

CS 315: Computer Networks Lab
Spring 2024-25, IIT Dharwad
Assignment-8
Wireshark Lab: NAT & SMTP
March 10, 2025

Lab Instructions

- Please leave your bags on the Iron shelf near the SP16 entrance.
- Login to the Ubuntu OS on your machine. The login credentials are as follows:
 - Username: user
 - Password: 123456
- Mark your attendance in the attendance sheet before leaving the lab.
- Handle the lab resources with utmost care.
- Please go through the following exercises in today's lab.
- It is recommended that you complete all the following exercises during the lab slot itself.
- If you face any difficulties, please feel free to seek help online or from your peers or TAs.
- After finishing all exercises, please carry your solutions with you (via email/pen drive) for future reference, and delete the files from the desktop.

Part-1(Introduction)

In this lab, we'll investigate the behaviour of a NAT router. This lab will be different from our other Wireshark labs, where we've captured a trace file at a single Wireshark measurement point. Because we're interested in capturing packets at *both* the input and output sides of the NAT device, we'll need to capture packets at *two* locations. Also, because many students don't have easy access to a NAT device or to two computers on which to take Wireshark measurements, this isn't a lab that is easily done "live" by a student. So, in this lab, you'll use Wireshark trace files that we've captured for you. This should be a relatively short and easy lab since the concepts behind NAT aren't difficult, but it'll be good nonetheless to observe NAT in action.

NAT Measurement Scenario

In this lab, we'll capture packets containing a simple HTTP GET request message from a client inside a home network to a remote server, and the corresponding HTTP response from that server. Within the home network, the home network router provides a NAT service, Figure 1 shows our Wireshark trace-collection scenario. We'll capture packets in *two* locations, and thus this lab has *two* trace files:

- We'll capture packets being received at the local area network (LAN) side of the NAT router. All devices in this LAN have addresses in 192.168.10/24. This file is named *nat-inside-wireshark-trace1-1.pcapng*.

- Because we're also interested in analysing packets being forwarded (and received) by the NAT router on its Internet-facing side, we'll collect a second trace file on the Internet side of the router, as shown in Figure 1. Packets captured by Wireshark at this point that were sent from a host on the right to the server on the left will have undergone NAT translation by the time they reach this second measurement point. This file is named ***nat-outside-wireshark-trace1-1.pcapng***.

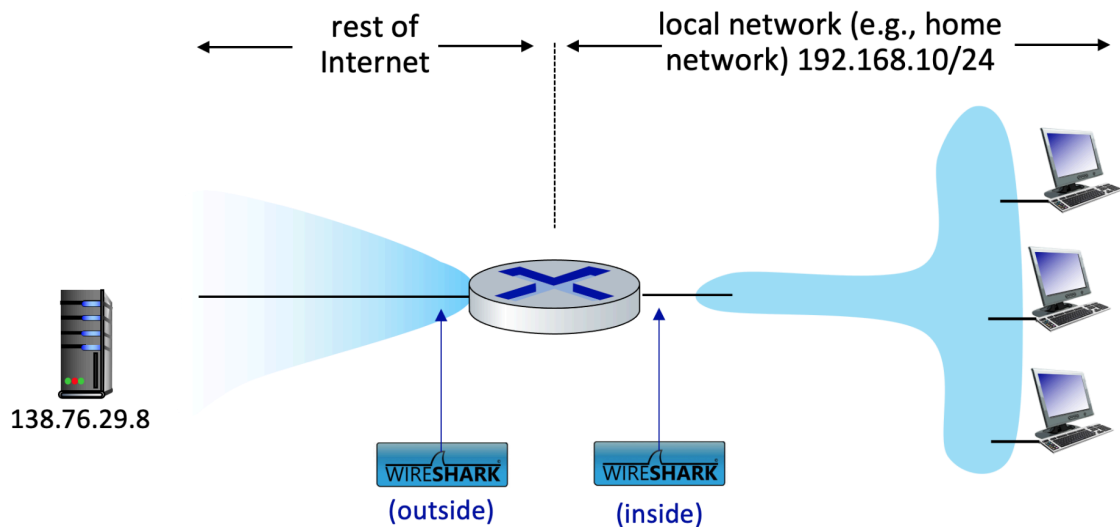


Figure 1: NAT packet capture scenario

Let's first take a look at what's happening on the LAN side of the NAT router. Open the ***nat-inside-wireshark-trace1-1.pcapng*** trace file. In this file, you should see an HTTP GET request addressed to the external web server at IP address 138.76.29.8, as well as the subsequent HTTP response message ("200 OK"). Both of these messages in the trace file were captured on the LAN side of the router.

