

# 南京大学本科生实验报告

课程名称：计算机网络 任课教师：田臣/李文中 助教：

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## 实验名称

计算机网络试验2

## 实验目的

实现交换机以及各种机制

## 实验内容

Python基本语法使用

交换机的工作机制

## 实验结果与核心代码解读（合并了原模板的两个模块）

PS：下面结合代码进行实现思路的介绍（代码是摘录重点为了展示，在缩进代码块上和源代码不一定一样）

### Task2

#### 实现思维简述

这个任务是打算实现一个基本的交换机。

考虑到交换机的功能逻辑，有两个重点问题。1：对于广播的地址特殊处理，2：对已知地址和端口对应存储，为发送做准备，以下结合代码说明实现思路

初始定义所需的变量

```
1 boardcast_addr="ff:ff:ff:ff:ff:ff"
2 list_port=[]
3 list_address=[]
```

对广播地址处理，先对来源的数据对（端口和地址）进行处理，看看是否在列表里，然后决定增加与否，最后洪泛

```

1  if packet[0].dst == broadcast_addr:
2      if input_port in list_port:
3          print("broadcast src port in list")
4      else:
5          print("broadcast src port not in list")
6          list_port.append(input_port)
7          list_address.append(packet[0].src)
8      for intf in my_interfaces:
9          if input_port != intf.name:
10             log_debug ("Flooding packet {} to {}".format(packet,
11 intf.name))
12             net.send_packet(intf.name, packet)
13             log_info ("broadcast packet from {} to {}".format(input_port,
14 intf.name))

```

对非广播地址处理，首先看看来源的数据对（端口和地址）是否存在

```

1  if input_port in list_port:
2      print("src port in list")
3  else:
4      print("src port not in list")
5      list_port.append(input_port)
6      list_address.append(packet[0].src)

```

接着就是找一找有没有地址的保存记录，有就发，没有就算了，有标志位send\_flag指示

```

1  index=0
2  send_flag=0
3  for address in list_address:
4      if address==packet[0].dst:
5          net.send_packet(list_port[index], packet)
6          log_info ("find port {} of address
7 {}".format(list_port[index],packet[0].dst))
8          send_flag=1
9          break
10     index+=1

```

对于上面没有的情况进行处理

```

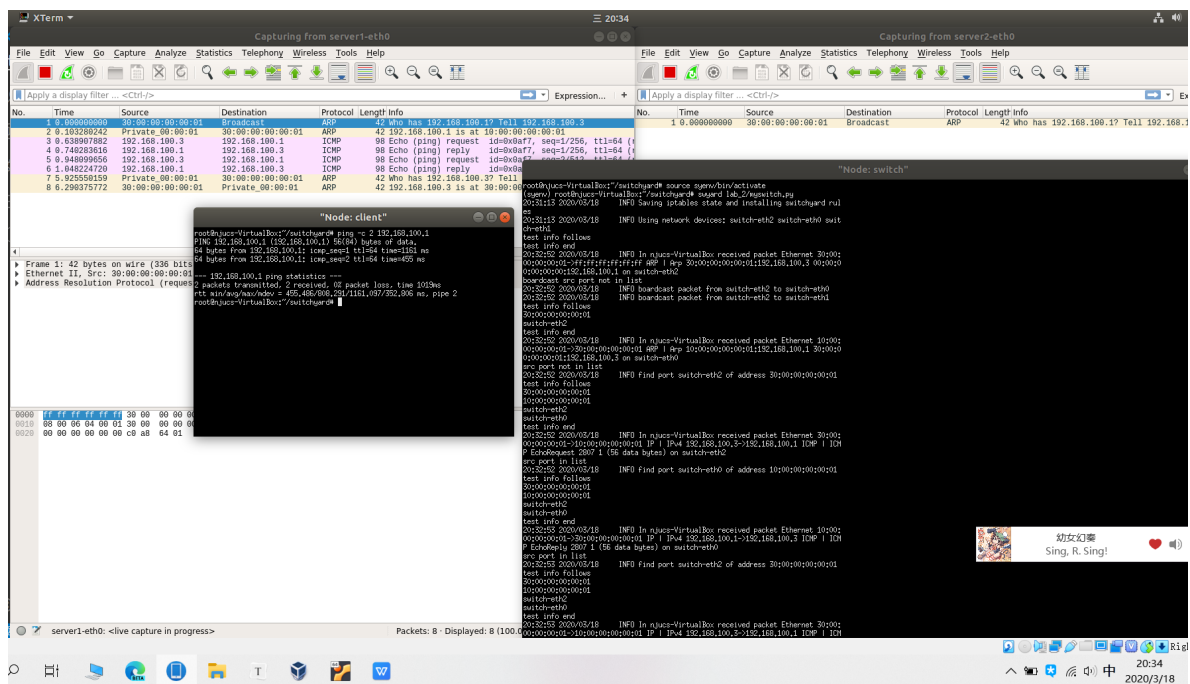
1  if send_flag!=1:
2      print("didn't find port")
3      for intf in my_interfaces:
4          if input_port != intf.name:
5              log_debug ("Flooding packet {} to {}".format(packet, intf.name))
6
7              net.send_packet(intf.name, packet)
8              log_info ("didnt find packet from {} to {}".format(input_port,
9 intf.name))

