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

Lab6

实验目的

学习滑动窗口的原理

实验内容

对发送端，中间窗口以及接收端的代码逻辑进行修改

实验结果

Task2

首先对中间窗口的逻辑尽心修改，按照实验手册中的说明，编写代码如下：

```
def handle_packet(self, recv: switchyard.llnetbase.ReceivedPacket):
    _, fromIface, packet = recv
    if fromIface == self.intf1:
        log_debug("Received from blaster")
        '''
        Received data packet
        Should I drop it?
        If not, modify headers & send to blastee
        '''
        if random.random() < self.dropRate:
            log_info("Packet dropped!")
        else:
            packet[Ethernet].dst = EthAddr('20:00:00:00:00:01')
            self.net.send_packet("middlebox-eth1", packet)
    elif fromIface == "middlebox-eth1":
        log_debug("Received from blastee")
        '''
        Received ACK
        Modify headers & send to blaster. Not dropping ACK packets!
        net.send_packet("middlebox-eth0", pkt)
        '''
        packet[Ethernet].dst = EthAddr('10:00:00:00:00:01')
        self.net.send_packet("middlebox-eth0",packet)
    else:
        log_debug("Oops :))")
```

Task3

对接收方进行修改，收到原数据并回复ACK

```
def handle_packet(self, recv: switchyard.llnetbase.ReceivedPacket):
    _, fromIface, packet = recv
    log_debug(f"I got a packet from {fromIface}")
    log_debug(f"Pkt: {packet}")
    packetACK = Ethernet() + IPv4(protocol=IPProtocol.UDP) + UDP()
    seq = packet[3].to_bytes()[0:4]
    payload = packet[3].to_bytes()[4:12]
    packetACK += seq
    packetACK += payload
    packetACK[Ethernet].src=EthAddr('20:00:00:00:00:01')
    packetACK[IPv4].src=IPv4Address('192.168.200.1')
    packetACK[Ethernet].dst=EthAddr('10:00:00:00:00:01')
    packetACK[IPv4].dst=IPv4Address(self.blasterIp)
    self.net.send_packet(self.net.interfaces()[0],packetACK)
```

Task4

按照逻辑对发送方进行修改：

```
def handle_packet(self, recv: switchyard.llnetbase.ReceivedPacket, queue, tempTime):
    _, fromIface, packet = recv
    log_info("I got a packet")
    seq = packet[3].to_bytes()[0:4]
    seqnum = int.from_bytes(seq, byteorder='big', signed=False)
    for node in queue:
        if node.sequence == seqnum:
            node.ackflag = 1
    while len(queue) > 0:
        if queue[0].ackflag == 1 :
            del(queue[0])
            if self.LHS < self.RHS:
                self.LHS = self.LHS + 1
            tempTime = time.time()
        else:
            break
```

```
def handle_no_packet(self, queue, startTime, tempTime):
    log_info("Didn't receive anything")
    now = time.time()
    if now - tempTime > self.timeout:
        for node in queue:
            if node.ackflag == 0:
                self.net.send_packet(self.net.interfaces()[0],node.packet)
                self.reTX += 1
                self.TOs += 1

    # Do other things here and send packet
    if self.RHS < self.num:
        if self.RHS - self.LHS + 1 < self.senderWindow:
            # Creating the headers for the packet
            pkt = Ethernet() + IPv4() + UDP()
            pkt[1].protocol = IPProtocol.UDP
            pkt += self.seq.to_bytes(4,byteorder='big', signed=False)
            pkt += self.length.to_bytes(2,byteorder='big', signed=False)
            pkt += b'Test'
            pkt[Ethernet].dst=EthAddr('20:00:00:00:00:01')
```

```
            pkt[IPv4].dst=self.blasteeIp
            pkt[Ethernet].src=EthAddr('10:00:00:00:00:01')
            pkt[IPv4].src=IPv4Address('192.168.100.1')
            self.RHS = self.seq
            queue.append(Node(pkt,self.seq))
            self.seq = self.seq + 1
            self.net.send_packet(self.net.interfaces()[0],pkt)

    elif len(queue) == 0:
        endTime = time.time()
        totalTime = endTime - startTime
        print("Total TX time (in seconds)",totalTime)
        print("Number of reTX",self.reTX)
        print("Number of coarse TOs",self.TOs)
        print("Throughput (Bps)",(self.reTX + self.num) * self.length / totalTime)
        print("Goodput (Bps)",self.num * self.length / totalTime)
```

