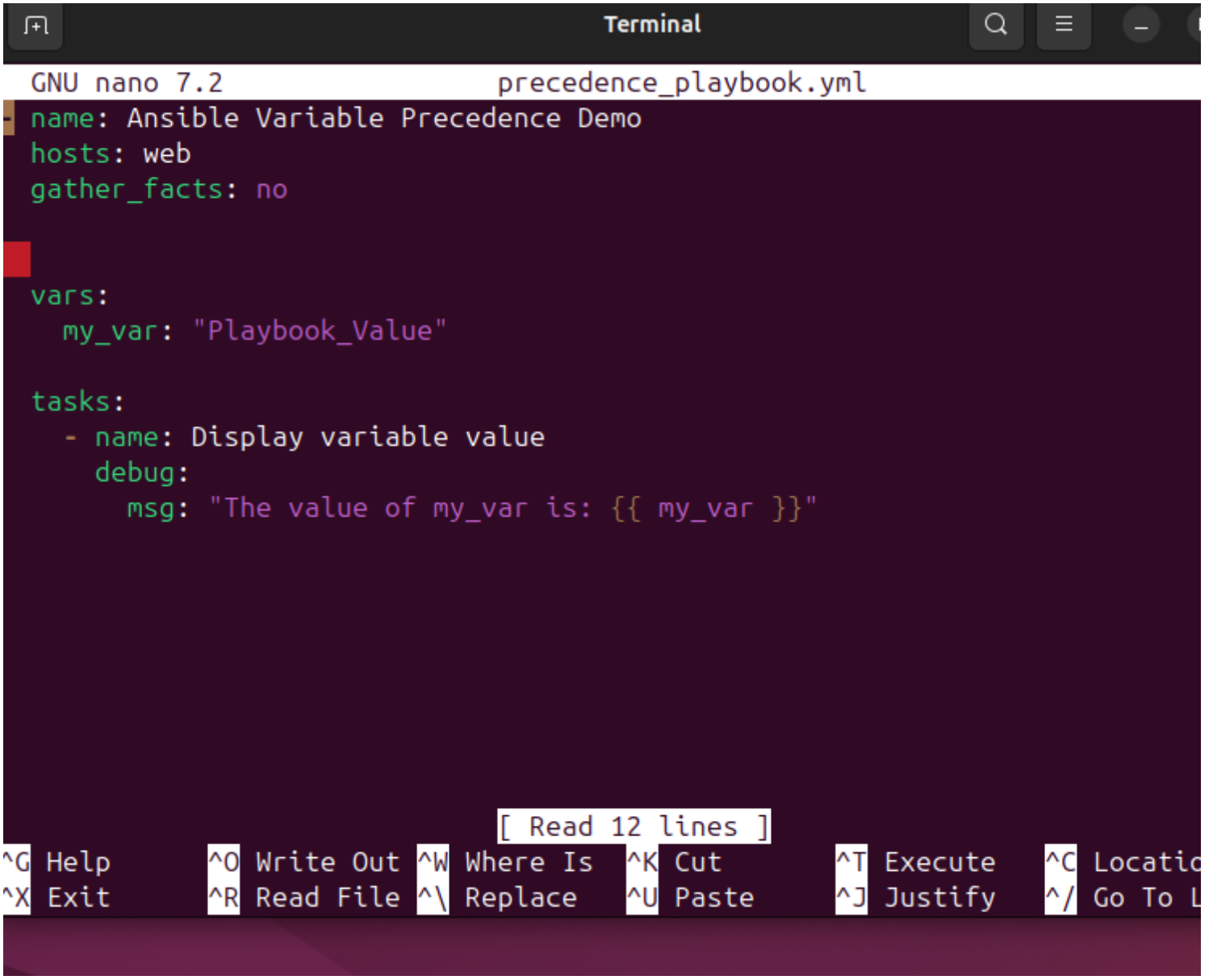
Q3. DevOps – Ansible Variable Precedence Demonstration Task: Demonstrate how variable precedence works in Ansible.