```

## 测试结果展示

如试验手册中介绍的方法进行测试，实现之后利用client去ping server1发送两个request

理论而言只有server1收到request以及回送两个reply，server2只有Arp包，如下证明了正确性



## Task3

### 实现思维简述

Task3就是引入了超时，所以实现有所不同，根据流程图实现如下

定义一些所需的类和变量

```
1 import time
2 class info:
3     def __init__(self,create_times,ports,addresses):
4         self.create_time=create_times
5         self.port=ports
6         self.address=addresses
7 boardcast_addr="ff:ff:ff:ff:ff:ff"
8 list_info=[]
```

在最开始检查并移出超时项（每一项有创建时间，只要获取当前的时间戳进行计算即可）

这里是在一收到包就进行检查

```
1 index=0
2 while index<len(list_info):
3     temp_time=time.time()
4     if temp_time-list_info[index].create_time>=10:
5         del(list_info[index])
6     else:
7         index+=1
```

同样的先对广播的地址进行处理

先检查源地址和端口的对应情况，如果不对就刷新端口重置事件

如果是没有对应那就创建对应的数据，然后放在列表里

最后就是一个洪泛的模块了

```
1 if packet[0].dst == boardcast_addr:
```

```

2     flag=0
3     for i in list_info:
4         if i.address== packet[0].src:
5             flag=1
6             if i.port != input_port:
7                 i.port=input_port
8                 i.create_time=time.time()
9             break
10    if flag==0:
11        cur_time=time.time()
12        temp=info(cur_time,input_port,packet[0].src)
13        list_info.append(temp)
14
15    for intf in my_interfaces:
16        if input_port != intf.name:
17            log_debug ("Flooding packet {} to {}".format(packet,
18 intf.name))
19            net.send_packet(intf.name, packet)
20            log_info ("boardcast packet from {} to {}".format(input_port,
21 intf.name))

```

然后就是非广播模式了

同样的是对源数据和端口的情况进行分析，原理和实现和上面一模一样

```

1     flag=0
2     for i in list_info:
3         if i.address== packet[0].src:
4             flag=1
5             if i.port != input_port:
6                 i.port=input_port
7                 i.create_time=time.time()
8             break
9     if flag==0:
10        cur_time=time.time()
11        temp=info(cur_time,input_port,packet[0].src)
12        list_info.append(temp)

```

然后就是对发出的数据端口进行了分析

其实就是有匹配就发送，一个都不匹配就和广播一样了。

```

1     send_flag=0
2     for i in list_info:
3         if i.address==packet[0].dst:
4             net.send_packet(i.port, packet)
5             log_info ("find port {} of address
6 {}".format(i.port,packet[0].dst))
7             send_flag=1
8             break
9
10    if send_flag!=1:
11        print("didn't find port")
12        for intf in my_interfaces:
13            if input_port != intf.name:
14                log_debug ("Flooding packet {} to {}".format(packet, intf.name))

