

Российский университет дружбы народов  
Факультет физико-математических и естественных наук

# Отчёт по лабораторной работе №6

Москва 2023

1032203967  
Быстров Глеб

## Цель работы (задание)

- Знакомство с принципами работы дисциплины очереди Token Bucket Filter, которая формирует входящий/исходящий трафик для ограничения пропускной способности
- Получение навыков моделирования и исследования поведения трафика посредством проведения интерактивного и воспроизводимого экспериментов в Mininet

# Задачи (метод выполнения)

- Запуск лабораторной топологии

```
Activities  XTerm  Dec 23 06:33  mininet@mininet-vm: ~  
mininet@mininet-vm:~$ ifconfig  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
    inet 127.0.0.1 netmask 255.0.0.0  
    loop txqueuelen 1000 (Local Loopback)  
    RX packets 64 bytes 4760 (4.7 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 64 bytes 4760 (4.7 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
mininet@mininet-vm:~$ sudo dhclient eth0  
mininet@mininet-vm:~$ sudo dhclient eth1  
mininet@mininet-vm:~$ xauth list $DISPLAY  
mininet-vm/unix: MIT-MAGIC-C00KIE-1 5b022c626e667c2b9644daa4c85ac4aa  
#ffff#6d696e696e65742d766d#: MIT-MAGIC-C00KIE-1 5b022c626e667c2b9644daa4c85ac4aa  
mininet@mininet-vm:~$ sudo -i  
root@mininet-vm:~# xauth list $DISPLAY  
mininet-vm/unix: MIT-MAGIC-C00KIE-1 5b022c626e667c2b9644daa4c85ac4aa  
#ffff#6d696e696e65742d766d#: MIT-MAGIC-C00KIE-1 5b022c626e667c2b9644daa4c85ac4aa  
root@mininet-vm:~# logout  
mininet@mininet-vm:~$ sudo mn --topo=linear,2 -x  
*** Creating network  
*** Adding controller  
*** Adding hosts:  
h1 h2
```



# Задачи (метод выполнения)

- Ограничение скорости на конечных хостах

```
root@mininet-vm:/home/mininet# sudo tc qdisc add dev h1-eth0 root tbf rate 10
gbit burst 5000000 limit 15000000
root@mininet-vm:/home/mininet# egrep '^CONFIG_HZ_[0-9]+' /boot/config- 'uname
-r'
grep: /boot/config-: No such file or directory
grep: uname -r: No such file or directory
root@mininet-vm:/home/mininet# egrep '^CONFIG_HZ_[0-9]+' /boot/config-'uname
-r'
grep: /boot/config-uname -r: No such file or directory
root@mininet-vm:/home/mininet# egrep '^CONFIG_HZ_[0-9]+' /boot/config-'uname
-r'
CONFIG_HZ_250=y
root@mininet-vm:/home/mininet#
```

```
-----+host: h2"
-----
Server listening on 5201
-----
Accepted connection from 10.0.0.1, port 50672
[ 7] local 10.0.0.2 port 5201 connected to 10.0.0.1 port 50674
[ ID] Interval          Transfer    Bitrate
[ 7] 0.00-1.00 sec      998 MBytes  8.35 Gbits/sec
[ 7] 1.00-2.00 sec      1.04 GBytes  8.93 Gbits/sec
[ 7] 2.00-3.00 sec      1.08 GBytes  9.28 Gbits/sec
[ 7] 3.00-4.00 sec      1.09 GBytes  9.36 Gbits/sec
[ 7] 4.00-5.00 sec      1.07 GBytes  9.21 Gbits/sec
[ 7] 5.00-6.00 sec      1.08 GBytes  9.30 Gbits/sec
[ 7] 6.00-7.00 sec      1.08 GBytes  9.32 Gbits/sec
[ 7] 7.00-8.01 sec      1.09 GBytes  9.33 Gbits/sec
[ 7] 8.01-9.00 sec      1.07 GBytes  9.19 Gbits/sec
[ 7] 9.00-10.01 sec     1.09 GBytes  9.26 Gbits/sec
-----
[ ID] Interval          Transfer    Bitrate
[ 7] 0.00-10.01 sec    10.7 GBytes  9.15 Gbits/sec
-----
```

