

Lecture 16 - Internet Protocol

Exercise 1: What is the difference between IP and "The Internet"? Does a network using IP have to be on the Internet? Does someone using the Internet have to use IP?

IP - protocol, spec, documents

Internet - network of co-operating service providers using IP

Exercise 2: What is the value of the first byte of IP frame that uses the shortest possible header? If first byte is $0x46$, what is the length of the Options field in bytes?

2

$0x45$ \rightarrow IPv4
 \swarrow
 $= 5 \times 32\text{-bit word}$

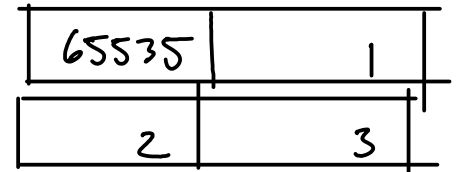
$0x46$ \rightarrow IPv4

$\rightarrow 6 \times 32$ bit words.

- 5×32 mandatory

$\frac{1 \times 32 \text{ bits}}{8} = 4 \text{ bytes for options.}$

Exercise 3: A protocol header contains four 16-bit fields with decimal values 65535, 1, 2, and 3 that are to be included in an IPv4 checksum. What is the value of the header checksum?



① add

	1 0005
--	----------

= 65541 = 0x00010005

MS LS

② add MS 16 bits fold

6

③ invert all bits

FFF9

6 = 11111100

FFF9

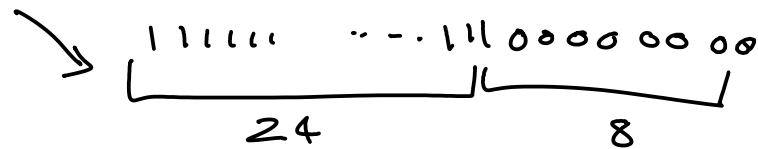
check: 65535 + 1 + 2 + 3 + 65529

① : 1 65534

② 65535 (FFFF)

③ 0

Exercise 4: What is the netmask in binary for a /24 network? What is it in decimal? How can the netmask be used to determine if one IP address is on the same network as another? Is the address 192.168.2.200 in the 192.168.2.0/25 network?



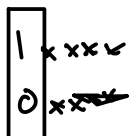
/24 means 24 bits of the address are network address

netmask 255.255.255.0 ← decimal

$$(A_1 \& NM) \stackrel{?}{=} (A_2 \& NM)$$

↑
binary AND

is 192.168.2.200
in 192.168.2.0/25 network?



192.168.2.0
+ 0
+ 127



Exercise 5: Who "owns" the 24.80.0.0/13 network?

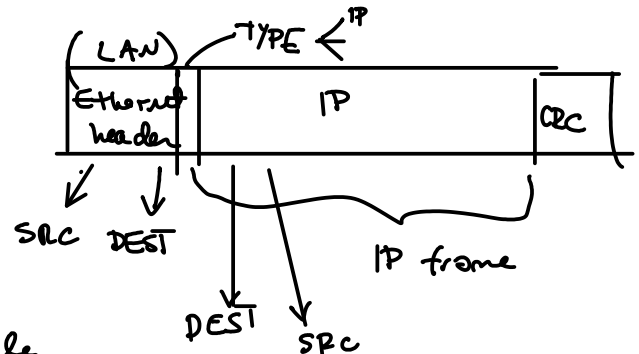
according to whois.arin.net,
Show →

WHOIS-RWS	
Network	
Net Range	24.80.0.0 - 24.87.255.255
CIDR	24.80.0.0/13
Name	SHAW-COMM
Handle	NET-24-80-0-0-1
Parent	NET24 (NET-24-0-0-0-0)
Net Type	Direct Allocation
Origin AS	
Organization	Shaw Communications Inc. (SHAWC)
Registration Date	2001-07-12
Last Updated	2012-03-02

Exercise 6: For the routing table above, what port ("Interface") would be used by frames with the following destination IP addresses: 127.0.0.255? 192.168.1.1? 192.168.2.1? 204.191.10.32?

