HW 11

Mike Hanling

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Questions

1. (5 points) What are the two parts of a packet? Which stores the address and what stores the data?

   The Header stores the address and the Payload stores the data.

2. (5 points) What does it mean for the Internet to be "packet switched"?

   It means that at junctions (routers and devices) the devices know exactly where to send the packet solely on the Header, no need to look at the Payload. There are no pre-determined routes, but hops are determined on the go.

3. (5 points) What are the different layers of the protocol stack and what purpose do they serve in delivering a packet?

   The Application Layer is the start and end of a packet's life (get requests and requests for data by the user).
   The Transport Layer is for ports, to make sure the right process on the computer gets the right information.
   The Internet Layer is where packets hop across junctions to get from one destination to another through networks.
   The Link Layer allows for packets to be shared across networks. Ex: Ethernet and Wifi.
   The Physical Layer is for transmitting the 0's and 2's across the medium, the actual information in the packets.

4. (5 points) An Internet address (version 4) is stored in how many bytes?

   4

5. (5 points) A domain name, unlike an IP address, is more human usable, what protocol enables domain names to be resolved into IP addresses?

   DNS

6. (15 points) Using the host command line tool, resolve the following domain names to an IPv4 address(es). Indicate those that also have IPv6 addresses, and also, rerun host a few times, indicate which hosts IP addressed changed on subsequent runs.

   (a) www.cis.upenn.edu

IP : 158.130.69.163
IPv6 : 2607:f470:8:64:5ea5::d

(b) www.cs.swarthmore.edu

IP : 130.58.68.137

(c) www.usna.edu

IP : 10.4.36.20

(d) facebook.com

IP : 31.13.69.228
IPv6 : 2a03:2880:f103:83:face:b00c:0:25de

(e) microsoft.com

IP : 191.239.213.197:104.40.211.35:104.43.195.251:23.100.122.175:23.96.52.53

7. (10 points) What is the purpose of the port address? How many bytes and what C type would naturally store a port address?

To make sure that the right process on the computer gets the right packets. It is an unsigned short (2 bytes) and is stored in sockaddr_in as sin_port.

8. (10 points) TCP provides reliable data transmission, but at what cost? Why might you want to use UDP over TCP?

TCP has acknowledgements and extra sending of data to make it more reliable. This can slow down the time it takes the send the same amount of data (send to moving on).

9. (20 points) For each of the descriptions below of a network type, indicate the type that best matches that description. Options include: struct in_addr, in_addr_t, s_addr, struct sockaddr ,

struct sockaddr _in, sin_family, sin_port, sin_addr,

struct addrinfo , ai_family, ai_addr.

(a) Specifies the address type, e.g., AF_INET, for the addrinfo structure.

```
int ai_family
```

(b) Specifies the addres type, e.g., AF_INET, for the sockaddr_in structure.

```
short sin_family
```

(c) A type defined as a uint32

```
uint32_t in_addr_t
```

(d) A generic address structure for sockets

```
struct sockaddr
```

(e) A structure to store an IPv4 Internet address

```
struct in_addr
```

(f) An unsigned short storing the port for a sockaddr_in

```
short sin_port
```

(g) Structure used to hint at IP addresses for resolving as well as storing results.

```
struct addrinfo
```

(h) Member of the sockaddr_in that stores the address

```
struct in_addr sin_addr
```

(i) The sole member of the in_addr structure

```
in_addr_t s_addr
```

(j) A generic socket address returned in a addrinfo

```
struct sockaddr ai_addr
```

(k) A specific address structure for sockets to store IP, port pairs

```
struct sockaddr_in
```

10. (5 points) The following functions are opposites, inet_ntoa() and inet_aton(), what are their purposes? Provide a small example.

These functions switch between a readable IP address (w/ dots) and how it actually stored (as four unsigned bytes). In order to store a dotted IP, you use inet_aton(dotted) to convert it. And then to get it back in the dotted form, you use inet_ntoa(structure stored).

11. (5 points) When assign a port to a socket address, which of these two conversion should you use and why? htnos() vs. nths().

htons() because it will convert the short that is the port number to the `sin_port` that is stored in the `saddr_in`.

12. (10 points) Consider setting the address 10.4.32.41 on port 22. Complete the code below to do that.

```
struct sockaddr\_in

saddr;
//TODO: what assignments come next?
```

```
struct sockaddr\_in saddr;
saddr.sin\_family = AF\_INET;
inet\_aton("10.4.32.41", &(saddr.sin\_addr));
saddr.sin\_port = htons(22);
```