```

```

14 net.send_packet(intf.name, packet)
15 log_info ("didn't find packet from {} to {}".format(input_port,
    intf.name))

```

## 运行结果

VIRTUALBOX

```

20:51:37 2020/03/18 INFO In switch tests received packet Ethernet 30:00:00:00:02->ff:ff:ff:ff:ff:ff IP | IPv4 172.16.42.2->255.255.255.255
es) on eth1
20:51:37 2020/03/18 INFO boardcast packet from eth1 to eth0
20:51:37 2020/03/18 INFO boardcast packet from eth1 to eth2
20:51:37 2020/03/18 INFO In switch tests received packet Ethernet 20:00:00:00:00:01->30:00:00:00:00:02 IP | IPv4 192.168.1.100->172.16.42.2 I
) on eth0
20:51:37 2020/03/18 INFO find port eth1 of address 30:00:00:00:00:02
20:51:57 2020/03/18 INFO In switch tests received packet Ethernet 20:00:00:00:00:01->30:00:00:00:00:02 IP | IPv4 192.168.1.100->172.16.42.2 I
) on eth0
didn't find port
20:51:57 2020/03/18 INFO didnt find packet from eth0 to eth1
20:51:57 2020/03/18 INFO didnt find packet from eth0 to eth2
20:51:57 2020/03/18 INFO In switch tests received packet Ethernet 20:00:00:00:00:01->10:00:00:00:00:03 IP | IPv4 192.168.1.100->172.16.42.2 I
) on eth2

Results for test scenario switch tests: 9 passed, 0 failed, 0 pending

Passed:
1 An Ethernet frame with a broadcast destination address
  should arrive on eth1
2 The Ethernet frame with a broadcast destination address
  should be forwarded out ports eth0 and eth2
3 An Ethernet frame from 20:00:00:00:00:01 to
  30:00:00:00:00:02 should arrive on eth0
4 Ethernet frame destined for 30:00:00:00:00:02 should arrive
  on eth1 after self-learning
5 Timeout for 20s
6 An Ethernet Frame from 20:00:00:00:00:01 to
  30:00:00:00:00:02 should arrive on eth0
7 Ethernet frame destined for 30:00:00:00:00:02 should be
  flooded out eth1 and eth2
8 An Ethernet Frame should arrive on eth2 with destination
  address the same as eth2's MAC address
9 The hub should not do anything in response to a frame
  arriving with a destination address referring to the hub
  itself.

All tests passed!

(syenv) njucs@njucs-VirtualBox:~/switchyard$

```

## Deploy测试

在mininet里用client和server1互相ping，并根据输出语句查看功能是否可用

server1 ping client 后，理论上已经保存了server1的端口和地址数据，隔上一段时间后再client ping server1显示didn't find port 的提示语句。

```

20:58
Debug Terminal Help myswitch_to.py - switchyard - Visual Studio Code
myswitch_traffic.py myswitch_lru.py myswitch_to.py x
lab_2 > myswitch_to.py > ...
56         list_info.append(temp)
57
58     for intf in my_interfaces:
59         if input_port != intf.name:
60             log_debug ("Flooding packet {} to {}".format(packet, intf.name))
61             net.send_packet(intf.name, packet)
62             log_info ("boardcast packet from {}".format(intf.name))
63         else:
64             flag=0
65             for i in list_info:
66                 if i.address== packet[0].src:
67                     flag=1
68                     if i.port != input_port:
69                         i.port=input_port
70                         i.create_time=time.time()
71                     break
72             if flag==0:
73                 cur_time=time.time()
74                 temp=info(cur_time,input_port,packet[0].src)
75                 list_info.append(temp)
76             send_flag=0
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```

