计算机学院_计算机网络_课程实验报告

实验题目： NAT		学号：202200130048
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实验方法介绍：

通过 nat inside 和 outside 文件分析相关信息

实验过程描述：

1. inside 的捕获文件查看 get 和 ok
2. outside 的捕获文件查看 get 和 ok
3. 推测下一次 inside 文件 ok 的端口号

结论分析：

1. What is the IP address of the client that sends the HTTP GET request in the nat inside-wireshark-trace1-1.pcapng trace?

192.168.10.11

```
  4 0.027362245   192.168.10.11        138.76.29.8          HTTP      396 GET / HTTP/1.1
    [Header checksum status: Unverified]
    Source Address: 192.168.10.11
    Destination Address: 138.76.29.8
[Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
```

What is the source port number of the TCP segment in this datagram containing the HTTP GET request?

53924

```
▾ Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
    Source Port: 53924
    Destination Port: 80
    [Stream index: 0]
```

What is the destination IP address of this HTTP GET request?

138.76.29.8

```
    [Header checksum status: Unverified]
    Source Address: 192.168.10.11
    Destination Address: 138.76.29.8
[Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
```

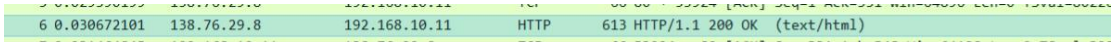
What is the destination port number of the TCP segment in this datagram containing the HTTP GET request?

80

```
▾ Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
    Source Port: 53924
    Destination Port: 80
    [Stream index: 0]
```

2. At what time is the corresponding HTTP 200 OK message from the webserver forwarded by the NAT router to the client on the router’s LAN side?

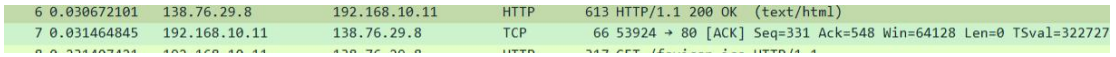
0.0306s

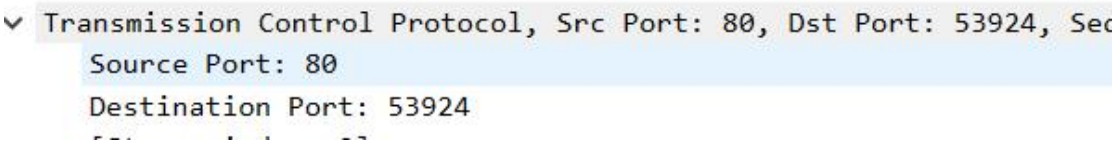


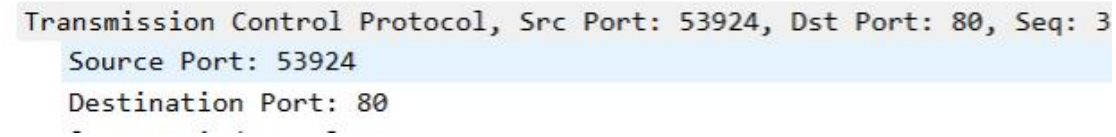
3. What are the source and destination IP addresses and TCP source and destination ports on the IP datagram carrying this HTTP 200 OK message?

Tcp src：53924，dst：80

Ok src：80，dst：53924

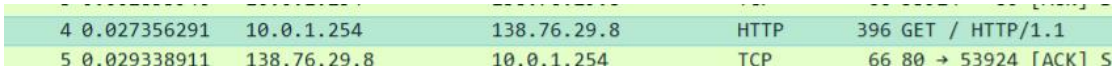






4. At what time does this HTTP GET message appear in the nat-outside-wireshark trace1-1.pcapng trace file?

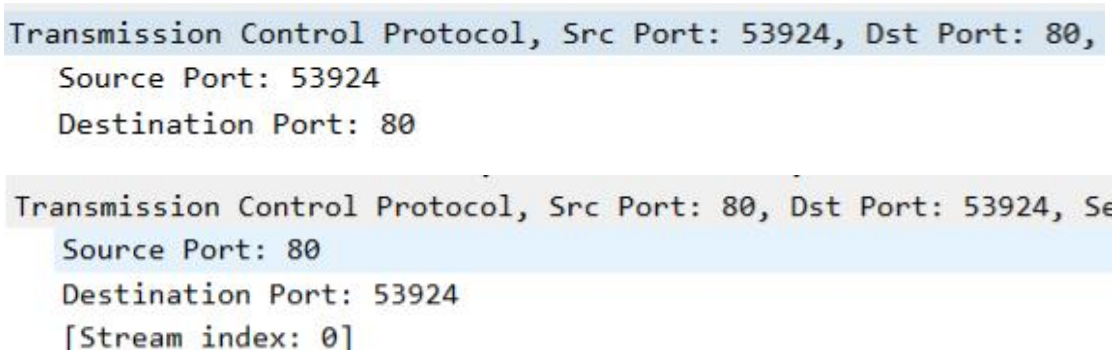
0.027356291s



5. What are the source and destination IP addresses and TCP source and destination port numbers on the IP datagram carrying this HTTP GET

