# 广播网络实验

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## 一、实验内容

### 1、实现节点广播

- (1)实现 main. c 中的 broadcast\_packet 函数;
- (2)使用 three\_nodes\_bw.py 拓扑文件,三个节点相互能够 ping 通。

### 2、广播网络传输效率

- (1)利用 iperf 测试网络链路的利用效率;
- (2)两种场景: H1: iperf client; H2, H3: servers; H1: iperf server; H2, H3: clients。

### 3、数据包在环路中不断转发

- (1)构建环形拓扑;
- (2)验证该拓扑下节点广播会产生数据包环路。

## 二、实验流程

1、broadcast packet 函数

```
void broadcast_packet(iface_info_t *iface, const char *packet, int len)
{
   // TODO: broadcast packet
   fprintf(stdout, "TODO: broadcast packet here.\n");

   iface_info_t *entry = NULL;
   list_for_each_entry(entry, &instance->iface_list, list) {
      if (entry->fd != iface->fd)
            iface_send_packet(entry, packet, len);
    }
}
```

#### 2、环形网络拓扑

```
#:/usr/bin/python
import sys
import os.path
from mininet.topo import Topo
from mininet.net import Mininet
from mininet.link import TCLink
from mininet.cli import CLI

def clearIP(n):
    for iface in n.intfList():
        n.cmd('ifconfig %s 0.0.0.0' % (iface))
```

```
lass BroadcastTopo(Topo)
    def build(self)
         h1 = self.addHost('h1')
h2 = self.addHost('h2')
b1 = self.addHost('b1')
b2 = self.addHost('b2')
          b3 = self.addHost('b3')
           self addLink(h1, b1)
          self addLink(h2, b2)
           self addLink(b1, b2)
           self addLink(b1, b3)
          self addLink(b2, b3)
                 __ '__main_
if __name__
    if not os.path.exists('/sbin/ethtool'):
    print 'ethtool not found, please install it using `apt install ethtool`'
          sys exit(1)
    topo = BroadcastTopo()
    net = Mininet(topo = topo, link = TCLink, controller = None)
    h1, h2, b1, b2, b3 = net.get('h1', 'h2', 'b1', 'b2', 'b3')
h1.cmd('ifconfig h1-eth0 10.0.0.1/8')
h2.cmd('ifconfig h2-eth0 10.0.0.2/8')
    clearIP(b1)
    clearIP(b2)
clearIP(b3)
    for h in [ h1, h2]:
    h.cmd('./disable_offloading.sh')
    h.cmd('./disable_ipv6.sh')
    net start()
    CLI(net)
    net stop()
```

