Experiment No.10
Simulation of software defined network using mininet
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Aim: To simulate a Software Defined Network (SDN) environment using Mininet and observe communication between hosts.

Objective:

To understand the concept of Software Defined Networking

To simulate a virtual network topology using Mininet

To configure and test connectivity between hosts using ping command

To integrate a controller (such as POX/OVS) for centralized control of the

SDN Requirement:

Ubuntu Linux (or VM with Ubuntu installed)

Mininet installed (mininet.org)

Open vSwitch (default in Mininet)

Python support for running Mininet scripts

Theory:
Software Defined Networking (SDN) is a networking paradigm that separates the control plane from the data plane. In SDN, a central controller manages the flow of traffic in the network, while switches and routers only forward packets based on rules defined by the controller.

Mininet is a popular network emulator that can create a realistic virtual network with hosts, switches, and controllers on a single machine. It allows testing of SDN applications quickly and efficiently. Key components:

Host: Represents end devices in the network

Switch: Open vSwitch used for packet forwarding

Controller: Centralized controller (like POX, Ryu, ONOS) that manages the network Link: Virtual connections between hosts, switches, and controllers

Procedure:

Step 1: Launch Mininet
Open a terminal in Ubuntu and run:
sudo mn --topo single,3 --mac --switch ovsk --controller remote

This command creates a simple topology with 1 switch and 3 hosts.

Step 2: Test connectivity
Use the command:
pingall
This sends ICMP packets between all hosts to verify connectivity.

Step 3: Start Mininet CLI
Run commands inside Mininet CLI:
h1 ping h2
h1 ping h3

Step 4: Create custom topology using Python
Create a Python script (topo.py):

```
from mininet.topo import Topo
from mininet.net import Mininet
from mininet.node import RemoteController
from mininet.cli import CLI

class MyTopo(Topo):
def build(self):
h1 = self.addHost('h1')
h2 = self.addHost('h2')
s1 = self.addSwitch('s1')
self.addLink(h1, s1)
self.addLink(h2, s1)

topo = MyTopo()
net = Mininet(topo=topo, controller=RemoteController)
net.start()
CLI(net)
net.stop()
```

Run the script using:

sudo python3 topo.py

Step 5: Attach a controller
Install and run POX controller:
git clone https://github.com/noxrepo/pox.git

cd pox
./pox.py forwarding.l2_learning

Step 6: Connect Mininet to POX controller
Run Mininet with remote controller option:
sudo mn --controller=remote,ip=127.0.0.1,port=6633

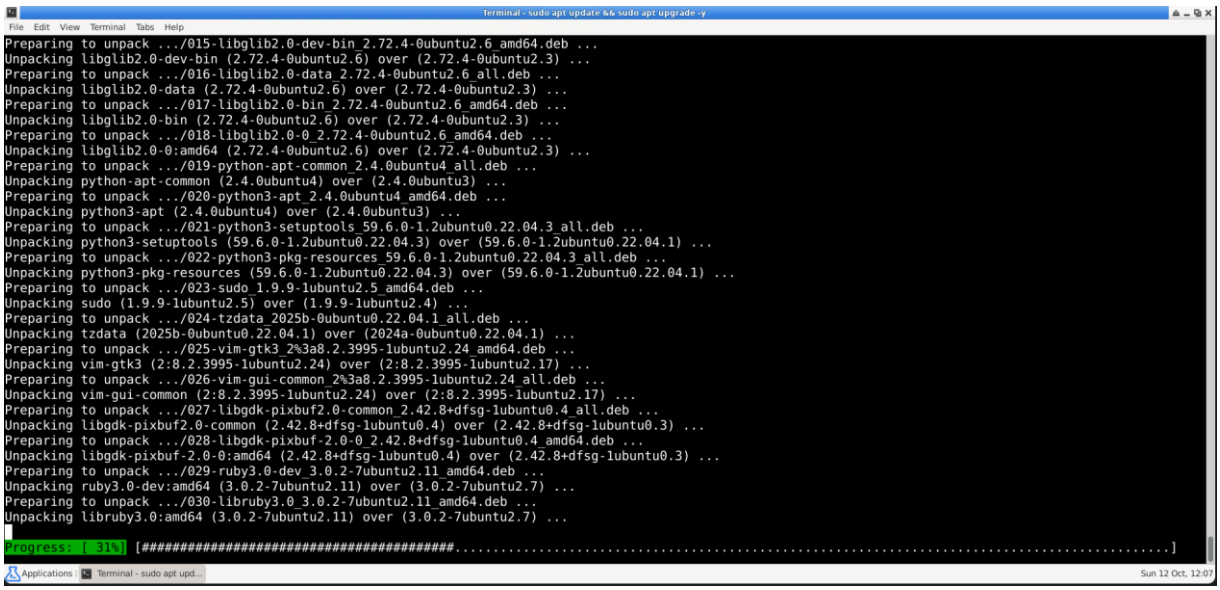
Output:

Pingall shows 100% packet delivery between hosts

Hosts communicate via switch controlled by the SDN controller

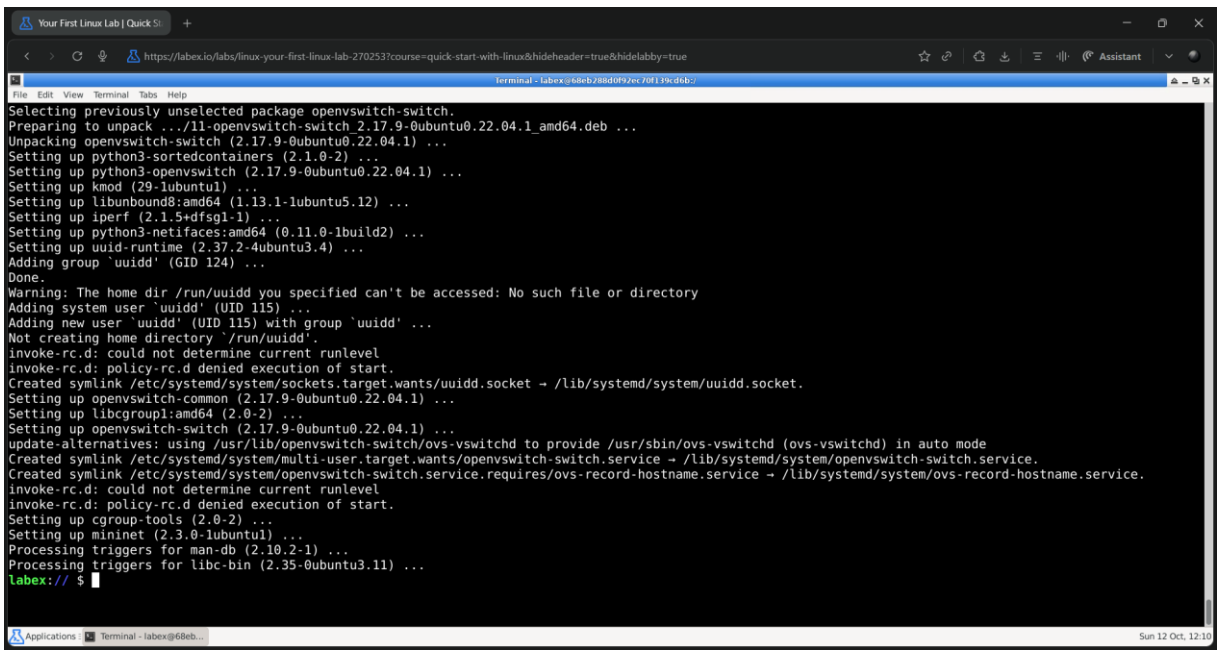
Routing and forwarding decisions are handled dynamically by the controller

