecting GID from range 100 to 999 ...
info: Adding group `docker' (GID 113) ...
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /usr/lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/docker.socket.
Processing triggers for dbus (1.14.10-4ubuntu4.1) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning linux images...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Gmail
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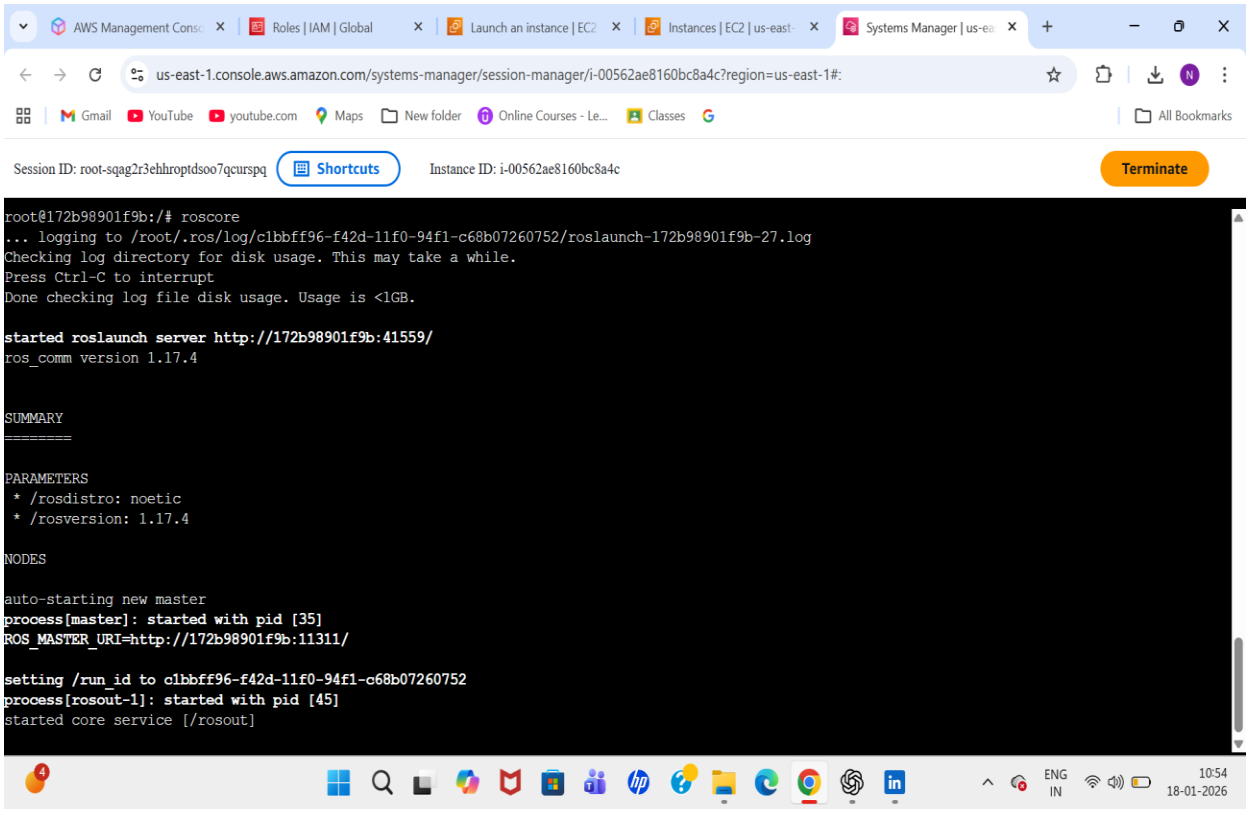
Session ID: root-sqag2r3ehhroptdsoo7qcurspq
Shortcuts
Instance ID: i-00562ae8160bc8a4c
Terminate
ubuntu@ip-172-31-22-147:~$ docker --version
Docker version 28.2.2, build 28.2.2-0ubuntu1~24.04.1
ubuntu@ip-172-31-22-147:~$ sudo systemctl start docker
ubuntu@ip-172-31-22-147:~$ sudo systemctl enable docker
ubuntu@ip-172-31-22-147:~$ sudo usermod -aG docker ubuntu
ubuntu@ip-172-31-22-147:~$ newgrp docker
ubuntu@ip-172-31-22-147:~$ docker pull ros:noetic-ros-base
noetic-ros-base: Pulling from library/ros
13b7e930469f: Pull complete
0da4792f7f41: Pull complete
d20358ca2eb5: Pull complete
5dce350d6ea4: Pull complete
60ca0507171d: Pull complete
59cc10980325: Pull complete
6932d16c2645: Pull complete
342ecf093a91: Pull complete
6c240714a1b7: Pull complete
ff0451913b17: Pull complete
Digest: sha256:72b8bc59035dc0a5b8e07aae28c16caa84192971d72d207c72ed734fb1d5e97d
Status: Downloaded newer image for ros:noetic-ros-base
docker.io/library/ros:noetic-ros-base
ubuntu@ip-172-31-22-147:~$ docker run -it ros:noetic-ros-base bash
root@172b98901f9b:/# roscore
... logging to /root/.ros/log/c1bbff96-f42d-11f0-94f1-c68b07260752/roslaunch-172b98901f9b-27.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.
ENG
IN
10:54
18-01-2026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us-east-1.console.aws.amazon.com/systems-manager/session-manager/i-00562ae8160bc8a4c?region=us-east-1#:
Gmail
YouTube
youtube.com
Maps
New folder
Online Courses - Le...
Classes
All Bookmarks
Session ID: root-sqag2r3ehhroptdsoo7qcurspq
Shortcuts
Instance ID: i-00562ae8160bc8a4c
Terminate
root@172b98901f9b:/# roscore
... logging to /root/.ros/log/c1bbff96-f42d-11f0-94f1-c68b07260752/roslaunch-172b98901f9b-27.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.
started roslaunch server http://172b98901f9b:41559/
ros_comm version 1.17.4
SUMMARY
PARAMETERS
* /rosdistro: noetic
* /rosversion: 1.17.4
NODES
auto-starting new master
process[master]: started with pid [35]
ROS_MASTER_URI=http://172b98901f9b:11311/
setting /run_id to c1bbff96-f42d-11f0-94f1-c68b07260752
process[rosout-1]: started with pid [45]
started core service [/rosout]
ENG
IN
10:54
18-01-2026

## 7. Advantages of Cloud-Based ROS

- Remote accessibility
- Scalability
- Reduced local system dependency
- Industry-standard DevOps approach using Docker

## 8. Conclusion

The project successfully demonstrates the deployment of ROS Noetic on a cloud platform using AWS EC2 and Docker. This approach ensures compatibility, stability, and aligns with modern cloud and DevOps practices, making it suitable for real-world robotic development.

### 9. Future Scope

- Integration with Gazebo simulator
- GUI access using VNC
- Multi-user ROS development environment
- CI/CD for robotic applications