```

8         break
9     if flag==0:
10         if len(list_info) >=max_len:
11             for i in range(1,len(list_info)):
12                 list_info[i-1]=list_info[i]
13                 temp=info(input_port,packet[0].src)
14                 list_info[len(list_info)-1]=temp
15         else:
16             temp=info(input_port,packet[0].src)
17             list_info.append(temp)
18     for intf in my_interfaces:
19         if input_port != intf.name:
20             log_debug ("Flooding packet {} to {}".format(packet,
21 intf.name))
22             net.send_packet(intf.name, packet)
23             log_info ("boardcast packet from {} to {}".format(input_port,
24 intf.name))

```

然后就是非广播的处理了，对于源数据的处理和上面是一样的，然后就是对发出的数据的处理

其实差不多，匹配成功就放到最后面，实现和源数据处理差不多，不成功就广播

```

1  flag=0
2  for i in range(len(list_info)):
3      if list_info[i].address== packet[0].src:
4          flag=1
5          if list_info[i].port != input_port:
6              list_info[i].port = input_port
7          break
8  if flag==0:
9      if len(list_info) >= max_len:
10         for i in range(1,len(list_info)):
11             list_info[i-1]=list_info[i]
12             temp=info(input_port,packet[0].src)
13             list_info[len(list_info)-1]=temp
14         else:
15             temp=info(input_port,packet[0].src)
16             list_info.append(temp)
17
18
19  send_flag=0
20  for i in range(len(list_info)):
21      if list_info[i].address == packet[0].dst:
22          net.send_packet(list_info[i].port, packet)
23          log_info ("find port {} of address
24 {}".format(list_info[i].port,packet[0].dst))
25          send_flag=1
26          temp_info = list_info[i]
27          del(list_info[i])
28          list_info.append(temp_info)
29          break
30
31  if send_flag!=1:
32      log_info("didn't find port")
33      for intf in my_interfaces:
34          if input_port != intf.name:

```

```

35         log_debug ("Flooding packet {} to {}".format(packet,
36                 intf.name))
37         net.send_packet(intf.name, packet)
38         log_info ("didn't find packet from {} to
39                 {}".format(input_port, intf.name))

```

## 测试结果

```

21:12:42 2020/03/18 INFO In switch tests received packet Ethernet 40:00:00:00:00:05->20:00:00:00:00:01 IP | IPv4 128.16.42.4->192.
) on eth4
21:12:42 2020/03/18 INFO find port eth0 of address 20:00:00:00:00:01
21:12:42 2020/03/18 INFO In switch tests received packet Ethernet 30:00:00:00:00:05->20:00:00:00:00:01 IP | IPv4 172.16.42.5->192.
) on eth4
21:12:42 2020/03/18 INFO find port eth0 of address 20:00:00:00:00:01
21:12:42 2020/03/18 INFO In switch tests received packet Ethernet 20:00:00:00:00:05->30:00:00:00:00:02 IP | IPv4 192.16.42.4->172.
on eth4
21:12:42 2020/03/18 INFO didn't find port
21:12:42 2020/03/18 INFO didn't find packet from eth4 to eth0
21:12:42 2020/03/18 INFO didn't find packet from eth4 to eth1
21:12:42 2020/03/18 INFO didn't find packet from eth4 to eth2
21:12:42 2020/03/18 INFO didn't find packet from eth4 to eth3
21:12:42 2020/03/18 INFO In switch tests received packet Ethernet 20:00:00:00:00:01->10:00:00:00:00:03 IP | IPv4 192.168.1.100->17
) on eth2

Results for test scenario switch tests: 18 passed, 0 failed, 0 pending

Passed:
1 An Ethernet frame with a broadcast destination address
should arrive on eth1
2 The Ethernet frame with a broadcast destination address
should be forwarded out ports eth0, eth2, eth3 and eth4
3 An Ethernet frame from 20:00:00:00:00:01 to
30:00:00:00:00:02 should arrive on eth0
4 Ethernet frame destined for 30:00:00:00:00:02 should arrive
on eth1 after self-learning
5 An Ethernet frame from 20:00:00:00:00:03 to
30:00:00:00:00:02 should arrive on eth2
6 Ethernet frame destined for 30:00:00:00:00:02 should arrive
on eth1 after self-learning
7 An Ethernet frame from 30:00:00:00:00:04 to
20:00:00:00:00:01 should arrive on eth3
8 Ethernet frame destined to 20:00:00:00:00:01 should arrive
on eth0 after self-learning
9 An Ethernet frame from 20:00:00:00:00:01 to
30:00:00:00:00:04 should arrive on eth0
10 Ethernet frame destined to 20:00:00:00:00:01 should arrive
on eth3 after self-learning
11 An Ethernet frame from 40:00:00:00:00:05 to
20:00:00:00:00:01 should arrive on eth4
12 Ethernet frame destined to 20:00:00:00:00:01 should arrive

```

## Deploy测试

### 测试代码

