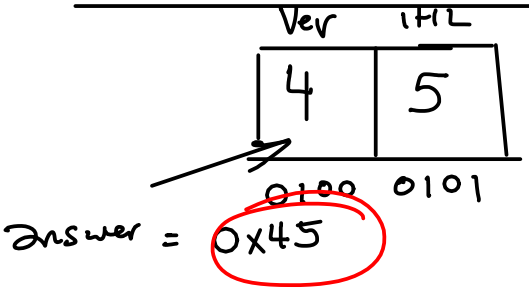
Lecture 12 - Internet Protocol

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?

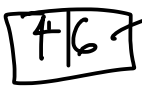
IP is a protocol
The Internet is a (public) network.
A network using IP can be private (e.g. military, intra-company).
Yes, to use the internet you have to use IP protocols.

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



Answer = 0x45

5 x 32 bits
5 x 4 bytes
5 x 2 x 16 bit word
} 20 bytes.



6 32-bits word in header
− 5 before options
1 32-bit word for options.
= 4 bytes

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

65535	1
2	3
	65529 ← checksum.

1. 65541 = 0x00010005

2.
$$\begin{array}{r} 0x0005 \\ +\ 0x0001 \\ \hline 0x0006 \end{array}$$

3. 0xFFF9 → decimal

Exercise 4: (a) What is the netmask in binary for a /24 network? (b) What is it in decimal? (c) 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? ~~252~~ 00

(a) 1111 1111 . 1111 1111 . 1111 11 00 . 0000 0000

24 1's — 32-24=8 0's

(b) 255 . 255 . 255 . 0

(c) IP address AND Netmask & compare to network address

(d) network address: 192.168.2.0 /25

ip address to test: 192.168.2.200

in binary: 1100 0000 . 1010 1000 . 0000 0010 . 1100 1000

netmask: 1111 1111 . 1111 1111 . 1111 1111 . 1000 0000

AND result: 1100 0000 . 1010 1000 . 0000 0010 . 1000 0000

same as?: 1100 0000 . 1010 1000 . 0000 0010 . 0000 0000

yes/no? NOT IN THAT NETWORK

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

SHAW-CONM owns 24.80.0.0 → 24.87.255.255

13 MS bits are the network
19 LS bits specify the host

3 + 8 + 8 = 19 bits

2^{19} hosts ≈ 500K

Exercise 6: Does the header checksum change each time a packet is forwarded? Why?

yes: the TTL changes.

Exercise 7: For the routing table above, what port ("Interface") would be used by packets with the following destination IP addresses: 127.0.0.255? 192.168.1.1? 192.168.2.1? 204.191.10.32?

Router:

Destination	Gateway	Subnet Mask	Metric	Interface
192.168.1.0	*	255.255.255.0	0	br0 (LAN)
204.191.0.0	*	255.255.0.0	0	vlan1 (WAN)
127.0.0.0	*	255.0.0.0	0	lo
default	204.191.1.1	0.0.0.0	0	vlan1 (WAN)

127.0.0.255
255.255.255.0

127.0.0.0

L2 address used of → 192.168.1.1 → br0 (LAN) (192.168.1.0 matches).

of gateway → 192.168.2.1 → default (WAN via 204.191.1.1) (no matches)

of → 204.191.10.32 → vlan1 (WAN) (direct) (204.191.0.0 matches).

Exercise 8: What pairs of values are stored in an ARP cache? What addresses from a received packet need to be examined to validate an ARP cache entry?

- both the IP & MAC source addresses.

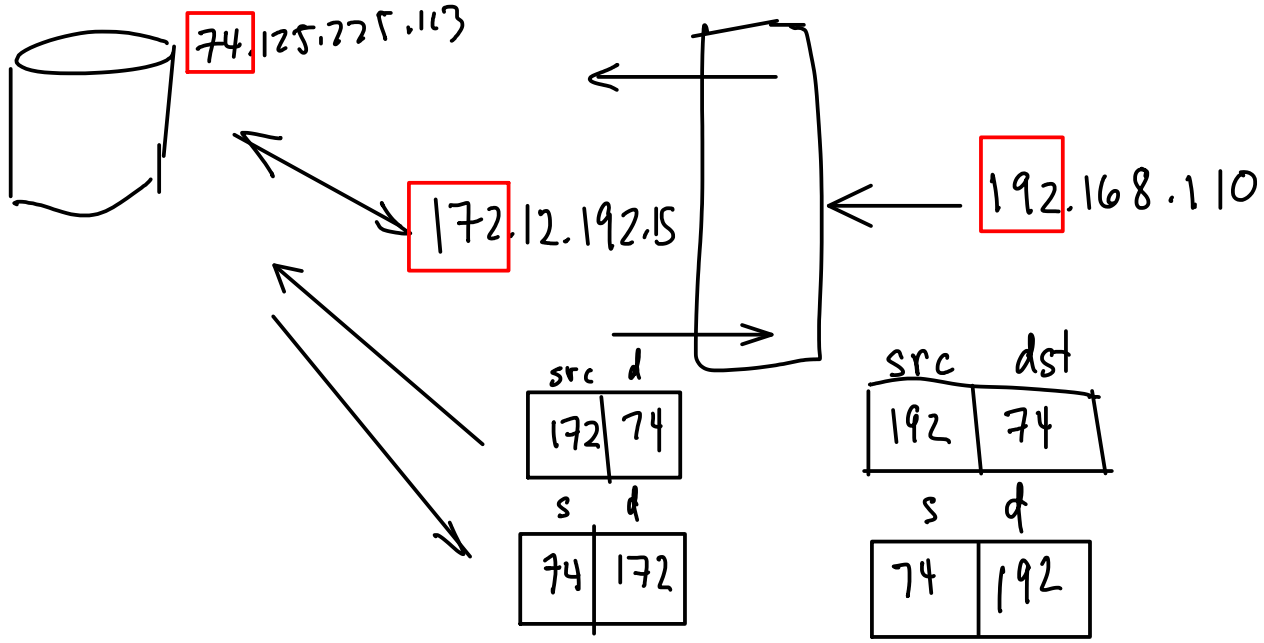
- same

Exercise 9: When a host boots up, what must it send out first, an ARP request or a DHCP request?

	L2	IP
DHCP: ⟶ our IP address.	broadast	
ARP; IP → MAC	"	

independent: neither one needs to be first

Exercise 10: 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 packet to a host at address 74.125.225.113 requesting a web page. Show the source/destination address pairs of the request and response packets on the private and public sides of the router.



Exercise 11: 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?

→ must use IP address

– otherwise can't resolve the host name of DNS server.

Who gets ask	for what	name server.
•	NS for . ca	
.ca NS	NS for bcit.ca	
.bcit.ca NS	A for mx.bcit.ca	

address