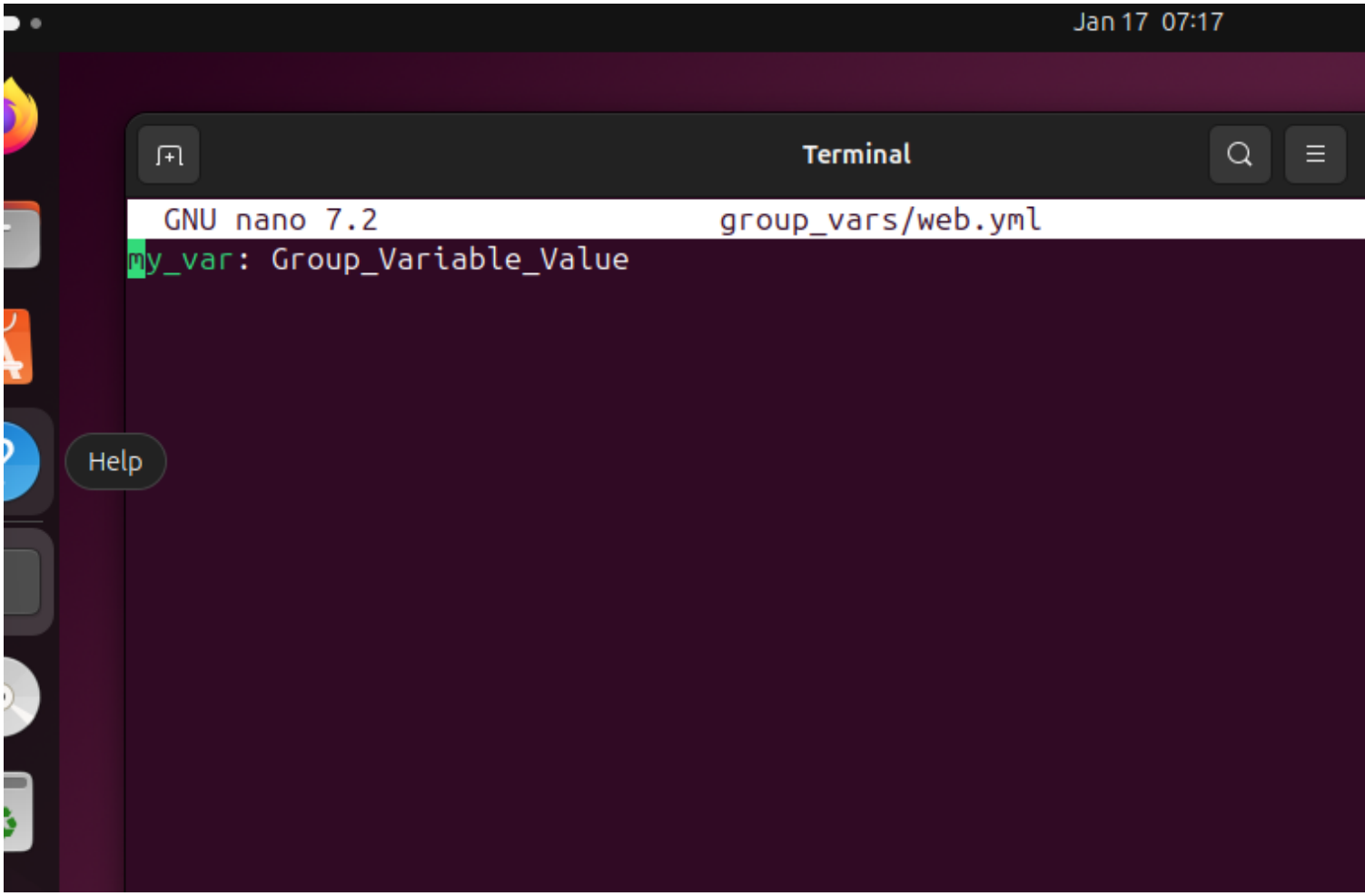
Requirements: ● Define the same variable in:

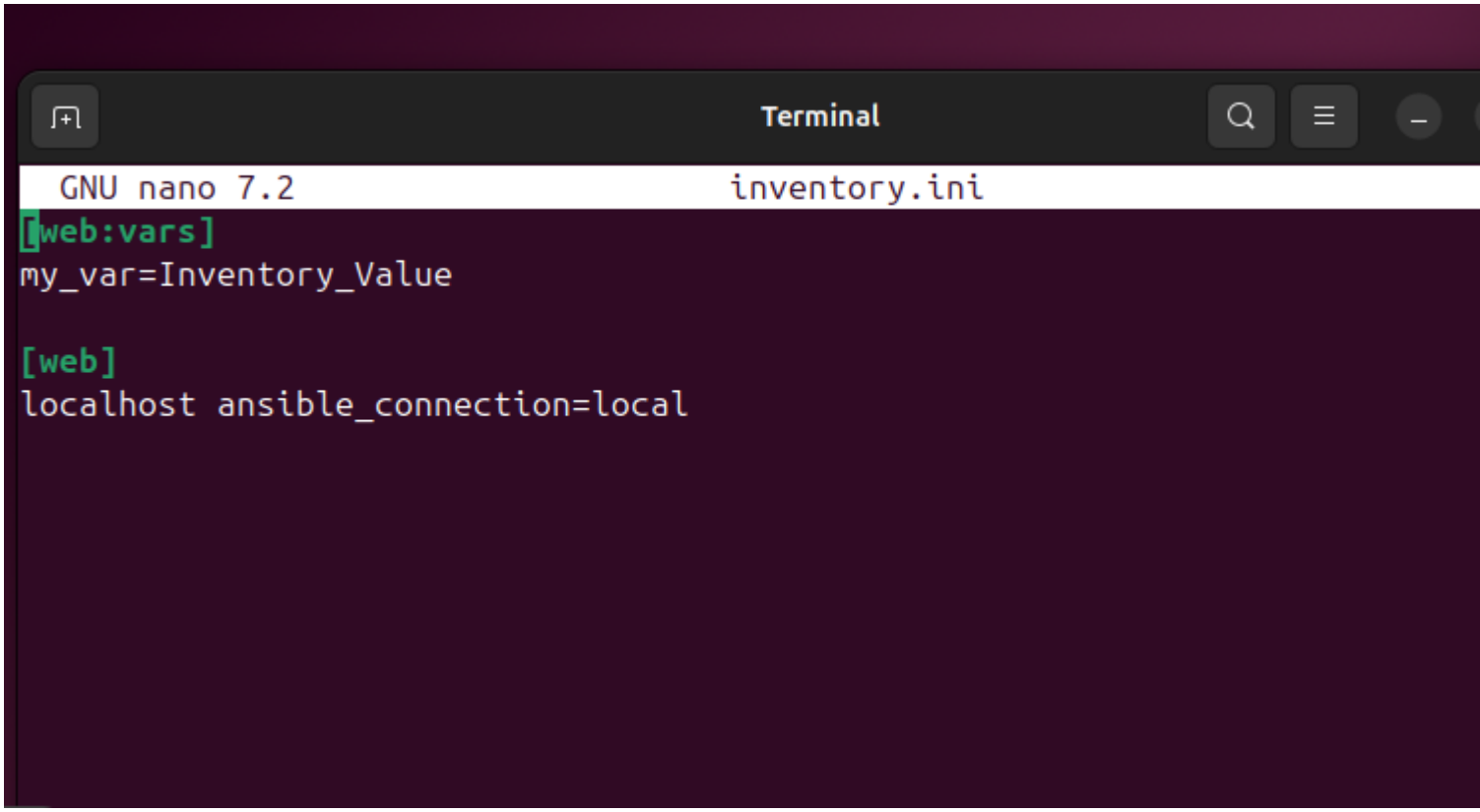
o Inventory o Group variables o Playbook ● Observe and explain which value is applied Live demonstration must include: ● Variable definitions at different levels ● Playbook execution ● Output verification ● Explanation of Ansible variable hierarchy

```
usha@usha-VirtualBox:~$ sudo apt update
Hit:1 http://in.archive.ubuntu.com/ubuntu noble InRelease
Ign:2 https://pkg.jenkins.io/debian-stable binary/ InRelease
Hit:3 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:4 http://in.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:5 https://pkg.jenkins.io/debian-stable binary/ Release
Hit:6 http://in.archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
132 packages can be upgraded. Run 'apt list --upgradable' to see them.
usha@usha-VirtualBox:~$ sudo apt install ansible -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ansible is already the newest version (9.2.0+dfsg-0ubuntu5).
0 upgraded, 0 newly installed, 0 to remove and 132 not upgraded.
usha@usha-VirtualBox:~$ ansible --version
ansible [core 2.16.3]
  config file = None
  configured module search path = ['/home/usha/.ansible/plugins/modules', '/usr/sha
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  ansible collection location = /home/usha/.ansible/collections:/usr/share/ansible/
  executable location = /usr/bin/ansible
  python version = 3.12.3 (main, Nov  6 2025, 13:44:16) [GCC 13.3.0] (/usr/bin/pyth
  jinja version = 3.1.2
  libyaml = True
usha@usha-VirtualBox:~$ mkdir ansible-precedence-demo
usha@usha-VirtualBox:~$ cd ansible-precedence-demo
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano inventory.ini
```