```

1 print("test info start")
2 for i in list_info:
3     print("add",i.address)
4     print("por",i.port)
5 print("test info end")

```

测试思路：由于每一次ping都是双向的（request和reply），就先client ping server1这个时候已经有两个端口数据了（由于测试的需求把maxsize改为2了）如下

可以看到有10和30两个地址和端口了（30是client，10是server1）



```

on switch-eth0
21:25:36 2020/03/18 INFO find port switch-eth2 of address 30:00:00:00:00:01
test info start
add 10:00:00:00:00:01
por switch-eth0
add 30:00:00:00:00:01
por switch-eth2
test info end
21:25:42 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->30:0
0:00:00:00:01 ARP | Arp 10:00:00:00:00:01:192.168.100.1 00:00:00:00:00:00:192.168.100.3 on switch
-eth0
21:25:42 2020/03/18 INFO find port switch-eth2 of address 30:00:00:00:00:01
test info start
add 10:00:00:00:00:01
por switch-eth0
add 30:00:00:00:00:01
por switch-eth2
test info end
21:25:42 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 30:00:00:00:00:01->10:0
0:00:00:00:01 ARP | Arp 30:00:00:00:00:01:192.168.100.3 10:00:00:00:00:01:192.168.100.1 on switch
-eth2
21:25:42 2020/03/18 INFO find port switch-eth0 of address 10:00:00:00:00:01
test info start
add 30:00:00:00:00:01
por switch-eth2
add 10:00:00:00:00:01
por switch-eth0
test info end
21:25:42 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->30:0
0:00:00:00:01 ARP | Arp 10:00:00:00:00:01:192.168.100.1 30:00:00:00:00:01:192.168.100.3 on switch
-eth0

```

然后server1 ping -c 1 server2，如下

可以看到端口换了是10和20了，原因就是30被挤出去了（根据LRU）

```

on switch-eth0
21:26:09 2020/03/18 INFO find port switch-eth0 of address 10:00:00:00:00:01
test info start
add 20:00:00:00:00:01
por switch-eth1
add 10:00:00:00:00:01
por switch-eth0
test info end
21:26:09 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 20:00:00:00:00:01->10:0
0:00:00:00:01 ARP | Arp 20:00:00:00:00:01:192.168.100.2 00:00:00:00:00:00:192.168.100.1 on switch
-eth1
21:26:09 2020/03/18 INFO find port switch-eth0 of address 10:00:00:00:00:01
test info start
add 20:00:00:00:00:01
por switch-eth1
add 10:00:00:00:00:01
por switch-eth0
test info end
21:26:09 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->20:0
0:00:00:00:01 ARP | Arp 10:00:00:00:00:01:192.168.100.1 20:00:00:00:00:01:192.168.100.2 on switch
-eth0
21:26:09 2020/03/18 INFO find port switch-eth1 of address 20:00:00:00:00:01

```

## Task5

### 基本实现思路

基本思路和上一个任务差不多，代码也是抄过来改一改

同样定义需要的变量

```

1 class info:
2     def __init__(self, ports, addresses, vals):
3         self.port=ports
4         self.address=addresses
5         self.val=vals
6
7     boardcast_addr="ff:ff:ff:ff:ff:ff"
8     max_len=5
9     list_info=[]

```

对广播模式进行分析，同理先分析源数据的地址和端口，发现不对的就校对，发现没有就加入。

如果原来的满了就循环找到最小进行删除，反之就直接加入

最后进行洪泛