127.0.0.255 → lo port
 192.168.1.1 → br0
 192.168.2.1 → vlan1
 204.191.10.32 → vlan1

Exercise 7: What pairs of values are stored in an ARP cache?
 What addresses from a received frame need to be examined to validate an ARP cache entry?



IP address	Ethernet address

typically
 → SRC LAN & SRC IP address

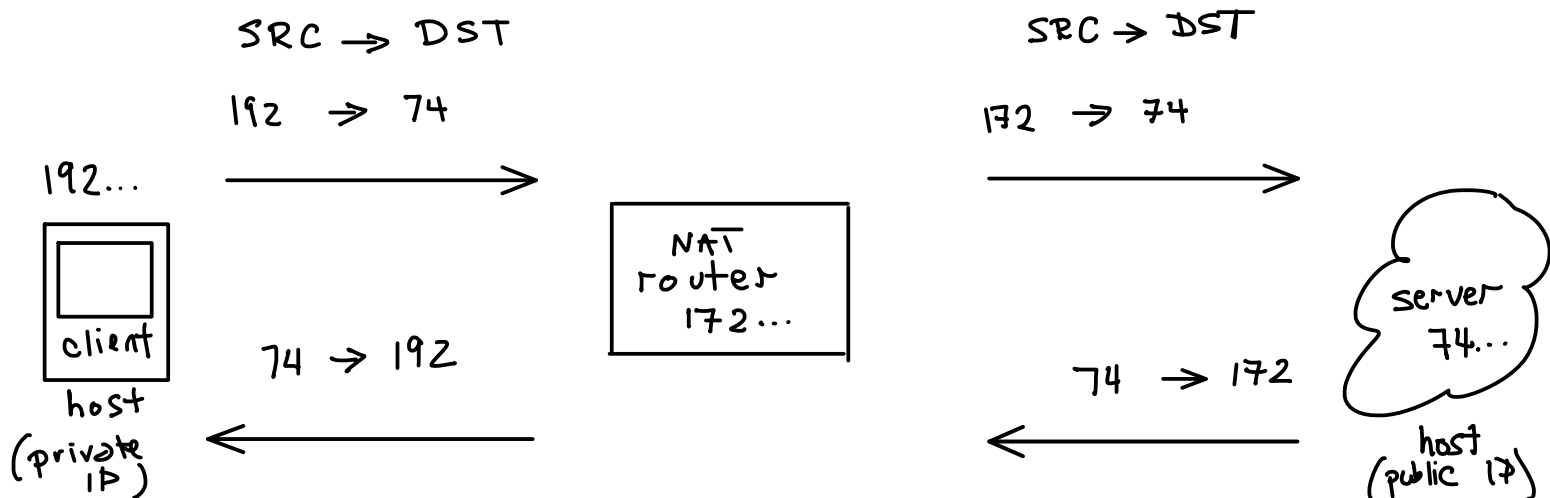
Exercise 8: When a host boots up, what must it send out first, an ARP request or a DHCP request?

neither;

ARP - don't need own IP address
 DHCP - don't need dest IP address or LAN

Exercise 9: A host with a (private) address 192.168.1.10 is behind a NAT router with an (public) address of 172.12.192.15. The host sends a frame to a host at address 74.125.225.113 requesting a web page. Show the source/destination address pairs of the request and response frames on the private and public sides of the router.

abbreviate: 192 = 192.168.1.10
 172 = 172.12.192.15
 74 = 74.125.225.113



Exercise 10: Can a host's DNS server be configured using a host name? Why or why not? Assuming a host has an empty DNS cache, what queries would it generate to look up the IP address of the host mx.bcit.ca?

- ① No. To reach the DNS server we need its IP address, but we can't get it without access to the DNS server.
- ② A recursive DNS query would require the following queries to look up mx.bcit.ca:
 - ① query the root DNS server for the IP address of the DNS server for ".ca"
 - ② query the DNS server for ".ca" for the IP address of the DNS server for "bcit.ca"
 - ③ query the DNS server for "bcit.ca" for the IP address of "mx.bcit.ca"