基本思想是按照实验手册中的两种情形，首先当发送方没有收到ack时，如果此时 `RHS - LHS + 1 ≤ SW` 时，我们只需要发送我们构造好的包，而当放松方这边计时器超时的时候，我们只需重新发送对应超时的包即可，当我们的处理队列为空且RHS大于等于我们设定的最大num时，我们只需要打印出计算得到的数据即可。

而当发送端接收到包的时候，也即收到某一个发送包的ack，则将队列中的ackflag置1，将其从队列中移除即可，然后重置计时器。

Deploy

`sudo python start_mininet.py`

`xterm middlebox`

`xterm blastee`

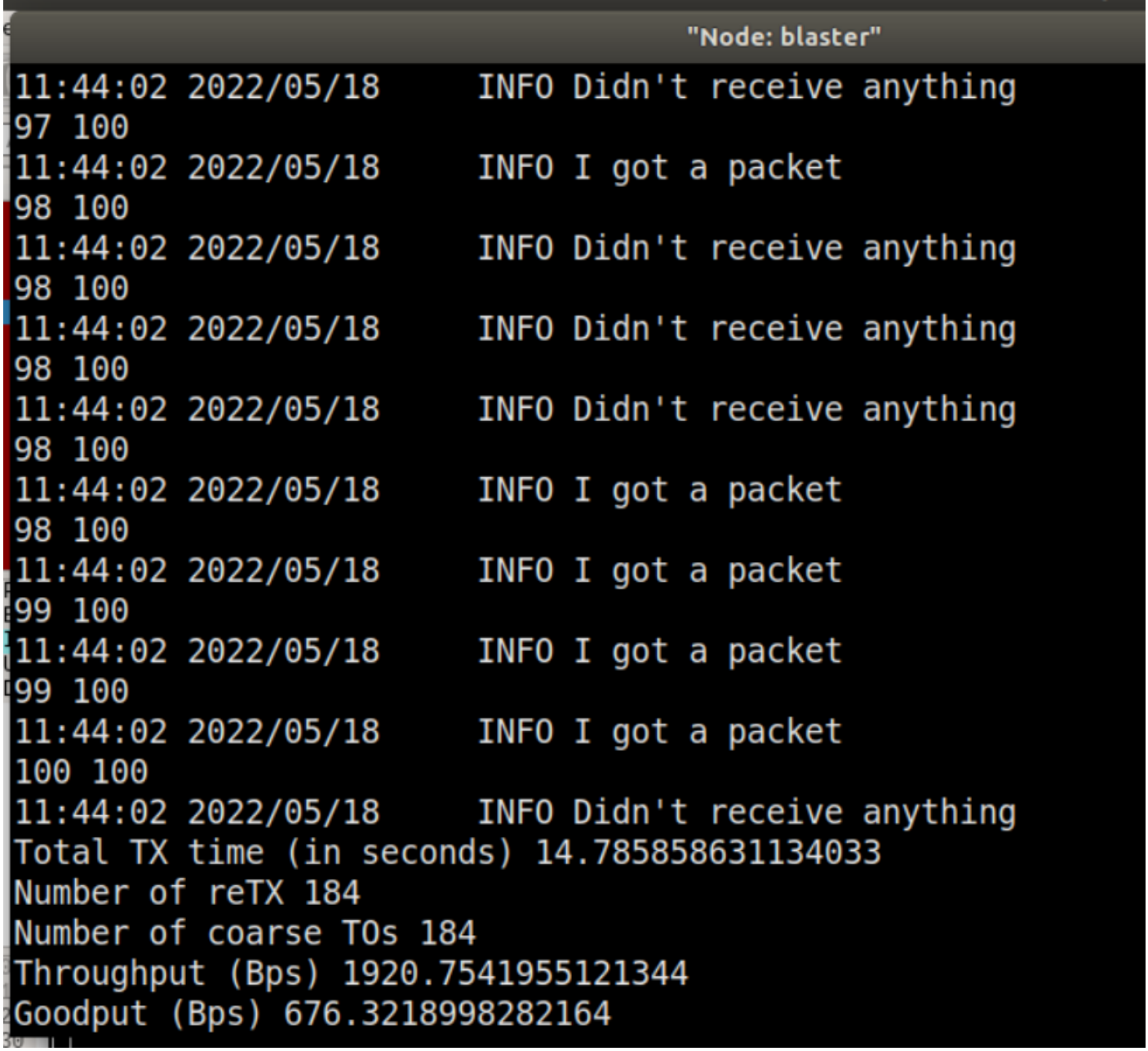
`xterm blaster`

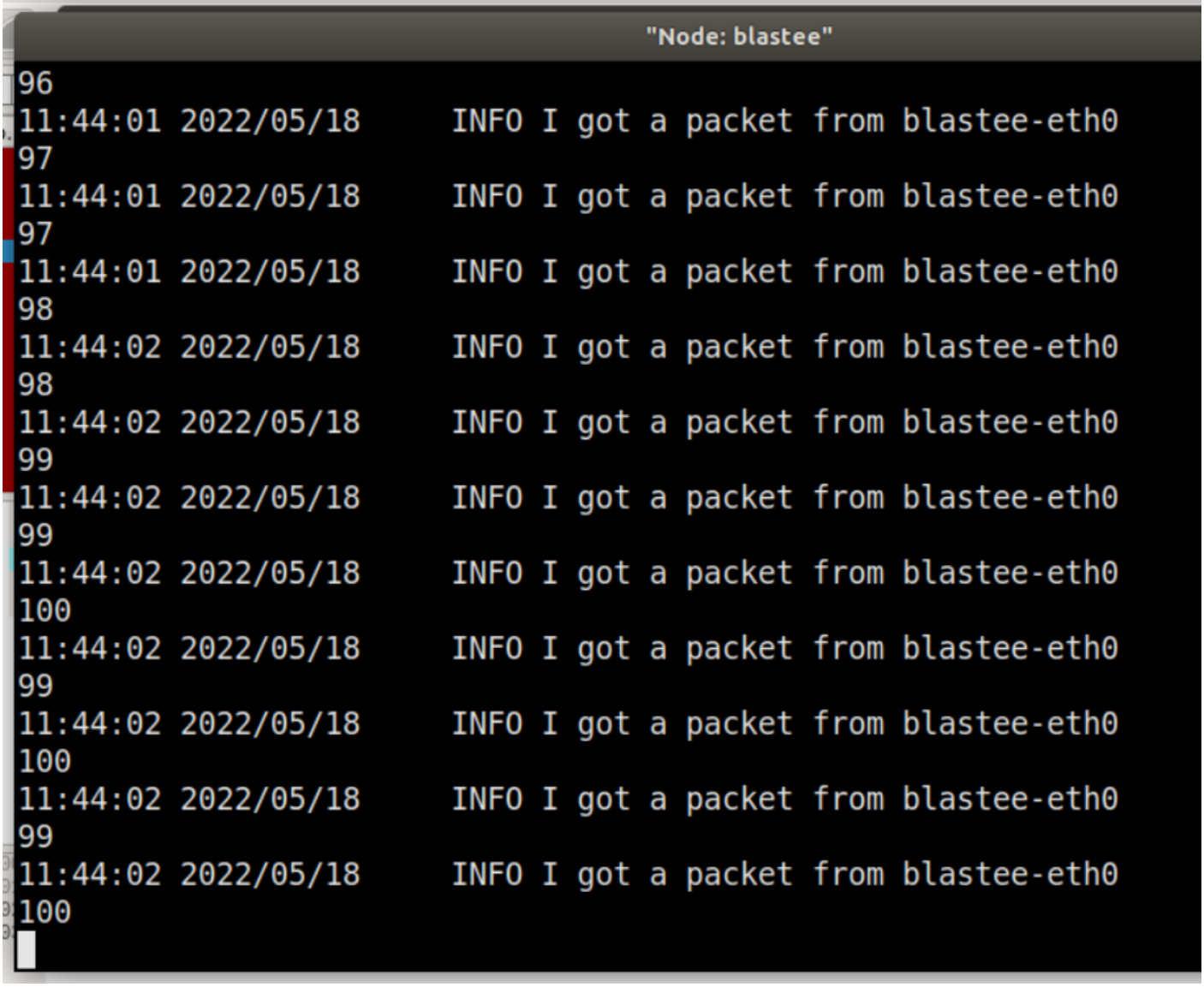
`middlebox# swyard middlebox.py -g 'dropRate=0.19'`