```

1 if packet[0].dst == boardcast_addr:
2     flag=0
3     for i in range(len(list_info)):
4         if list_info[i].address== packet[0].src:
5             flag=1
6             if list_info[i].port != input_port:
7                 list_info[i].port = input_port
8             break
9     if flag==0:
10        if len(list_info) >=max_len:
11            min_pos=0
12            min_data=10000
13            for i in range(len(list_info)):
14                if list_info[i].val < min_data:
15                    min_pos=i
16                    min_data=list_info[i].val
17            del(list_info[min_pos])
18            temp=info(input_port,packet[0].src,0)
19            list_info.append(temp)
20        else:
21            temp=info(input_port,packet[0].src,0)
22            list_info.append(temp)
23    for intf in my_interfaces:
24        if input_port != intf.name:
25            log_debug ("Flooding packet {} to {}".format(packet, intf.name))
26            net.send_packet(intf.name, packet)
27

```

然后对非广播模式进行分析

对于源数据的分析和上面完全一致

```

1 if packet[0].dst == boardcast_addr:
2     flag=0
3     for i in range(len(list_info)):
4         if list_info[i].address== packet[0].src:
5             flag=1
6             if list_info[i].port != input_port:
7                 list_info[i].port = input_port
8             break
9     if flag==0:

```

```

10         if len(list_info) >= max_len:
11             min_pos = 0
12             min_data = 10000
13             for i in range(len(list_info)):
14                 if list_info[i].val < min_data:
15                     min_pos = i
16                     min_data = list_info[i].val
17             del(list_info[min_pos])
18             temp = info(input_port, packet[0].src, 0)
19             list_info.append(temp)
20         else:
21             temp = info(input_port, packet[0].src, 0)
22             list_info.append(temp)

```

然后是发送逻辑的实现

就是找端口匹配，如果有那就匹配发送，流量+=1，反之就洪泛就完事了

```

1  send_flag = 0
2  for i in range(len(list_info)):
3      if list_info[i].address == packet[0].dst:
4          net.send_packet(list_info[i].port, packet)
5          log_info("find port {} of address {}".format(list_info[i].port, packet[0].dst))
6          send_flag = 1
7          list_info[i].val += 1
8          break
9
10 if send_flag != 1:
11     log_info("didn't find port")
12     for intf in my_interfaces:
13         if input_port != intf.name:
14             log_debug("Flooding packet {} to {}".format(packet,
15 intf.name))
16             net.send_packet(intf.name, packet)
17             log_info("didn't find packet from {} to {}".format(input_port,
18 intf.name))
19

```

**测试结果**

```
15
16
17 def main(net):
18     boardcast_addr="ff:ff:ff:ff:ff:ff"
19     my_interfaces = net.interfaces()

OUTPUT    TERMINAL    DEBUG CONSOLE

21:54:57 2020/03/18    INFO didn't find port
21:54:57 2020/03/18    INFO didnt find packet from eth2 to eth0
21:54:57 2020/03/18    INFO didnt find packet from eth2 to eth1
test info start
add 30:00:00:00:00:02
por eth1
por 1
add 20:00:00:00:00:03
por eth2
por 0
test info end
21:54:57 2020/03/18    INFO In switch tests received packet Ethernet 20:00:00:00:00:01->10:00:00:00:00:03 IP | IPv4 192.168.1.100->172
) on eth2

Results for test scenario switch tests: 8 passed, 0 failed, 0 pending

Passed:
1 An Ethernet frame with a broadcast destination address
should arrive on eth1
2 The Ethernet frame with a broadcast destination address
should be forwarded out ports eth0 and eth2
3 An Ethernet frame from 20:00:00:00:00:01 to
30:00:00:00:00:02 should arrive on eth0
4 Ethernet frame destined for 30:00:00:00:00:02 should arrive
on eth1 after self-learning
5 An Ethernet frame from 20:00:00:00:00:03 to
30:00:00:00:00:03 should arrive on eth2
6 Ethernet frame destined for 30:00:00:00:00:03 should be
flooded on eth0 and eth1
7 An Ethernet frame should arrive on eth2 with destination
address the same as eth2's MAC address
8 The switch should not do anything in response to a frame
arriving with a destination address referring to the switch
itself.