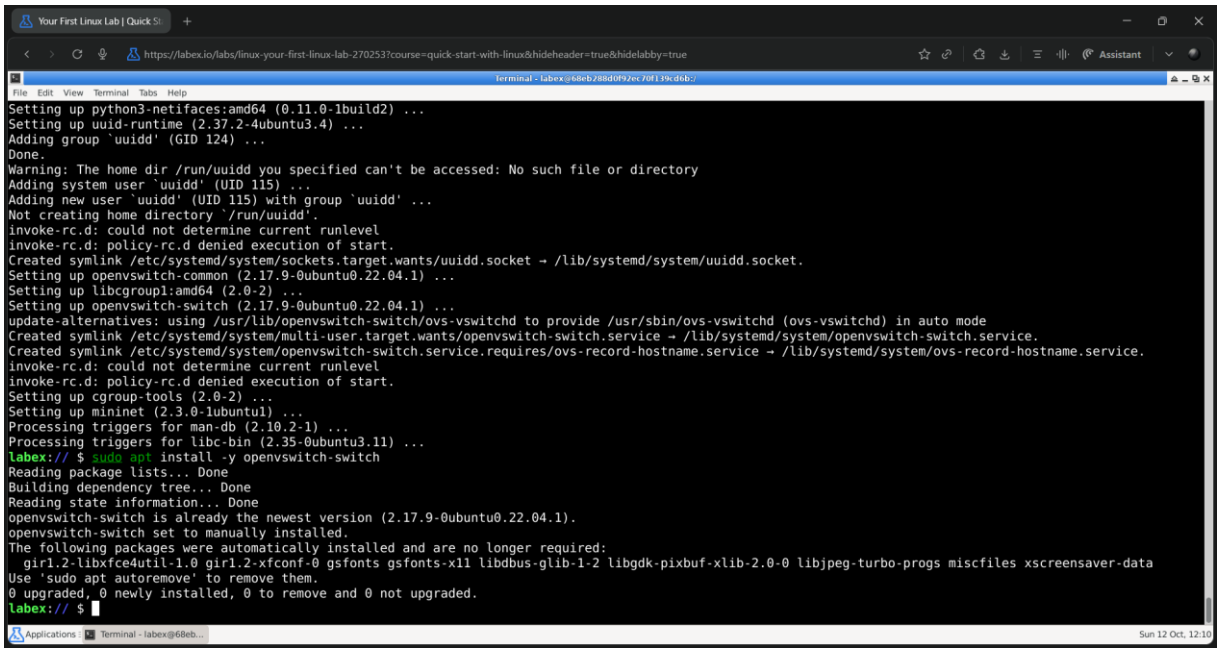
Output:-

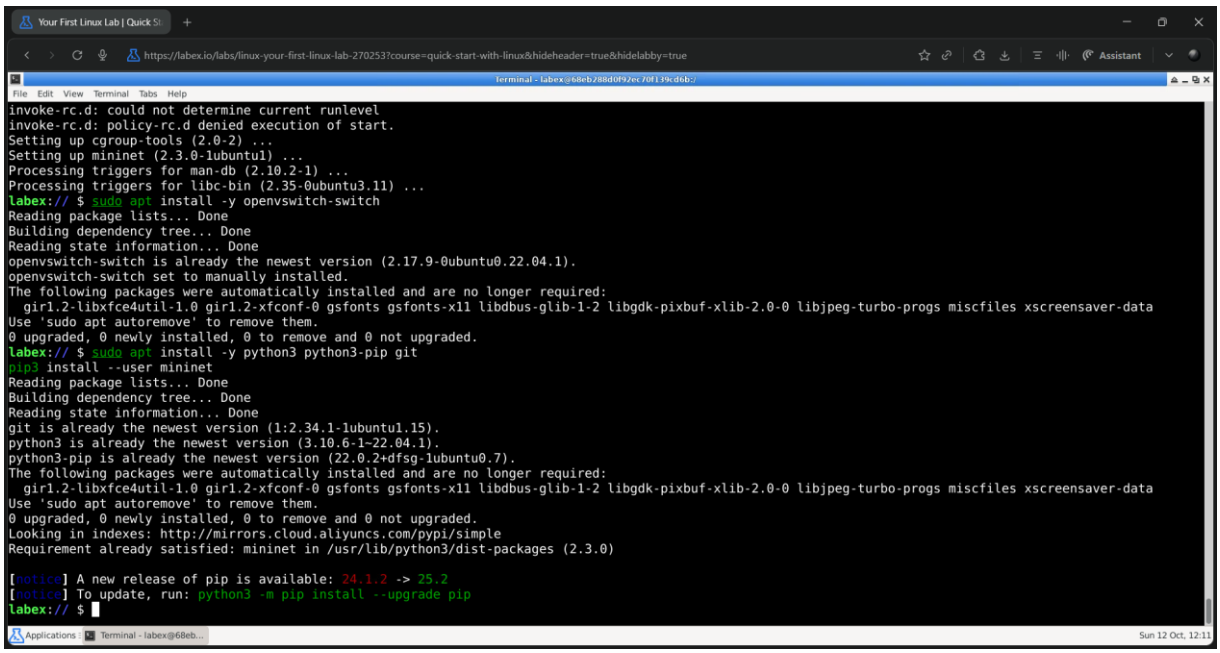


```
Terminal - labex@68eb288d0f92ec70f139cd6b:/
File  Edit  View  Terminal  Tabs  Help
Setting up python3-dev (3.10.6-1~22.04.1) ...
Setting up python3-pip (22.0.2+dfsg-1ubuntu0.7) ...
Setting up gfortran-11 (11.4.0-1ubuntu1~22.04.2) ...
Setting up libwebkit2gtk-4.0-37:amd64 (2.48.7-0ubuntu0.22.04.2) ...
Setting up openjdk-17-source (17.0.16+8~us1-0ubuntu1~22.04.1) ...
Setting up libyelp0:amd64 (42.1-1ubuntu0.1) ...
Setting up apport (2.20.11-0ubuntu82.10) ...
Installing new version of config file /etc/init.d/apport ...
invoke-rc.d: could not determine current runlevel
invoke-rc.d: policy-rc.d denied execution of restart.
Setting up yelp (42.1-1ubuntu0.1) ...
Setting up language-pack-zh-hans (1:22.04+20240902) ...
Setting up language-pack-zh-hans-base (1:22.04+20240902) ...
Generating locales (this might take a while)...
Generation complete.
Setting up language-pack-gnome-zh-hans (1:22.04+20240902) ...
Setting up language-pack-gnome-zh-hans-base (1:22.04+20240902) ...
Processing triggers for mailcap (3.70+nmu1ubuntu1) ...
Processing triggers for desktop-file-utils (0.26-1ubuntu3) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for libc-bin (2.35-0ubuntu3.11) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for plymouth-theme-ubuntu-text (0.9.5+git20211018-1ubuntu3) ...
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for ca-certificates (20240203~22.04.1) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...

done.
done.
labex:// $
```







Conclusion:

Simulation of SDN using Mininet demonstrates how networks can be virtualized and centrally managed using controllers. This experiment shows host-to-host connectivity and highlights the role of the controller in defining packet forwarding behavior