Answer the following questions.

- What is the IP address of the client that sends the HTTP GET request in the ***nat-inside-wireshark-trace1-1.pcapng*** trace? What is the source port number of the TCP segment in this datagram containing the HTTP GET request? What is the destination IP address of this HTTP GET request? What is the destination port number of the TCP segment in this datagram containing the HTTP GET request?
- At what time is the corresponding HTTP 200 OK message from the web server forwarded by the NAT router to the client on the router's LAN side?
- What are the source and destination IP addresses and TCP source and destination ports on the IP datagram carrying this HTTP 200 OK message?

In the following, we'll focus on these two HTTP messages (GET and 200 OK). Our goal below will be to locate these two HTTP messages in the trace file *nat-outside-wireshark-trace1-1.pcapng*, captured on the Internet-side link between the router and the ISP. Because the captured packets heading towards the server will have already been forwarded through the NAT router, some of the IP addresses and port numbers will have been changed as a result of NAT translation.

Open the trace file *nat-outside-wireshark-trace1-1.pcapng*. Note that the time stamps in this file and the *nat-inside-wireshark-trace1-1.pcapng* files are not necessarily synchronized.

In the *nat-outside-wireshark-trace1-1.pcapng* trace file, find the HTTP GET message that corresponds to the HTTP GET message that was sent from the client to the 138.76.29.8 server at time $t=0.027362245$, where $t=0.027362245$ is the time at which this message was sent, as recorded in the *nat-inside-wireshark-trace1-1.pcapng* trace file.

4. At what time does this HTTP GET message appear in the *nat-outside-wireshark-trace1-1.pcapng* trace file?
5. What are the source and destination IP addresses and TCP source and destination port numbers on the IP datagram carrying this HTTP GET (as recorded in the *nat-outside-wireshark-trace1-1.pcapng* trace file)?
6. Which of these four fields is different from your answer to question 1 above?
7. Are any fields in the HTTP GET message changed?
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, Source Address, TTL**?

Let's continue to look at the *nat-outside-wireshark-trace1-1.pcapng* trace file. Find the HTTP reply containing the "200 OK" message that was received in response to the HTTP GET request you just examined in questions 4-8 above.

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

Lastly, let's consider what happens when the NAT router receives this datagram that you examined in questions 9 and 10, performs NAT translation, and finally forwards that datagram to the destination host on the LAN side. Based on your answers to questions 1 through 10 above

and your knowledge of how NAT works, you should be able to answer the following question without actually looking at the *nat-inside-wireshark-trace1-1.pcapng* trace file:

11. 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?

To ensure you understand NAT, you should now use Wireshark to peek into the *nat-inside-wireshark-trace1-1.pcapng* trace file at look at the HTTP reply (“200 OK”).

Do your answers to question 11 above match what you see in the *nat-inside-wireshark-trace1-1.pcapng* trace file?

Part-2: SMTP

Answer the following questions referring to *Assignment_8_smtp_trace.pcap* file

1. What is the IP address of the client, and DNS resolver?
2. Mention the domain name, and IP address of the mail server to which the client is requesting to send an email.
3. What is the source and destination port number of the SMTP connection between the client and the mail server? Does the destination port number match with the standard port of SMTP in `/etc/services/`?
4. Enumerate all SMTP commands sent by the client to the mail server, starting from the service ready response from the mail server until the connection is closed.
5. Mention the different response codes that the mail server sends to the client for each of the SMTP commands. [**Hint:** Refer to section 3.2.2 in [paper](#)]
6. Complete the entries of the ‘Internet Message Format’ in the table based on the observed reassembled data frame.

| Field Name | Value |
|------------|-------|
| FROM | |
| TO | |
| Subject | |
| Date | |

| | |
|--------------|--|
| Message ID | |
| MIME version | |

7. What is the total size of the data transmitted from the client to the mail server? Mention the total number of data fragments and their byte size.

Submission Details

- Write your answers in a single doc/tex file, and submit its PDF named after your IIT Dharwad roll number, which contains all answers (with screenshots, if necessary).