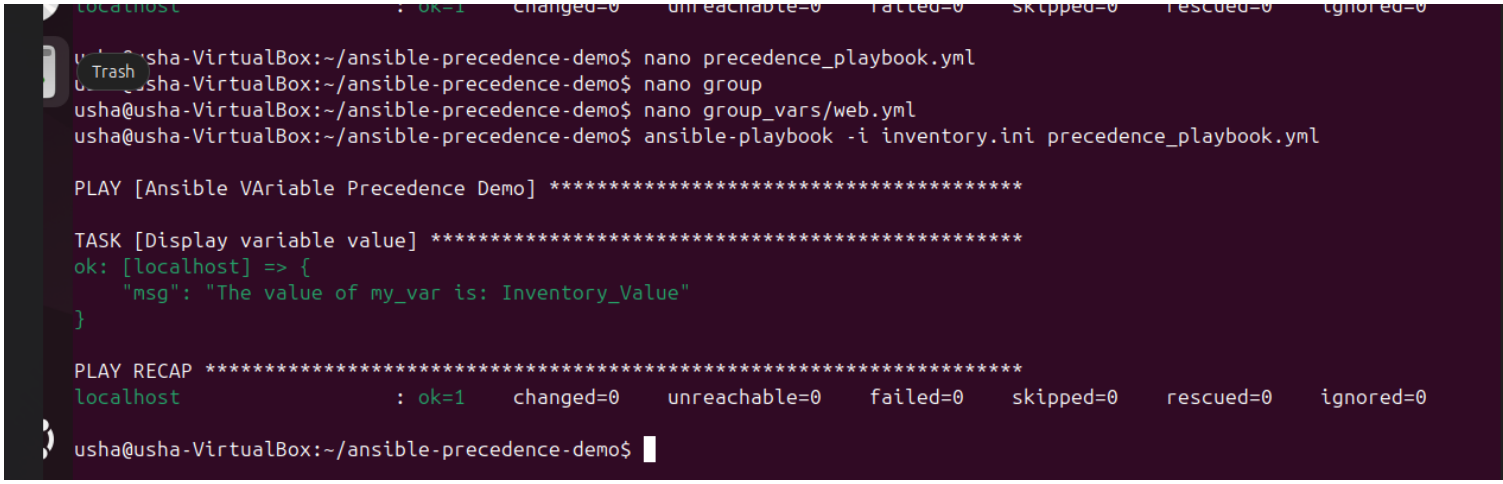
```
  libyaml = True
usha@usha-VirtualBox:~$ mkdir ansible-precedence-demo
usha@usha-VirtualBox:~$ cd ansible-precedence-demo
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano inventory.ini
usha@usha-VirtualBox:~/ansible-precedence-demo$ mkdir group_vars
usha@usha-VirtualBox:~/ansible-precedence-demo$ ^C
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano group_vars/web.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano precedence_playbook.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ ansible-playbook -i inventory.ini precedence_playbook.yml

PLAY [Ansible VAriable Precedence Demo] ************************************

TASK [Display variable value] **********************************************
ok: [localhost] => {
    "msg": "The value of my_var is: Playbook_Value"
}

PLAY RECAP *********************************************************************
localhost                  : ok=1    changed=0    unreachable=0    failed=0    skipped=0    rescued=0    ign

usha@usha-VirtualBox:~/ansible-precedence-demo$ nano precedence_playbook.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ ansible-playbook -i inventory.ini precedence_playbook.yml

PLAY [Ansible VAriable Precedence Demo] ************************************
```


Terminal
GNU nano 7.2 precedence_playbook.yml
name: Ansible Variable Precedence Demo
hosts: web
gather_facts: no
vars:
my_var: "Playbook_Value"
tasks:
- name: Display variable value
debug:
msg: "The value of my_var is: {{ my_var }}"
[Read 12 lines]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Locatio
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To L


Jan 17 07:17
Terminal
GNU nano 7.2 group_vars/web.yml
my_var: Group_Variable_Value
Help




```
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano precedence_playbook.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano groups_var/web.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano group_vars/web.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ ansible-playbook -i inventory.ini precedence_playbook.yml

PLAY [Ansible Variable Precedence Demo] ************************************

TASK [Display variable value] **********************************************
ok: [localhost] => {
    "msg": "The value of my_var is: Group_Variable_Value"
}

PLAY RECAP *********************************************************************
localhost                  : ok=1    changed=0    unreachable=0    failed=0    skipped=0    rescued=0

usha@usha-VirtualBox:~/ansible-precedence-demo$
```

