COMP 189: Homework #5

Assigned Feb 11, 2022
Due Feb 18, 2022

29 points total

Instructions: *For each problem, show all your work (required for credit). For answers requiring written answers, while no more than five or six sentences are expected, sufficient justification must be given for any position, opinion, or perspective taken.*

Submission Instructions: *submit your solutions in PDF format through MyCourses Assignments.*

Technical Exercises

1. Traffic shaping (12 pts)

Consider an ISP router that services your neighborhood. It is performing traffic shaping on the data flowing to the block – it can send 10 packets every millisecond to the neighborhood. It is configured so that streaming video packets (which it can magically identify) wait no more than 1 millisecond. When a packet can't be sent right away, the router holds it in its memory till it can be sent.

For this question, assume that a packet is a total of 700kB (including header and content) and that the router can process (send along or store for later) any arriving packets within the same millisecond within which they arrive for the block.

- The router starts out with no waiting packets in memory
- In the first millisecond, 15 streaming video packets arrive and 10 non-streaming packets arrive
- In the second millisecond, 2 streaming video packets arrive and 10 non-streaming packets arrive
- In the third millisecond, 10 streaming video packets arrive and 12 non-streaming packets arrive

At the end of the third millisecond, how many packets are waiting? How much storage space is the router using to store the waiting packets?

If this pace of packet arrival keeps up, what will eventually happen on the router? In this situation, what do you think the router should do?

a)
We have 10 packets getting sent every millisecond. The streaming video packets only wait in storage for 1 millisecond and 1 packet is equal to 700Kb.
Note: nsp = non-streaming video packet & sp = streaming video packet

At the start of the 1st millisecond:
- 15 sp arrive
- 10 nsp arrive.

At the end of the 1st millisecond:
- 10 nsp stored
- 5 sp stored

At the start of the 2nd millisecond:
- 2 sp arrive.

- 10 nsp arrive.

At the end of the 2nd millisecond:

- 5 + 2 = 7 sp sent
- 3 nsp sent
- 17 nsp stored

At the start of the 3rd millisecond:

- 10 sp arrive
- 12 nsp arrive

At the end of the 3rd millisecond:

- 10 sp sent
- 29 nsp stored

At the end: 29 non-streaming packets waiting at the end of the 3rd millisecond and thus 29 * 700kb = 20,300kb = 20.3 megabytes.

b)
The router's buffer is going to be filled with non-streaming packets if the traffic continues like so because the video streaming packet takes precedence. Eventually, the router's buffer will be filled up. In other words, the router will buffer bloat and will cause a slow internet due to high latency and any packets sent to the router will be dropped.

2. Traffic shaping and NAT (12 pts)

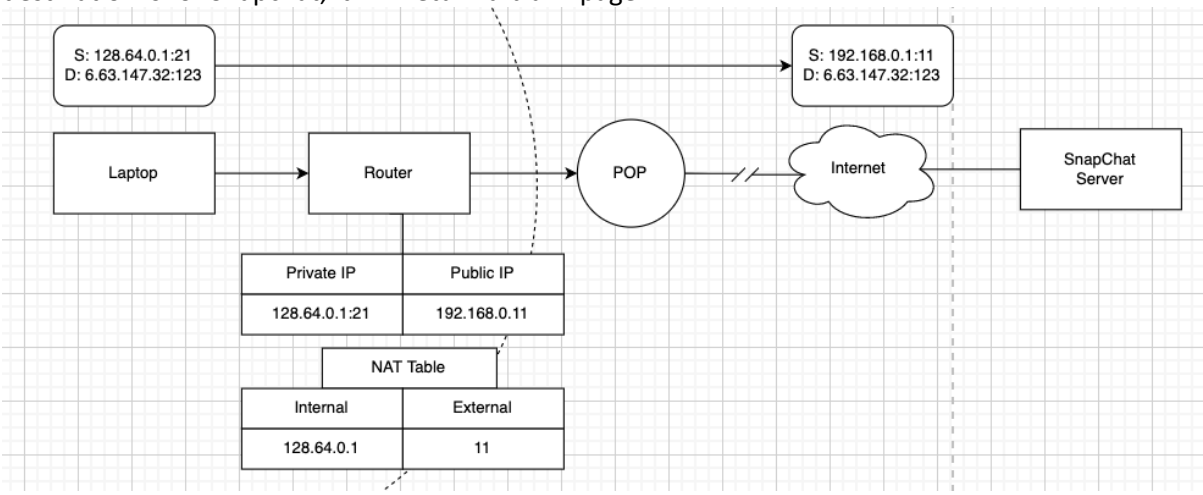
The traffic that leaves your house typically is subject to network address translation. This means that ports and IP addresses are being changed by the NAT. And yet, ISPs still have no trouble blocking traffic. Why is this? Diagram a setup in which

- your laptop is behind a NAT (that you control – so the NAT doesn't do any traffic shaping or packet filtering),
- your NAT is directly connected to an ISP-owned POP
- The POP is connected to "the internet" (meaning, were not worrying about all the other infrastructure – just connect the POP up to the internet "cloud")
- The ISP has decided to block all packets bound for SnapChat.
- your laptop is trying to communicate with a SnapChat server, but its outbound packets are getting blocked.

Show the outbound packet movement as we did in past homeworks, show where it is blocked and indicate how the ISP knows to block the traffic (despite the fact that the NAT is changing IP addresses and ports).

The reason the ISPs have no trouble blocking traffic is because it knows how to block the outbound packet movement from my device to the Snapchat server. This is because it knows how to detect the Snapchat server's port and IP address as well as cease the outbound packet movement.
Like mentioned in the question, the traffic that leaves a device is subject to a NAT meaning that the port and IP address are being changed by that NAT. But note that when doing so, only the source port

and IP address get modified not the destination IP address. This means that the ISP can still check and deny traffic being sent to the Snapchat server from my device. The ISP is shaping traffic as it's taking part in shallow packet inspection to prevent traffic to a certain IP address and port. By doing so, the ISP can inspect the header of the packet which includes its source and destination. Once realizing its destination is for Snapchat, it will return a blank page.



Discussion

1. Network Neutrality (5 pts)

An MP has proposed a bill that will require all absolute network neutrality: no packet can be treated differently than any other packet. In four or fewer sentences, using web browsing and video streaming, explain why this is a bad idea. (Anything more than four *reasonable* sentences will be penalized).

Network neutrality regarding web browsing and video streaming would be a bad idea because ISPs would then not be able to prioritize packets that are transferring through their networks. If there was no prioritization (network neutrality) then ISPs wouldn't allocate certain amounts of capacity to packet protocols like TCP and UDP, the packets do not get any inspection and they get sent out on a first come first serve basis. All this would also cause major issues in internet trafficking and slow video streaming experiences since heavier packets wouldn't get priority.