Research Topic: Implementing a NAT Device using a P4 Programmable Switch

Students: Samuel Kelley, Talha Gill
Advisors: Ali Mazlum, Jose Gomez

1. Introduction

The basic idea behind NAT is for an ISP to assign each home or business a single IP address (or at most, a small number of them) for Internet traffic. Within the customer network, every computer gets a unique private IP address, which is used for routing intramural traffic. However, just before a packet exits the customer network and goes to the ISP, an address translation from the unique internal IP address to the shared public IP address takes place. This translation makes use of three ranges of IP addresses that have been declared as private. Networks may use them internally as they wish. The only rule is that no packets containing these addresses may appear on the Internet itself. The three reserved ranges of private IP addresses are:

- 10.0.0.0 – 10.255.255.255/8 (16,777,216 hosts)
- 172.16.0.0 – 172.31.255.255/12 (1,048,576 hosts)
- 192.168.0.0 – 192.168.255.255/16 (65,536 hosts)

2. Research Challenge

The goal of this project is to implement a NAT on a programmable switch, using the P4 language. The NAT will enable the internal network to communicate with the Internet by performance the network translation (private IP address <-> public IP address) as a packet crosses the NAT.