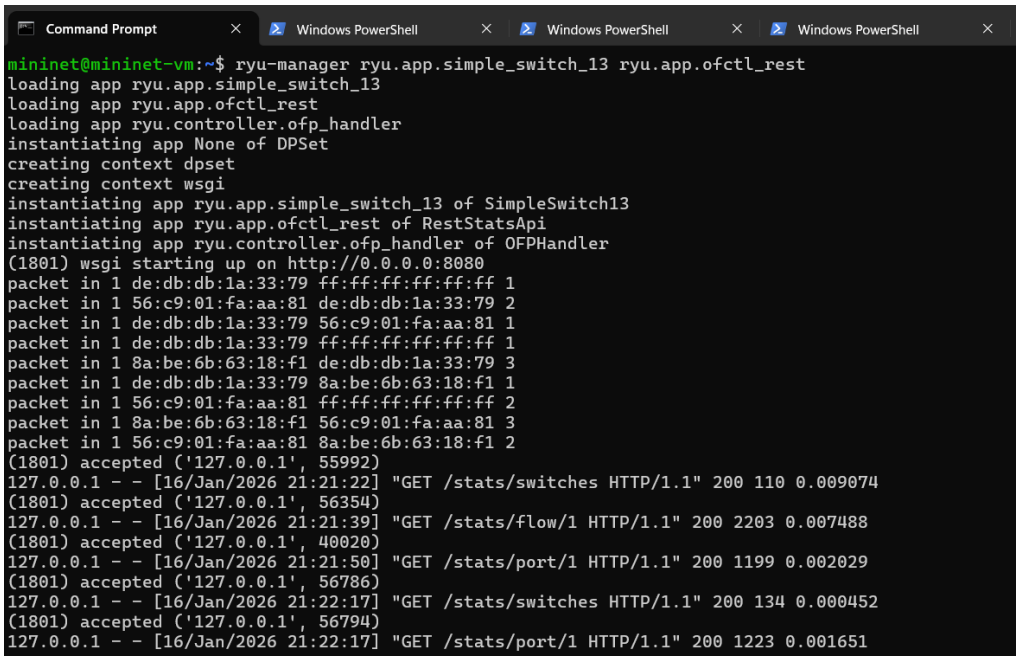

localhost : ok=1 changed=0 unreachable=0 failed=0 skipped=0 rescued=0 ignored=0
Trash
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano precedence_playbook.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano group
usha@usha-VirtualBox:~/ansible-precedence-demo$ nano group_vars/web.yml
usha@usha-VirtualBox:~/ansible-precedence-demo$ ansible-playbook -i inventory.ini precedence_playbook.yml
PLAY [Ansible VAriable Precedence Demo] ************************************
TASK [Display variable value] **
ok: [localhost] => {
"msg": "The value of my_var is: Inventory_Value"
}
PLAY RECAP ***
localhost : ok=1 changed=0 unreachable=0 failed=0 skipped=0 rescued=0 ignored=0
usha@usha-VirtualBox:~/ansible-precedence-demo$

Network Automation – API-Driven Network Data Collection Task: Collect network-related data using REST APIs exposed by a controller or monitoring service. Requirements: ● Use a Python script to: o Query an API endpoint (e.g., Ryu REST API or Prometheus API) o Parse and display selected data ● No network configuration changes required Live demonstration must include: ● API endpoint usage ● Python script execution ● Parsed output ● Explanation of API-driven automation

