

Лабораторная работа №3.

Измерение и тестирование пропускной способности сети. Воспроизводимый эксперимент

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Цели и задачи работы

Основной целью работы является знакомство с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3, а также получение навыков проведения воспроизводимого эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.

```
mininet@mininet-vm:~$ cd work/lab_iperf3/  
mininet@mininet-vm:~/work/lab_iperf3$ mkdir lab_iperf3_topo  
mininet@mininet-vm:~/work/lab_iperf3$ cd lab_iperf3_topo/  
mininet@mininet-vm:~/work/lab_iperf3/lab_iperf3_topo$ cp ~/mininet/examples/emphynet.py ~/work/lab_iperf3/lab_iperf3_topo/  
mininet@mininet-vm:~/work/lab_iperf3/lab_iperf3_topo$ mv emphynet.py lab_iperf3_topo.py  
mininet@mininet-vm:~/work/lab_iperf3/lab_iperf3_topo$ ls  
lab_iperf3_topo.py
```

Рис. 1: Копирование файла с примером скрипта mininet/examples/emphynet.py

```
def emptyNet():  
    "Create an empty network and add nodes to it."  
  
    net = Mininet( controller=Controller, waitConnected=True )  
  
    info( '*** Adding controller\n' )  
    net.addController( 'c0' )  
  
    info( '*** Adding hosts\n' )  
    h1 = net.addHost( 'h1', ip='10.0.0.1' )  
    h2 = net.addHost( 'h2', ip='10.0.0.2' )  
  
    info( '*** Adding switch\n' )  
    s3 = net.addSwitch( 's3' )  
  
    info( '*** Creating links\n' )  
    net.addLink( h1, s3 )  
    net.addLink( h2, s3 )  
  
    info( '*** Starting network\n' )  
    net.start()  
  
    print( "Host", h1.name, "has IP address", h1.IP(), "and MAC address", h1.MAC() )  
  
    info( '*** Running CLI\n' )  
    CLI( net )  
  
    info( '*** Stopping network' )  
    net.stop()  
  
if __name__ == '__main__':  
    setLogLevel( 'info' )  
    emptyNet()
```

```
mininet@mininet-vm:~/work/lab_iperf3/lab_iperf3_topo$ sudo python lab_iperf3_topo.py
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
*** Starting network
*** Configuring hosts
h1 h2
*** Starting controller
c0
*** Starting 1 switches
s3 ...
*** Waiting for switches to connect
s3
Host h1 has IP address 10.0.0.1 and MAC address 3a:11:a8:bf:0c:37
*** Running CLI
*** Starting CLI:
mininet> exit
```

Рис. 3: Проверка запуска скрипта lab_iperf3_topo.py

Функции ограничения производительности и изоляции

```
GNU nano 4.8                                lab_iperf3_topo2.py
#!/usr/bin/env python

"""
This example shows how to create an empty Mininet object
(without a topology object) and add nodes to it manually.
"""

from mininet.net import Mininet
from mininet.node import Controller
from mininet.cli import CLI
from mininet.log import setLogLevel, info
from mininet.node import CPULimitedHost
from mininet.link import TCLink

def emptyNet():

    "Create an empty network and add nodes to it."

    net = Mininet( controller=Controller, waitConnected=True, host = CPULimitedHost, Link = TCLink )

    info( '*** Adding controller\n' )
    net.addController( 'c0' )

    info( '*** Adding hosts\n' )
    h1 = net.addHost( 'h1', ip='10.0.0.1', cpu=50 )
    h2 = net.addHost( 'h2', ip='10.0.0.2', cpu=45 )

    info( '*** Adding switch\n' )
    s3 = net.addSwitch( 's3' )

    info( '*** Creating links\n' )
    net.addLink( h1, s3, bw=10, delay='5ms', max_queue_size=1000, loss=10, use_htb=True )
    net.addLink( h2, s3 )
```

Рис. 4: lab_iperf3_topo2.py. Задание сри и изменение параметров соединения между хостом h1 и коммутатором s3

Функции ограничения производительности и изоляции

```
mininet@mininet-vm:~/work/lab_iperf3/lab_iperf3_topo$ sudo python lab_iperf3_topo2.py
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
(10.00Mbit 5ms delay 10.00000% loss) (10.00Mbit 5ms delay 10.00000% loss) *** Starting network
*** Configuring hosts
h1 (cfs 5000000/1000000us) h2 (cfs 4500000/1000000us)
*** Starting controller
c0
*** Starting 1 switches
s3 (10.00Mbit 5ms delay 10.00000% loss) ...(10.00Mbit 5ms delay 10.00000% loss)
*** Waiting for switches to connect
s3
Host h1 has IP address 10.0.0.1 and MAC address 4e:6d:98:44:a4:90
Host h2 has IP address 10.0.0.2 and MAC address 42:98:76:f6:9e:fd
*** Running CLI
*** Starting CLI:
mininet> exit
*** Stopping network*** Stopping 1 controllers
c0
(cfs -1/1000000us) (cfs -1/1000000us) *** Stopping 2 links
..
*** Stopping 1 switches
s3
*** Stopping 2 hosts
h1 h2
*** Done
```

Рис. 5: Запуск скрипта lab_iperf3_topo2.py.