# Задачи (метод выполнения)

- Ограничение скорости на коммутаторах

```
"switch: s1" (root)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s2-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether de:cc:1b:a5:a0:0f txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s2-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 5e:17:37:9a:de:37 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vm:/home/mininet# sudo tc qdisc add dev s1-eth2 root tbf rate
0gbit burst 5000000 limit 15000000
```

```
"host: h2"
Server listening on 5201
-----
Accepted connection from 10.0.0.1, port 50676
[ 7] local 10.0.0.2 port 5201 connected to 10.0.0.1 port 50678
[ ID] Interval          Transfer      Bitrate
[ 7] 0.00-1.00 sec 1.03 GBytes 8.82 Gbits/sec
[ 7] 1.00-2.00 sec 1.07 GBytes 9.19 Gbits/sec
[ 7] 2.00-3.01 sec 1.07 GBytes 9.15 Gbits/sec
[ 7] 3.01-4.01 sec 1.07 GBytes 9.15 Gbits/sec
[ 7] 4.01-5.00 sec 1.04 GBytes 9.02 Gbits/sec
[ 7] 5.00-6.00 sec 1.05 GBytes 8.98 Gbits/sec
[ 7] 6.00-7.00 sec 1.05 GBytes 9.00 Gbits/sec
[ 7] 7.00-8.00 sec 1.06 GBytes 9.12 Gbits/sec
[ 7] 8.00-9.00 sec 1.03 GBytes 8.87 Gbits/sec
[ 7] 9.00-10.01 sec 1.06 GBytes 8.95 Gbits/sec
-----
[ ID] Interval          Transfer      Bitrate
[ 7] 0.00-10.01 sec 10.5 GBytes 9.03 Gbits/sec
-----
Server listening on 5201
-----
```

# Задачи (метод выполнения)

- Объединение NETEM и TBF

```
"switch: s1" (root)
ether de:cc:1b:a5:a0:0f txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s2-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
ether 5e:17:37:9a:de:37 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vm:/home/mininet# sudo tc qdisc add dev s1-eth2 root tbf rate
0gbit burst 5000000 limit 15000000
root@mininet-vm:/home/mininet# sudo tc qdisc del dev s1-eth2 root
root@mininet-vm:/home/mininet# sudo tc qdisc add dev s1-eth2 root handle 1:
netem delay 10ms
root@mininet-vm:/home/mininet# sudo tc qdisc add dev s1-eth2 parent 1: hand
e 2: tbf rate 2gbit burst 10000000 limit 20000000
root@mininet-vm:/home/mininet#
```

```
"host: h2"
-----
Accepted connection from 10.0.0.1, port 50682
[ 7] local 10.0.0.2 port 5201 connected to 10.0.0.1 port 50684
[ ID] Interval          Transfer      Bitrate
[ 7] 0.00-1.00 sec      163 MBytes   1.37 Gbits/sec
[ 7] 1.00-2.00 sec      127 MBytes   1.06 Gbits/sec
[ 7] 2.00-3.00 sec      121 MBytes   1.01 Gbits/sec
[ 7] 3.00-4.00 sec      149 MBytes   1.25 Gbits/sec
[ 7] 4.00-5.00 sec      153 MBytes   1.29 Gbits/sec
[ 7] 5.00-6.00 sec      154 MBytes   1.29 Gbits/sec
[ 7] 6.00-7.00 sec      158 MBytes   1.33 Gbits/sec
[ 7] 7.00-8.00 sec      114 MBytes   955 Mbits/sec
[ 7] 8.00-9.00 sec      114 MBytes   955 Mbits/sec
[ 7] 9.00-10.00 sec     126 MBytes   1.06 Gbits/sec
[ 7] 10.00-10.02 sec     318 KBytes   142 Mbits/sec
-----
[ ID] Interval          Transfer      Bitrate
[ 7] 0.00-10.02 sec     1.35 GBytes   1.15 Gbits/sec
-----
Server listening on 5201
-----
```



# Задачи (метод выполнения)

- Воспроизводимые эксперименты

```
Activities  XTerm  Dec 23 10:24
mininet@mininet-vm: ~/work/lab_6

*** Starting controller
c0
*** Starting 2 switches
s1 s2 ...
*** Waiting for switches to connect
s1 s2
*** Set delay
*** s1 : ('tc qdisc add dev s1-eth2 root handle 1: netem delay 10ms',)
*** s1 : ('tc qdisc add dev s1-eth2 parent 1: handle 2: tbf rate 2gbit burst 10
00000 limit 2000000',)
*** Traffic generation*** h2 : ('iperf3 -s -D -1',)
*** h1 : ('iperf3 -c', '10.0.0.2', '-J > iperf_result.json')
*** h1 : ('ping -c 100', '10.0.0.2', '| grep "time=" | awk \'{print $5, $7}\'' |
sed -e \'/s/time=//g\' -e \'/s/icmp_seq=//g\'> ping.dat')
*** Stopping network*** Stopping 1 controllers
c0
*** Stopping 3 links
...
*** Stopping 2 switches
s1 s2
*** Stopping 2 hosts
h1 h2
*** Done
```

```
./ping_plot
./ping_plot: 6: plot: not found
make: *** [Makefile:7: ping.png] Error 127
mininet@mininet-vm:~/work/lab_6$
```

# Результаты и их анализ

- Познакомился с принципами работы дисциплины очереди Token Bucket Filter
- Получил навыки моделирования и исследования поведения трафика посредством проведения экспериментов





Благодарю за внимание