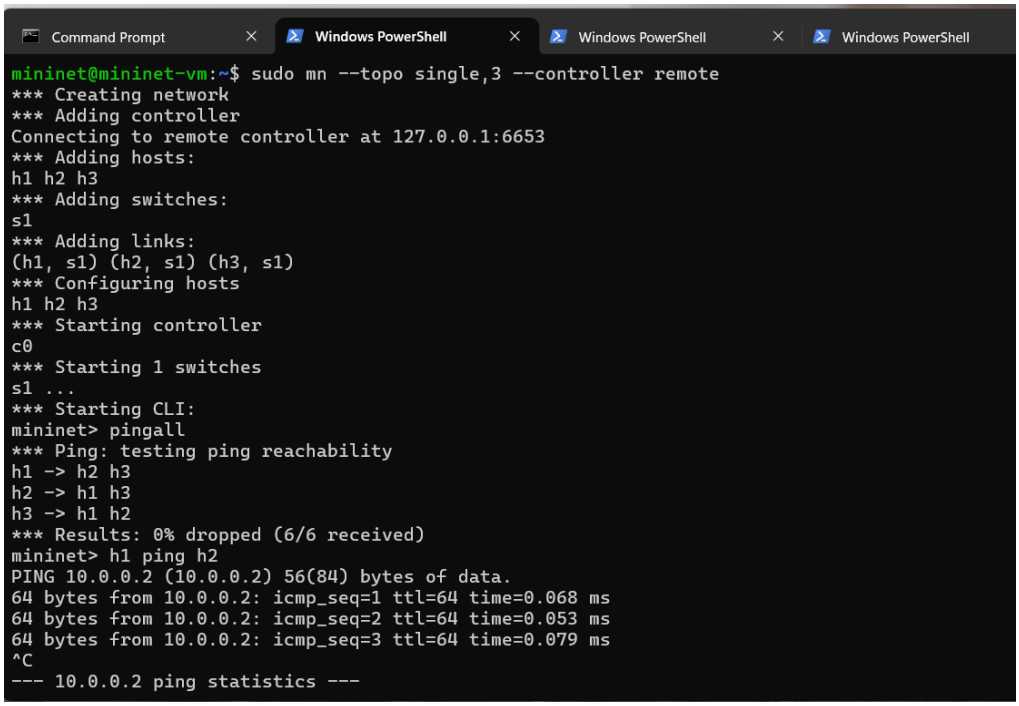
Terminal1:

Ssh -Y mininet@192.168.56.106

Passwd: mininet



Terminal2:



Terminal3:


Last login: Fri Jan 16 21:20:38 2026 from 192.168.56.1
mininet@mininet-vm:~$ curl http://localhost:8080/stats/switches
[1]mininet@mininet-vm:~$
mininet@mininet-vm:~$ curl http://localhost:8080/stats/flow/1
{"1": [{"priority": 1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 532, "duration_sec": 51, "duration_nsec": 27000000, "packet_count":
6, "length": 104, "flags": 0, "actions": ["OUTPUT:1"], "match": {"in_port": 2, "dl_src": "56:c9:01:fa:aa:81", "dl_dst": "de:db:db:1a:33:79"}, "table_id": 0}
, {"priority": 1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 434, "duration_sec": 51, "duration_nsec": 22000000, "packet_count": 5, "l
ength": 104, "flags": 0, "actions": ["OUTPUT:2"], "match": {"in_port": 1, "dl_src": "de:db:db:1a:33:79", "dl_dst": "56:c9:01:fa:aa:81"}, "table_id": 0}, {"p
riority": 1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 238, "duration_sec": 51, "duration_nsec": 1000000, "packet_count": 3, "length"
: 104, "flags": 0, "actions": ["OUTPUT:1"], "match": {"in_port": 3, "dl_src": "8a:be:6b:63:18:f1", "dl_dst": "de:db:db:1a:33:79"}, "table_id": 0}, {"priorit
y": 1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 140, "duration_sec": 50, "duration_nsec": 980000000, "packet_count": 2, "length": 10
4, "flags": 0, "actions": ["OUTPUT:3"], "match": {"in_port": 1, "dl_src": "de:db:db:1a:33:79", "dl_dst": "8a:be:6b:63:18:f1"}, "table_id": 0}, {"priority":
1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 238, "duration_sec": 50, "duration_nsec": 945000000, "packet_count": 3, "length": 104, "
flags": 0, "actions": ["OUTPUT:2"], "match": {"in_port": 3, "dl_src": "8a:be:6b:63:18:f1", "dl_dst": "56:c9:01:fa:aa:81"}, "table_id": 0}, {"priority": 1, "
cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 140, "duration_sec": 50, "duration_nsec": 936000000, "packet_count": 2, "length": 104, "flag
s": 0, "actions": ["OUTPUT:3"], "match": {"in_port": 2, "dl_src": "56:c9:01:fa:aa:81", "dl_dst": "8a:be:6b:63:18:f1"}, "table_id": 0}, {"priority": 0, "cook
ie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_count": 546, "duration_sec": 53, "duration_nsec": 666000000, "packet_count": 9, "length": 80, "flags": 0
, "actions": ["OUTPUT:CONTROLLER"], "match": {}, "table_id": 0}]}mininet@mininet-vm:~$
mininet@mininet-vm:~$
mininet@mininet-vm:~$ curl http://localhost:8080/stats/port/1
{"1": [{"rx_packets": 0, "tx_packets": 0, "rx_bytes": 0, "tx_bytes": 0, "rx_dropped": 3, "tx_dropped": 0, "rx_errors": 0, "tx_errors": 0, "rx_frame_err": 0,
"rx_over_err": 0, "rx_crc_err": 0, "collisions": 0, "duration_sec": 64, "duration_nsec": 225000000, "port_no": "LOCAL"}, {"rx_packets": 11, "tx_packets": 1
2, "rx_bytes": 854, "tx_bytes": 896, "rx_dropped": 0, "tx_dropped": 0, "rx_errors": 0, "tx_errors": 0, "rx_frame_err": 0, "rx_over_err": 0, "rx_crc_err": 0,
"collisions": 0, "duration_sec": 64, "duration_nsec": 275000000, "port_no": 1}, {"rx_packets": 11, "tx_packets": 12, "rx_bytes": 854, "tx_bytes": 896, "rx_
dropped": 0, "tx_dropped": 0, "rx_errors": 0, "tx_errors": 0, "rx_frame_err": 0, "rx_over_err": 0, "rx_crc_err": 0, "collisions": 0, "duration_sec": 64, "du
ration_nsec": 279000000, "port_no": 2}, {"rx_packets": 8, "tx_packets": 9, "rx_bytes": 560, "tx_bytes": 602, "rx_dropped": 0, "tx_dropped": 0, "rx_errors":
0, "tx_errors": 0, "rx_frame_err": 0, "rx_over_err": 0, "rx_crc_err": 0, "collisions": 0, "duration_sec": 64, "duration_nsec": 273000000, "port_no": 3}]}min
inet@mininet-vm:~$ client_loop: send disconnect: Connection reset
PS C:\Users\USHA CT>

