Computer Network, 10 questions 100 points in 3 pages. January, 2015

1. (10%) A router has just received the following new IP addresses: 140.121.96.0/21, 140.121.104.0/21, 140.121.112.0/21, and 140.121.120.0/21.
    a. If all of them use the same outgoing line, can they be aggregated?(5%)
    b. Follow up on above question, If so, to what? If not, why not?(5%)
2. (10%) Consider a subnet with prefix 192.168.56.128/26.
    a. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network.(2%)
    b. Suppose an ISP owns the block of addresses of the form 192.168.56.32/26. Suppose the ISP wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?(8%)
3. (10%) Cyclic Redundancy Check.
    a. What is Cyclic Redundancy Check (CRC) used for?(5%)
    b. How to achieve that? (5%)
4. (10%) CSMA mechanism.
    a. How the transmission collision problem is solved in the CSMA with collision detection (CSMA/CD) protocol?(5%)
    b. Is CSMA/CD a fair scheme? Why or why not?(5%)
5. (10%) Wireless communication.
    a. What is the hidden terminal problem? (5%)
    b. How the IEEE 802.11 MAC protocol avoids this problem?(5%)
6. (10%) Data communication. What is circuit switching? What is packet switching? Please explain the differences between them. (10%)

7. (10%) Figure 1 is IP packet format. Please answer following questions.

   a. What is minimal size of IPv4 header?(2%)

   b. What is minimal and max size of IPv4 packets? (2%)

   c. Why we need to partition an IPv4 packet? (2%)

   d. If an IP packet X is partition into multiple sub-packets including A and B, how to know A B belong to same packets? (2%)

   e. When should we reassembly the fragmented packets back? (2%)

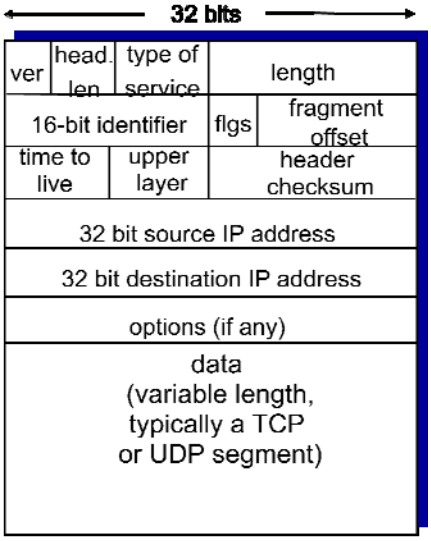

Figure 1: IP packet format.

8. (10%) “out-of-band” v.s. “in-band” control mechanisms.

   a. Why it is said that FTP sends control information with “out-of-band” mechanism? (5%)

   b. What are ***advantages*** and ***disadvantages*** of “out-of-band” control (e.g. FTP), comparing with “in-band” control (e.g. HTTP)? (5%)

9. (10%) Mobile IP protocol has been proposed for years (even before the hype of smart-phone). However, it turns out to be not so popular as well.

   a. What problems mobile IP protocol tries to solve? (2%)

   b. Please give a short description about mobile IP protocol (3%)

c. What are possible reasons to prevent the mobile IP protocol being wildly used? (2%)

d. However, someone may argue that we do use mobile IP strategy because we can use our smart-phone to surf in the internet (e.g. check my FB, or read email) while we are moving around from one city to another. Do you agree or disagree with the above claims? Explain your reasons. (3%)

10. (10%) network security

a. What is key distribution problem for share-key encryption mechanisms, and how to solve it in practice? (5%)

b. What is key certification problem for public-key encryption mechanisms, and how to solve it in practice? (5%)