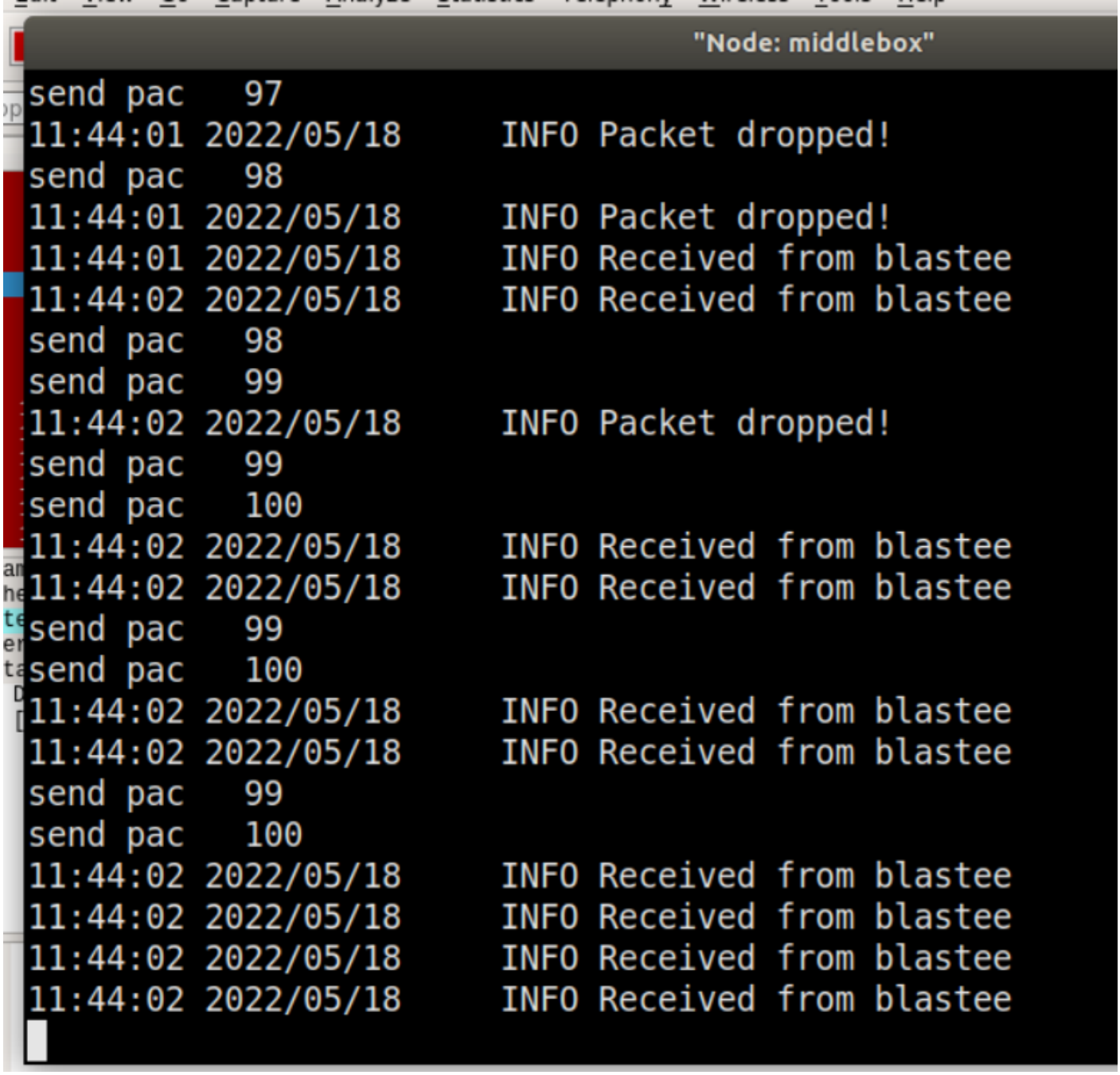
`blastee# swyard blastee.py -g 'blasterIp=192.168.100.1 num=100'`

`blaster# swyard blaster.py -g 'blasteeIp=192.168.200.1 num=100 length=100 senderWindow=5 timeout=300 recvTimeout=100'`