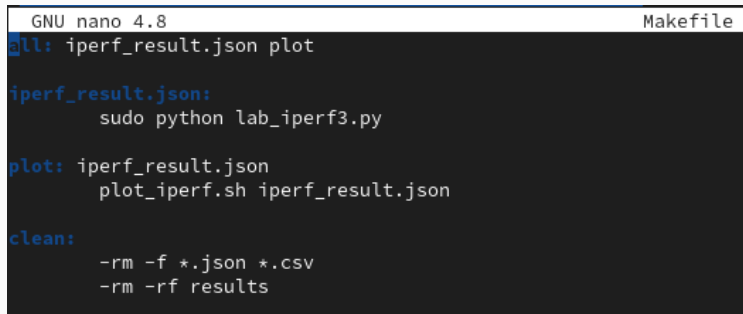

```
info( '*** Starting network\n')
net.start()

info ( '*** Traffic generation\n')
h2.cmdPrint( 'iperf3 -s -D -1' )
time.sleep(10) # Wait 10 seconds for servers to start
h1.cmdPrint( 'iperf3 -c', h2.IP(), '-J > iperf_result.json' )

# info( '*** Running CLI\n' )
# CLI( net )

info( '*** Stopping network' )
net.stop()
```

Рис. 6: lab_iperf3.py. Запуск сервера и клиента



```
GNU nano 4.8 Makefile
all: iperf_result.json plot

iperf_result.json:
    sudo python lab_iperf3.py

plot: iperf_result.json
    plot_iperf.sh iperf_result.json

clean:
    -rm -f *.json *.csv
    -rm -rf results
```

Рис. 7: Код Makefile

```
mininet@mininet-vm:~/work/lab_iperf3/iperf3$ make clean
rm -f *.json *.csv
rm -rf results
mininet@mininet-vm:~/work/lab_iperf3/iperf3$ ls -l
total 8
-rwxrwxr-x 1 mininet mininet 1349 Nov 27 02:52 lab_iperf3.py
-rw-rw-r-- 1 mininet mininet 180 Nov 27 03:01 Makefile
```

Рис. 8: Проверка отработки Makefile. Часть 1

Проверка Makefile

```
mininet@mininet-vm:~/work/lab_iperf3/iperf3$ make
sudo python lab_iperf3.py
*** Adding controller
*** Adding hosts
*** Adding switch
*** Creating links
(100.00Mbit 75ms delay) (100.00Mbit 75ms delay) (100.00Mbit 75ms delay) (100.00Mbit 75ms delay) *** Starting network
*** Configuring hosts
h1 (cfs -1/1000000us) h2 (cfs -1/1000000us)
*** Starting controller
c0
*** Starting 1 switches
s3 (100.00Mbit 75ms delay) (100.00Mbit 75ms delay) ... (100.00Mbit 75ms delay) (100.00Mbit 75ms delay)
*** Waiting for switches to connect
s3
*** Traffic generation
*** h2 : ('iperf3 -s -D -1',)
*** h1 : ('iperf3 -c', '10.0.0.2', '-J > iperf_result.json')
*** Stopping network*** Stopping 1 controllers
c0
*** Stopping 2 links
..
*** Stopping 1 switches
s3
*** Stopping 2 hosts
h1 h2
*** Done
plot_iperf.sh iperf_result.json
mininet@mininet-vm:~/work/lab_iperf3/iperf3$ ls -l
total 24
-rw-rw-r-- 1 mininet mininet 965 Nov 27 03:01 iperf.csv
-rw-r--r-- 1 root root 7758 Nov 27 03:01 iperf_result.json
-rwxrwxr-x 1 mininet mininet 1349 Nov 27 02:52 lab_iperf3.py
-rw-rw-r-- 1 mininet mininet 180 Nov 27 03:01 Makefile
drwxrwxr-x 2 mininet mininet 4096 Nov 27 03:01 results
```

Рис. 9: Проверка отработки Makefile. Часть 2

Выводы по проделанной работе

В ходе лабораторной работы я познакомилась с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3, а также получила навыки проведения воспроизводимого эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.