Terminal4:

```
[3]+  Stopped                 nano ryu_api.py
mininet@mininet-vm:~$ python3 ryu_api.py
Connected Switches:

Switch ID: 1
Port Statistics:
 Port 1:
   RX Packets: 11
   TX Packets: 12
 Port LOCAL:
   RX Packets: 0
   TX Packets: 0
 Port 2:
   RX Packets: 11
   TX Packets: 12
 Port 3:
   RX Packets: 8
   TX Packets: 9
----------------------------------------
mininet@mininet-vm:~$ nano ryu_api.py
mininet@mininet-vm:~$
```

Command Prompt | Windows PowerShell | Windows PowerShell | mininet@m

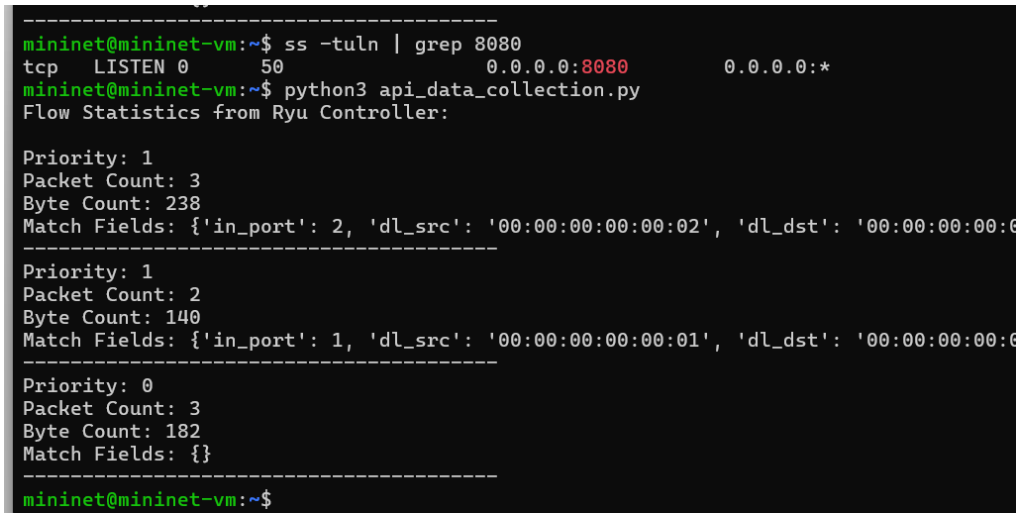
```
  GNU nano 4.8                                                  ryu_api.py
import requests

BASE_URL = "http://localhost:8080"

# Get switch list
switches = requests.get(f"{BASE_URL}/stats/switches").json()

print("Connected Switches:\n")

for dpid in switches:
    print(f"Switch ID: {dpid}")

    # Get port statistics
    port_stats = requests.get(f"{BASE_URL}/stats/port/{dpid}").json()

    print("Port Statistics:")

    # Correct parsing (list of ports)
    for port in port_stats[str(dpid)]:
        print(f" Port {port['port_no']}:")
        print(f"   RX Packets: {port['rx_packets']}")
        print(f"   TX Packets: {port['tx_packets']}")

    print("-" * 40)
```