按照上述部署，可以得到如下结果：

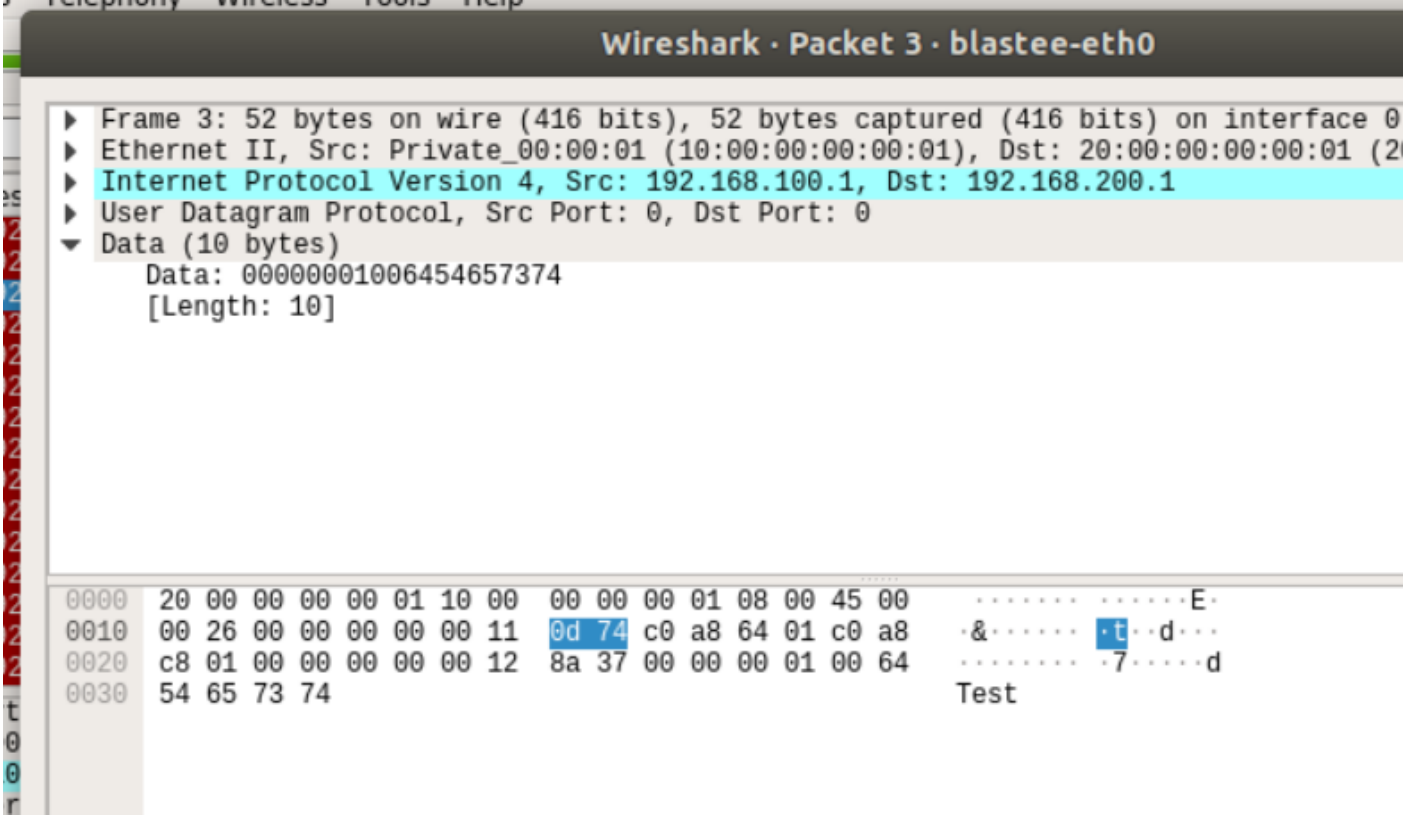

"Node: blaster"
11:44:02 2022/05/18 INFO Didn't receive anything
97 100
11:44:02 2022/05/18 INFO I got a packet
98 100
11:44:02 2022/05/18 INFO Didn't receive anything
98 100
11:44:02 2022/05/18 INFO Didn't receive anything
98 100
11:44:02 2022/05/18 INFO Didn't receive anything
98 100
11:44:02 2022/05/18 INFO I got a packet
98 100
11:44:02 2022/05/18 INFO I got a packet
99 100
11:44:02 2022/05/18 INFO I got a packet
99 100
11:44:02 2022/05/18 INFO I got a packet
100 100
11:44:02 2022/05/18 INFO Didn't receive anything
Total TX time (in seconds) 14.785858631134033
Number of reTX 184
Number of coarse TOs 184
Throughput (Bps) 1920.7541955121344
Goodput (Bps) 676.3218998282164


