Qualifying Exam: Network Architecture
Jan. 2013
Date: Friday, 2013/1/4 (1 hour)

Instruction:

- Put your name and student number on all your answer sheets.
- You have 60 minutes to complete the exam.
- **Show all your work. Partial credit will be considered, if you show intermediate steps in obtaining the answer.**

Question #1 (20pt): Stateless networks such as the IP network show various advantages. What are the disadvantages of stateless networks? (10pt) What are the problems of stateful network such as ATM compared to the Internet? (10pt)

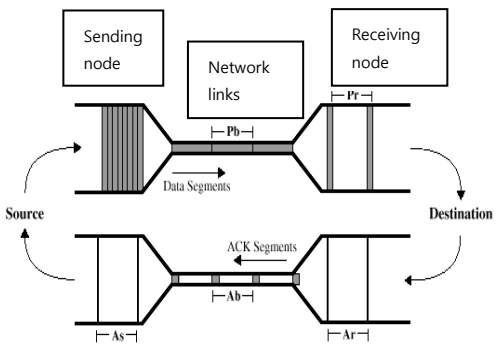
Question #2 (20pt): One of the key problems of current Internet is mobility problem. Basically IP address contains both location information and id information. It causes problem when the IP nodes move around. How does "Host Identity Protocol (HIP) tries to solve this problem? (10pt) One of the other problems must be "rapid BGP routing table growth". Major reasons are "Address fragmentation", "multi-homing", "load balancing", and "failure to aggregation". Suggest a solution to one of these problems. (10pt)

Question #3 (20pt): Packet classification is the process of categorizing packets into "flows" in an Internet router. All packets belonging to the same flow obey a predefined rule and are processed in a similar manner (action) by the router. Longest Prefix Matching for IP routing lookups can be seen as a special-case of one-dimensional packet classification. Fill up the blank assuming the IP routing lookup.

- Classifier = routing table
- One-dimension (destination address)
- Rule = ( ) (10pt)
- Regular expression = prefix
- Action = ( ) (10pt)
- Priority = prefix-length

Question #4 (20pt): Bufferbloat problem is the problem caused by large buffers in router. What kinds of problems are expected in terms of latency when router has large buffer for packet queue? (5pt) What will be the impact of large buffer in router to TCP congestion control? (5pt) Suppose that you drop the packets which stay longer than certain threshold time instead of dropping the packet by "Random Early Detection (RED)" algorithm. What will be the advantage and disadvantage compared to RED? (10pt)

Question #5 (20pt): Figure at right hand side shows self clocking behavior of TCP flow. What is the bottleneck link capacity? (P_s: packet size of packet pairs, P_b=P_r=A_r=A_b=A_s) (10pt) How do you apply this value to "Slow Start phase" of TCP congestion control? (10pt)



(a) Flow determined by Network Congestion