## 三、实验结果及分析

1、实验结果

测试 3 台 host 之间是否能够 ping 通

```
broadcast packet here,
                                                                                                                                                                                                                                                                                                                                                                                                                                            root@feng-VirtualBox:"/Lab/P04/04-broadcast# ping 10.0.0.2 -c 4
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 tt]=64 time=0.131 ms
64 bytes from 10.0.0.2: icmp_seq=2 tt]=64 time=0.122 ms
64 bytes from 10.0.0.2: icmp_seq=3 tt]=64 time=0.201 ms
64 bytes from 10.0.0.2: icmp_seq=4 tt]=64 time=0.297 ms
     TODO:
     TODO:
                                                                                                                                                                                                                                                                                                                                                                                                                                          --- 10.0.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3051ms
rtt min/avg/max/mdev = 0.122/0.187/0.297/0.072 ms
root@feng-VirtualBox: "/Lab/P04/04-broadcast# ping 10.0.0.3 -c 4
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data,
64 bytes from 10.0.0.3; icmp_seq=1 ttl=64 time=0.299 ms
64 bytes from 10.0.0.3; icmp_seq=2 ttl=64 time=0.246 ms
64 bytes from 10.0.0.3; icmp_seq=3 ttl=64 time=0.237 ms
64 bytes from 10.0.0.3; icmp_seq=4 ttl=64 time=0.147 ms
        ODO:
                               broadcast packet here-
        ODO:
        ono:
        ODO:
        ODO:
         ODO:
                                                                                                                                                                                                                                                                                                                                                                                                                                            --- 10.0.0.3 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3053ms
rtt min/avg/max/mdev = 0.147/0.232/0.299/0.055 ms
root@feng-VirtualBox:"/Lab/P04/04-broadcast# []
        ODO:
        ODO:
         ODO:
           ODO:
ODO:
                                                                                                                                                                                                                                                                                                                                                                                                                                              🔞 🖨 🗊 "Node: h3"
 root@feng-WirtualBox:"/Lab/P04/04-broadcast# ping 10.0.0.1 -c 4

PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.

64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=0.078 ms

64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=0.214 ms

64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=0.118 ms

64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=0.089 ms
                                                                                                                                                                                                                                                                                                                                                                                                                                          root@feng-VirtualBox:"/Lab/P04/04-broadcast# ping 10.0.0.1 -c 4 PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data, 64 bytes from 10.0.0.1; icmp_seq=1 ttl=64 time=0.092 ms 64 bytes from 10.0.0.1; icmp_seq=2 ttl=64 time=0.203 ms 64 bytes from 10.0.0.1; icmp_seq=3 ttl=64 time=0.152 ms 64 bytes from 10.0.0.1; icmp_seq=4 ttl=64 time=0.406 ms
0+ Ogtes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.157 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.157 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.157 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.157 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.157 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.309 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.309 ms
                                                                                                                                                                                                                                                                                                                                                                                                                                         --- 10.0.0.1 ping statistics --- 4 packets transmitted. 4 received, 0% packet loss, time 3031ms rtt min/avg/max/mdev = 0.092/0.213/0.406/0.118 ms root@feng-VirtualBox; "/Lab/P04/04-broadcast# ping 10.0.0.2 -c 4 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=0.338 ms 64 bytes from 10.0.0.2; icmp_seq=2 ttl=64 time=0.097 ms 64 bytes from 10.0.0.2; icmp_seq=3 ttl=64 time=0.097 ms 64 bytes from 10.0.0.2; icmp_seq=4 ttl=64 time=0.119 ms
      --- 10,0,0,3 ping statistics ---

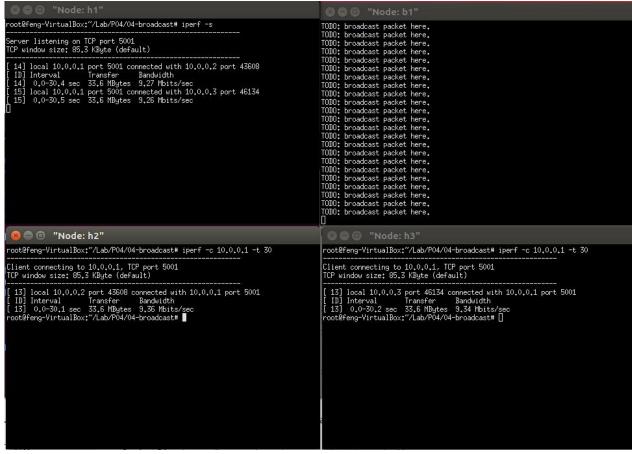
packets transmitted, 4 received, 0% packet loss, time 3080ms

tt min/avg/max/mdev = 0,113/0,192/0,309/0,073 ms

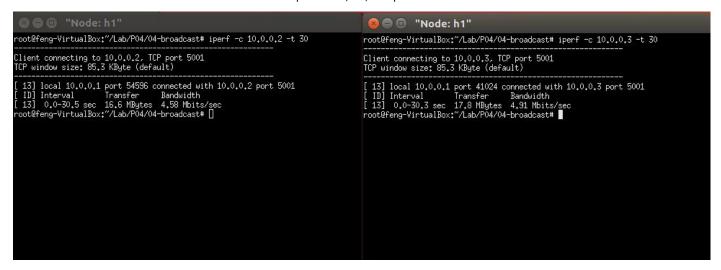
oot@feng-VirtualBox:~/Lab/P04/04-broadcast# []
                                                                                                                                                                                                                                                                                                                                                                                                                                             --- 10.0.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3053ms
rtt min/avg/max/mdez = 0.09770.170/0.338/0.097 ms
root@feng-VirtualBox:"/Lab/P04/04-broadcast#
```

#### 广播网络传输效率

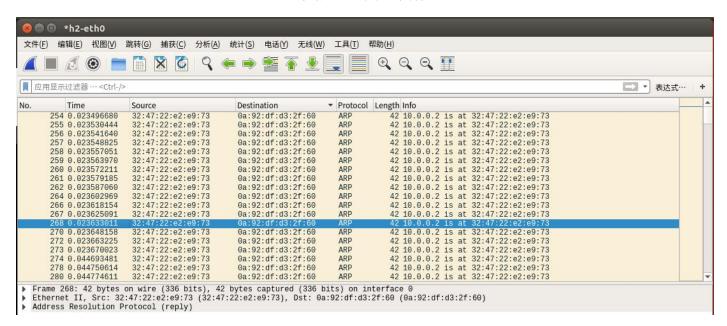
H1: iperf server; H2, H3: iperf clients

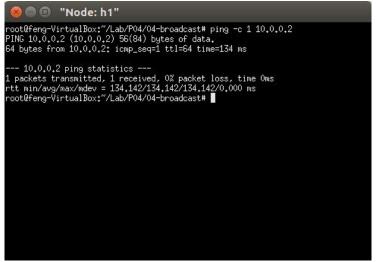


#### H1: iperf client; H2, H3: iperf servers



#### 数据包在环路中不断转发





- broadcast\_packe 函数部分编写正确,由结果看出连接到 hub 的节点能够相互 ping 通。
- 对于测试链路效率,当 h1 作为 Client,h2、h3 作为 Server 时,h1 同时向 h2 和 h3 发包,发给 h2 的包发到 hub 之后会同时发向 h2 和 h3,发给 h3 的包发给 hub 之后也会同时发向 h2 和 h3,因此,hub 到 h2 和 h3 的链路上都分别有两个包,因为 hub 到 h2 和 h3 的带宽都为 10MBb/s,因此链路上两个包的带宽之和应该小于 10,在图中也可以看出,一个带宽为 4.58Mb/s,另一个为 4.91Mb/s;当 h1 作为 Server,h2、h3 作为 Client 时,h2 发出去的包发到 hub 之后会同时发向 h1 和 h3,因为链路带宽是双向的,因此发向 h3 的包不会影响 h3 发出包,因此 h3 发出的包的带宽仍然为 10Mb/s 左右,同理 h2 发出去的包也为 10MB/s 左右。
- 在环路中,一个包发出后,三个 hub 不断转发,导致该包在环路中不停地旋转,浪费资源,因此在设计中应避免环路。