or

```
Terminated
mininet@mininet-vm:~$ ryu-manager ryu.app.simple_switch_13 ryu.app.ofctl_rest
loading app ryu.app.simple_switch_13
loading app ryu.app.ofctl_rest
loading app ryu.controller.ofp_handler
instantiating app None of DPSet
creating context dpset
creating context wsgi
instantiating app ryu.app.simple_switch_13 of SimpleSwitch13
instantiating app ryu.app.ofctl_rest of RestStatsApi
instantiating app ryu.controller.ofp_handler of OFPHandler
(2539) wsgi starting up on http://0.0.0.0:8080
(2539) accepted ('127.0.0.1', 44512)
127.0.0.1 - - [15/Jan/2026 22:08:14] "GET /stats/switches HTTP/1.1" 200 109 0.020006
packet in 1 00:00:00:00:00:01 ff:ff:ff:ff:ff:ff 1
packet in 1 00:00:00:00:00:02 00:00:00:00:00:01 2
packet in 1 00:00:00:00:00:01 00:00:00:00:00:02 1
(2539) accepted ('127.0.0.1', 60170)
127.0.0.1 - - [15/Jan/2026 22:08:46] "GET /stats/switches HTTP/1.1" 200 110 0.004868
(2539) accepted ('127.0.0.1', 36264)
127.0.0.1 - - [15/Jan/2026 22:09:05] "GET /stats/flow/1 HTTP/1.1" 200 996 0.014956
(2539) accepted ('127.0.0.1', 56536)
127.0.0.1 - - [15/Jan/2026 22:09:54] "GET /stats/flow/1 HTTP/1.1" 200 974 0.008203
(2539) accepted ('127.0.0.1', 34474)
127.0.0.1 - - [15/Jan/2026 22:10:13] "GET /stats/flow/1 HTTP/1.1" 200 999 0.006203
```

```
curl: (7) Failed to connect to localhost port 8080: Connection refused
mininet@mininet-vm:~$ curl http://localhost:8080/stats/switches
[]mininet@mininet-vm:~$ curl http://localhost:8080/stats/switches
[1]mininet@mininet-vm:~$ curl http://localhost:8080/stats/flow/1
{"1": [{"priority": 1, "cookie": 0, "idle_timeout": 0, "hard_timeout": 0, "byte_cour
on_nsec": 834000000, "packet_count": 3, "length": 104, "flags": 0, "actions": ["OUTP
src": "00:00:00:00:00:02", "dl_dst": "00:00:00:00:00:01"}, "table_id": 0}, {"priorit
0, "hard_timeout": 0, "byte_count": 140, "duration_sec": 77, "duration_nsec": 825000
4, "flags": 0, "actions": ["OUTPUT:2"], "match": {"in_port": 1, "dl_src": "00:00:00
:02"}, "table_id": 0}, {"priority": 0, "cookie": 0, "idle_timeout": 0, "hard_timeout
ec": 86, "duration_nsec": 993000000, "packet_count": 3, "length": 80, "flags": 0, "a
ch": {}, "table_id": 0}]}mininet@mininet-vm:~$
```

```
mininet@mininet-vm:~$ ^C
mininet@mininet-vm:~$ sudo mn --topo single,3 --mac --switch ovsk --controller remot
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1) (h3, s1)
*** Configuring hosts
h1 h2 h3
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=33.4 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.325 ms
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.325/16.843/33.362/16.518 ms
mininet>
```


----
mininet@mininet-vm:~$ ss -tuln | grep 8080
tcp LISTEN 0 50 0.0.0.0:8080 0.0.0.0:*
mininet@mininet-vm:~$ python3 api_data_collection.py
Flow Statistics from Ryu Controller:
Priority: 1
Packet Count: 3
Byte Count: 238
Match Fields: {'in_port': 2, 'dl_src': '00:00:00:00:00:02', 'dl_dst': '00:00:00:00:0

Priority: 1
Packet Count: 2
Byte Count: 140
Match Fields: {'in_port': 1, 'dl_src': '00:00:00:00:00:01', 'dl_dst': '00:00:00:00:0

Priority: 0
Packet Count: 3
Byte Count: 182
Match Fields: {}
----
mininet@mininet-vm:~$