All tests passed!

(syenv) njucs@njucs-VirtualBox:~/switchyard$
```

## Deploy 测试

测试思路：在代码的前面加上和上一个任务差不多的测试代码，然后改小了maxsize，然后client ping -c 1 server1。这个时候应该是有client和server1的端口了，然后再client ping -c 1 server2 查看结果如下

第一个ping

```
"Node: switch"
21:50:59 2020/03/18    INFO boardcast packet from switch-eth2 to switch-eth1
test info start
add 30:00:00:00:00:01
por switch-eth2
por 0
test info end
21:50:59 2020/03/18    INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->30:00:00:00:00:01 ARP | A
rp 10:00:00:00:00:01:192.168.100.1 30:00:00:00:00:01:192.168.100.3 on switch-eth0
21:50:59 2020/03/18    INFO find port switch-eth2 of address 30:00:00:00:00:01
test info start
add 30:00:00:00:00:01
por switch-eth2
por 1
add 10:00:00:00:00:01
por switch-eth0
por 0
test info end
21:50:59 2020/03/18    INFO In njucs-VirtualBox received packet Ethernet 30:00:00:00:00:01->10:00:00:00:00:01 IP | IP
v4 192.168.100.1->192.168.100.1 ICMP | ICMP EchoRequest 4456 1 (66 data bytes) on switch-eth0
21:50:59 2020/03/18    INFO find port switch-eth0 of address 10:00:00:00:00:01
test info start
add 30:00:00:00:00:01
por switch-eth2
por 2
add 10:00:00:00:00:01
por switch-eth0
por 1
test info end
21:51:00 2020/03/18    INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->30:00:00:00:00:01 IP | IP
v4 192.168.100.1->192.168.100.3 ICMP | ICMP EchoReply 4456 1 (66 data bytes) on switch-eth0
21:51:00 2020/03/18    INFO find port switch-eth2 of address 30:00:00:00:00:01
test info start
add 30:00:00:00:00:01
por switch-eth2
por 3
add 10:00:00:00:00:01
por switch-eth0
por 1
test info end
21:51:05 2020/03/18    INFO In njucs-VirtualBox received packet Ethernet 10:00:00:00:00:01->30:00:00:00:00:01 ARP | A
rp 10:00:00:00:00:01:192.168.100.1 00:00:00:00:00:00:00:00:00:00 on switch-eth0
21:51:05 2020/03/18    INFO find port switch-eth2 of address 30:00:00:00:00:01
test info start
add 30:00:00:00:00:01
por switch-eth2
por 3
add 10:00:00:00:00:01
por switch-eth0
por 1
test info end
21:51:05 2020/03/18    INFO In njucs-VirtualBox received packet Ethernet 30:00:00:00:00:01->10:00:00:00:00:01 ARP | A
rp 10:00:00:00:00:01:192.168.100.3 10:00:00:00:00:01:192.168.100.1 on switch-eth2
21:51:05 2020/03/18    INFO find port switch-eth0 of address 10:00:00:00:00:01

myswitch_traffic.py
lab_2 > myswitch_traffic.py > main
14 self.val=vals
15
16
17 def main(net):
18     boardcast_addr="ff:ff:ff:ff:ff:ff"
19     my_interfaces = net.interfaces()
20     mymacs = [intf.ethaddr for intf in my_interface
21
22     max len=2
23     list_info=[]
24
25     while True:
26         try:
27             timestamp,input_port,packet = net.recv_
28         except NoPackets:
29             continue
30         except Shutdown:
31             return
32
33         print("test info start")
34         for i in list_info:

OUTPUT    TERMINAL    DEBUG CONSOLE

*** switch : ('sysctl -w net.ipv6.conf.all.disable_ipv6=1',)
net.ipv6.conf.all.disable_ipv6 = 1
*** switch : ('sysctl -w net.ipv6.conf.default.disable_ipv6=
net.ipv6.conf.default.disable_ipv6 = 1
*** Starting controller