"Node: blastee"
96
11:44:01 2022/05/18 INFO I got a packet from blastee-eth0
97
11:44:01 2022/05/18 INFO I got a packet from blastee-eth0
97
11:44:01 2022/05/18 INFO I got a packet from blastee-eth0
98
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
98
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
99
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
99
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
100
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
99
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
100
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
99
11:44:02 2022/05/18 INFO I got a packet from blastee-eth0
100

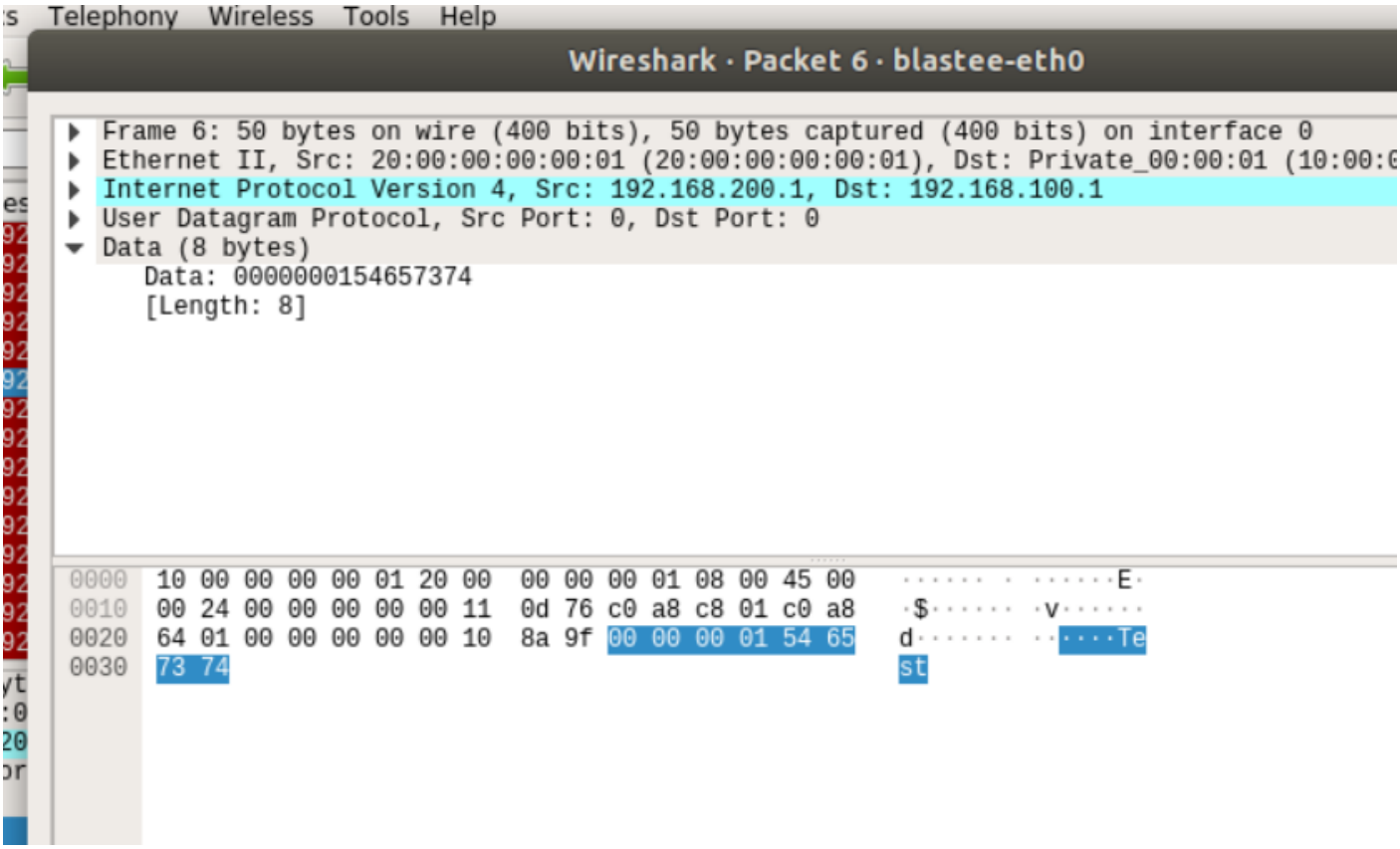


由上述结果可以看到，基本功能已经实现，具体实现逻辑已经在代码中体现出来。

