

CS 118 Project 2

This project consisted of writing a router that handled both the network and the link layer. When the router receives a packet on an Ethernet interface, it first checks the destination MAC address; if the MAC address does not match the packet is dropped immediately. Otherwise, the type field of the Ethernet header is checked.

If the packet is an ARP packet, the ARP header is extracted from the Ethernet frame. If the ARP packet is a request, then the router sends an ARP reply to the source MAC address only if the ARP target IP matches the router's IP at the relevant interface. If the ARP packet is a reply, then the router updates its ARP table- a table that keeps track of IP to MAC address mappings. In addition, whenever the ARP table is updated all the packets waiting on a given MAC address are sent out. These queue and ARP table structures are available in `sr_arpcache.c`.

If the packet is an IP packet, the router needs to check whether it is destined for the router or to another location by examining the destination IP in the IP header. If the packet is destined for the router, its data should be an ICMP packet; if not, the router sends an ICMP type 3 message for an unreachable port. This program only supports ICMP echo requests and responds with an ICMP echo reply message. If the packet is not destined for the router, the routing table is accessed to find the next-hop IP that the packet needs to be sent to based on the ultimate destination IP. This next-hop IP is then referenced in the ARP table to lookup the relevant destination MAC address and the proper interface the Ethernet packet should be forwarded out of.

One crucial function is sending an ARP reply in the case that the table is not complete for a given next-hop IP. In this case, a new packet ARP query packet is constructed and sent out. Internally, the packet needed to be forwarded is added to a queue behind the ARP request, so that when the request comes in the router will know this packet needs to be sent. There may be an arbitrary amount of packets in a queue for a given ARP request for two reasons: to be able to send the packets once an ARP reply comes in and so that only one ARP request is sent for each destination IP/MAC address that needs to be discovered.

The completed router functions as a nearly complete implementation of the IP and Ethernet protocols: it is pingable, traceroutable and forwards normal HTTP request and reply IP packets.