Get src：53924 dst：80

Tcp src：80 dst：53924



6. Which of these four fields are different than in your answer to question 1 above?

Source IP 不同

7. Are any fields in the HTTP GET message changed?

除了 source IP，其他都没改

```
Ethernet II, Src: PCSSystemtec_89:c7:7c (08:00:27:89:c7:7c), Dst: PCSSystemtec_82:36:d7 (08:0
  > Destination: PCSSystemtec_82:36:d7 (08:00:27:82:36:d7)
  > Source: PCSSystemtec_89:c7:7c (08:00:27:89:c7:7c)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.10.11, Dst: 138.76.29.8
Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
    Source Port: 53924
    Destination Port: 80
    [Stream index: 0]
  > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 330]
    Sequence Number: 1    (relative sequence number)
    Sequence Number (raw): 2729789995
    [Next Sequence Number: 331    (relative sequence number)]
    Acknowledgment Number: 1    (relative ack number)
    Acknowledgment number (raw): 2574368014
    1000 .... = Header Length: 32 bytes (8)
  > Flags: 0x018 (PSH, ACK)
> Frame 4: 396 bytes on wire (3168 bits), 396 bytes captured (3168 bits) on interface eth0, id 0
> Ethernet II, Src: PCSSystemtec_43:65:cd (08:00:27:43:65:cd), Dst: PCSSystemtec_22:fd:74 (08:00:27
> Internet Protocol Version 4, Src: 10.0.1.254, Dst: 138.76.29.8
v Transmission Control Protocol, Src Port: 53924, Dst Port: 80, Seq: 1, Ack: 1, Len: 330
    Source Port: 53924
    Destination Port: 80
    [Stream index: 0]
  > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 330]
    Sequence Number: 1    (relative sequence number)
    Sequence Number (raw): 2729789995
    [Next Sequence Number: 331    (relative sequence number)]
    Acknowledgment Number: 1    (relative ack number)
    Acknowledgment number (raw): 2574368014
    1000 .... = Header Length: 32 bytes (8)
  > Flags: 0x018 (PSH, ACK)
    Window: 502
    [Calculated window size: 64256]
    [Window size scaling factor: 128]
```

8. Which of the following fields in the IP datagram carrying the HTTP GET are changed from the datagram received on the local area network (inside) to the corresponding datagram forwarded on the Internet side (outside) of the NAT router: Version, Header Length, Flags, Checksum?

Checksum

```
v Internet Protocol Version 4, Src: 192.168.10.11, Dst: 138.76.29.8
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 382
    Identification: 0x6296 (25238)
  > 010. .... = Flags: 0x2, Don't fragment
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 64
    Protocol: TCP (6)
    Header Checksum: 0x64dc [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.10.11
    Destination Address: 138.76.29.8
```

```
Internet Protocol Version 4, Src: 10.0.1.254, Dst: 138.76.29.8
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 382
    Identification: 0x6296 (25238)
  > 010. .... = Flags: 0x2, Don't fragment
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 63
    Protocol: TCP (6)
    Header Checksum: 0x2492 [validation disabled]
    [Header checksum status: Unverified]
```

9. At what time does this message appear in the nat-outside-wireshark-trace1- 1.pcapng trace file?

0.030625966s

6	0.030625966	138.76.29.8	10.0.1.254	HTTP	613 HTTP/1.1 200 OK (text/html)
7	0.031448670	10.0.1.254	138.76.29.8	TCP	66 53924 → 80 [ACK] Seq=331 Ack=548

10. What are the source and destination IP addresses and TCP source and destination port numbers on the IP datagram carrying this HTTP reply ("200 OK") message

Ok src：80 dst：53924

Tcp src：53924 dst：80

```
Transmission Control Protocol, Src Port: 80, Dst Port: 53924, Seq: 1, Ack: 331, Len: 547
    Source Port: 80
    Destination Port: 53924
```

```
Transmission Control Protocol, Src Port: 53924, Dst Port: 80,
    Source Port: 53924
    Destination Port: 80
    [Stream index: 0]
```

10. What are the source and destination IP addresses and TCP source and destination port numbers on the IP datagram carrying the HTTP reply ("200 OK") that is forwarded from the router to the destination host in the right of Figure 1?

与 inside 里的 ok 一样

Tcp src：53924，dst：80

Ok src：80，dst：53924

结论：

1. 在 IP 数据报从本地局域网穿越 NAT（网络地址转换）路由器转发到互联网的过程中，对于承载 HTTP GET 请求的数据报，唯一肯定会发生变化的字段是 Checksum。其他字段如 Flags、Version、Header Length 通常不会因 NAT 操作而改变。

2. Checksum（校验和）：当 NAT 路由器对数据报进行处理，如更改源或目的 IP 地址（这是 NAT 的基本功能之一），或者由于封装在 IP 报头内的其他字段（如

端口号）发生改变时，需要重新计算整个 IP 报头以及可能的部分上层协议（如 TCP 报头）的校验和。因此，Checksum 字段必然会发生变化以反映这些改动。
3. NAT 设备会维护一个 NAT 表（或称为会话表、转换表），记录已建立的映射关系，包括内部 IP 地址、内部端口号、外部 IP 地址、外部端口号以及协议类型。后续数据包只要匹配到这个表中的条目，NAT 设备就会根据记录的端口号规律继续进行正确的转换。当会话结束或超时后，对应的端口号资源会被释放，可以再次用于新的连接。