在wireshark中可以抓到如下包：

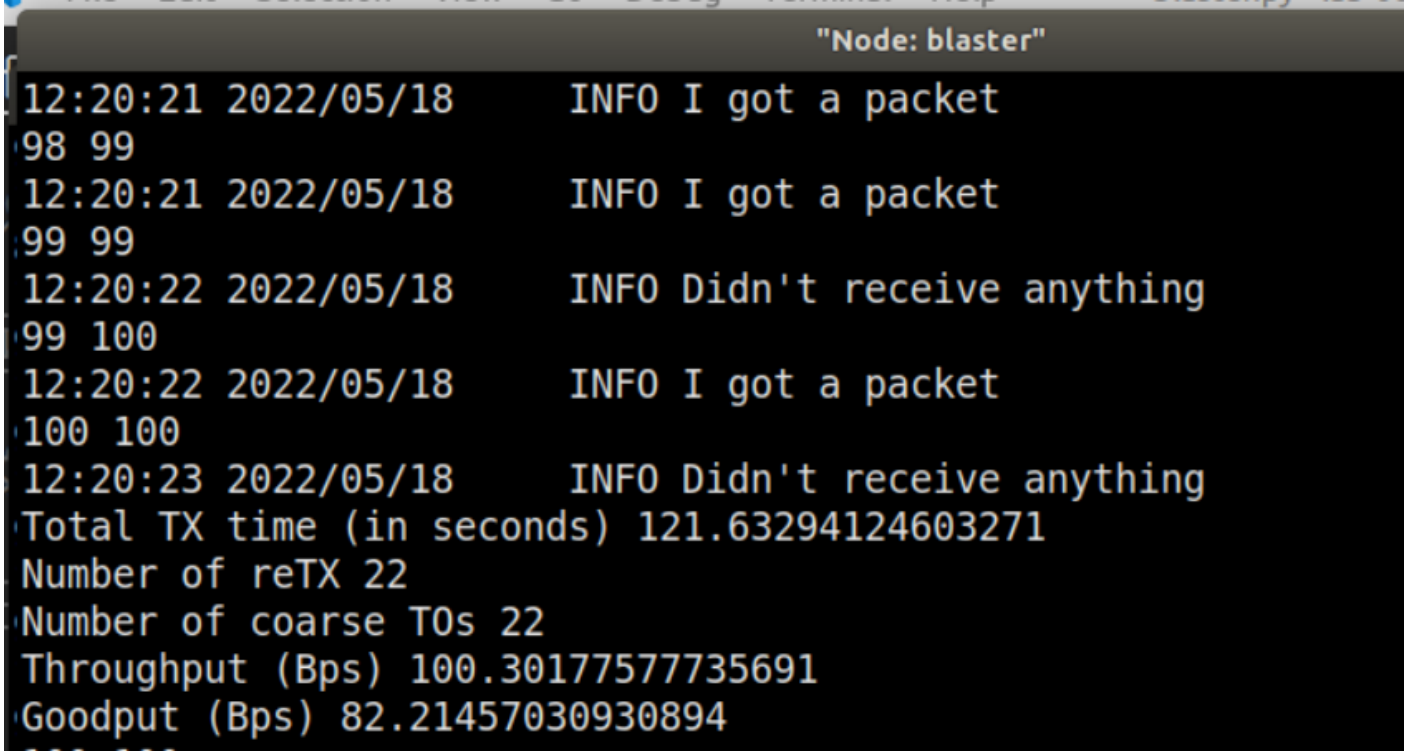


其中seq=1，payload是我们的自定义字符`Test`

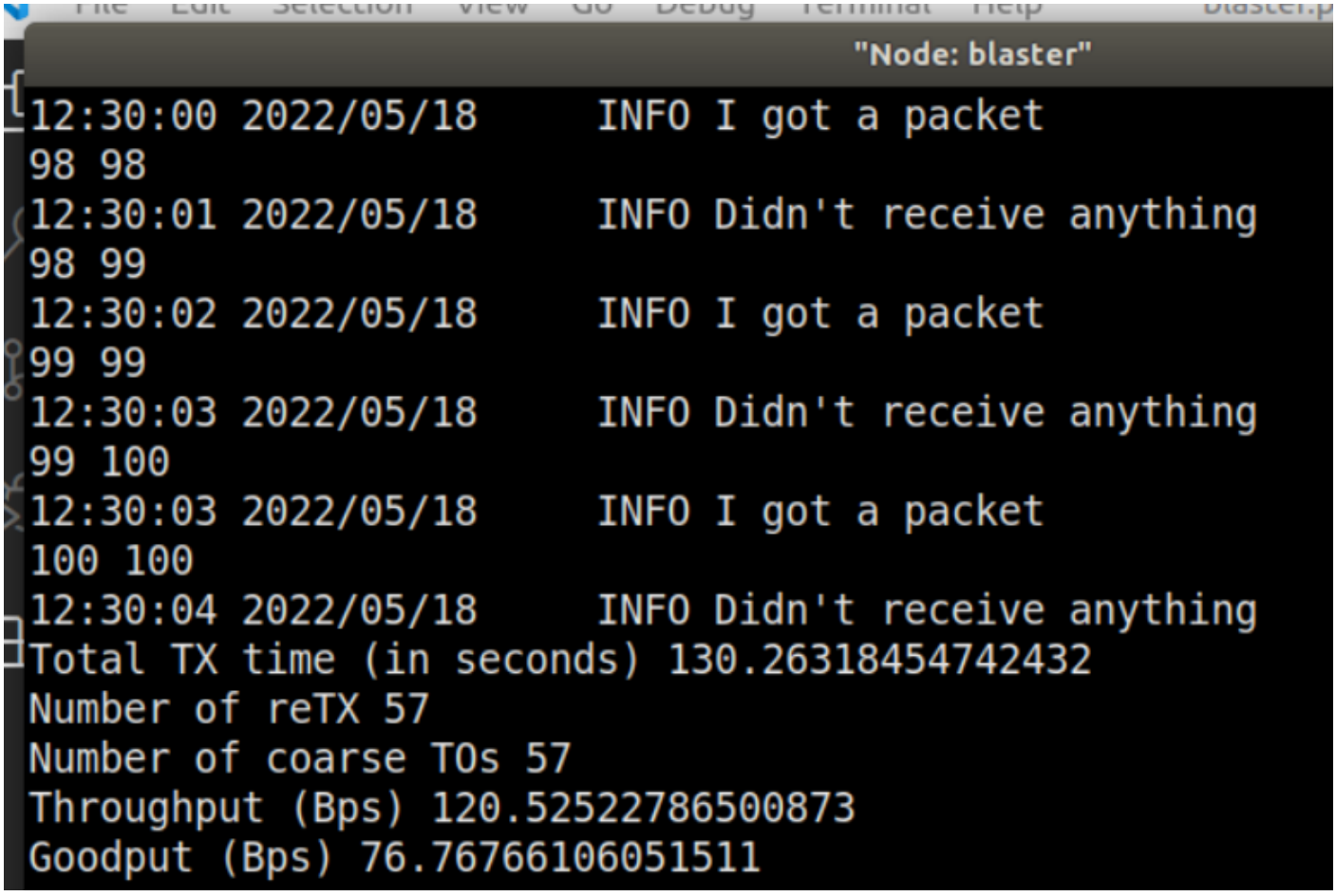


这个是blastee发送回去的ack。

下面改变`recvTimeout`的值，使得`recvTimeout=1000`观察输出结果：



下面改变`dropRate`，使得`dropRate=0.39`时可见：



由于重传变多，所以Throughput变大，但是goodput变小，也正是表明了因为网络的不稳定造成了实际有效传输的减小。

实验总结

本次实验首先要理清整体逻辑，进而按照实验手册的逻辑完善自身的实验流程，最后将其部署在网络中得到相应的结果。