*** Starting 0 switches

*** Starting CLI:
mininet> xterm switch
mininet> client ping -c 1 server1
PING 192.168.100.1 (192.168.100.1) 56(84) bytes of data.
64 bytes from 192.168.100.1: icmp_seq=1 ttl=64 time=1023 ms

--- 192.168.100.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1023.277/1023.277/1023.277/0.000 ms
mininet>
```

第二个ping

```
test_info end
21:52:30 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 30:00:00:00:00:01->20:00:00:00:00:01 IP 1 IP
v4 192.168.100.3->192.168.100.2 ICMP | ICMP EchoRequest 4467 1 (56 data bytes) on switch-eth2
21:52:30 2020/03/18 INFO find port switch-eth1 of address 20:00:00:00:00:01
test_info start
add 30:00:00:00:00:01
port switch-eth2
port 4
add 20:00:00:00:00:01
port switch-eth1
port 1
test_info end
21:52:30 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 20:00:00:00:00:01->30:00:00:00:00:01 IP 1 IP
v4 192.168.100.2->192.168.100.3 ICMP | ICMP EchoReply 4467 1 (56 data bytes) on switch-eth1
21:52:30 2020/03/18 INFO find port switch-eth2 of address 30:00:00:00:00:01
test_info start
add 30:00:00:00:00:01
port switch-eth2
port 5
add 20:00:00:00:00:01
port switch-eth1
port 1
test_info end
21:52:30 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 20:00:00:00:00:01->30:00:00:00:00:01 ARP | A
rp 20:00:00:00:00:01:192.168.100.2 00:00:00:00:00:01:192.168.100.3 on switch-eth1
21:52:30 2020/03/18 INFO find port switch-eth2 of address 30:00:00:00:00:01
test_info start
add 30:00:00:00:00:01
port switch-eth2
port 6
add 20:00:00:00:00:01
port switch-eth1
port 1
test_info end
21:52:36 2020/03/18 INFO In njucs-VirtualBox received packet Ethernet 30:00:00:00:00:01->20:00:00:00:00:01 ARP | A
rp 30:00:00:00:00:01:192.168.100.3 20:00:00:00:00:01:192.168.100.2 on switch-eth2
21:52:36 2020/03/18 INFO find port switch-eth1 of address 20:00:00:00:00:01
```

```
udpstack_tests.py
udpstack.py
lab_1
lab_2
__pycache__
myswitch_lru.py
myswitch_to.py
myswitch_traffic.py
myswitch.py
mytests_lru.py
mytests_to.py
mytests_traffic.py
mytests.py
start_mininet.py
switchtests_lru.srpy
switchtests_to.srpy
switchtests_traffic.srpy
switchtopo.py
switchyard
lib
sim
__init__.py
hostfirewall.py
```

```
while True:
    try:
        timestamp,input_port,packet = net.recv_
    except NoPackets:
        continue
    except Shutdown:
        return

    print("test info start")
    for i in list info:
```

```
*** Starting CLI:
mininet> xterm switch
mininet> client ping -c 1 server1
PING 192.168.100.1 (192.168.100.1) 56(84) bytes of data.
64 bytes from 192.168.100.1: icmp_seq=1 ttl=64 time=1023 ms

--- 192.168.100.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1023.277/1023.277/1023.277/0.000 ms
mininet> client ping -c 1 server2
PING 192.168.100.2 (192.168.100.2) 56(84) bytes of data.
64 bytes from 192.168.100.2: icmp_seq=1 ttl=64 time=926 ms

--- 192.168.100.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 926.614/926.614/926.614/0.000 ms
mininet> []
```

可以看到client端口的数据量累加了，server1的端口在列表里的位置被server2的端口替代，且数据包  
的数目一致

## 总结与感想

总结：结合上课的知识，按照试验手册的流程图完成交换机的策略实现。很重要的一点就是多使用  
log\_info进行快速的debug。同时注意出错信息即可

感想：用markdown再转pdf方便不少