

Electrical, Computer, and Systems Engineering
ECSE-6600: Internet Protocols
Spring 2002

Problem Set 3- Due Thursday, March 28th, 2002
[Tape-delayed students ONLY: Due April 3rd, 2002]

NOTE:

1. BE BRIEF.
2. SUBMIT THIS HOMEWORK USING WEBCT DROP BOX ONLINE!
3. All paper readings are available from the backup course web page:

<http://www.ecse.rpi.edu/Homepages/shivkuma/teaching/sp2002/index.html#readings>

I. Reading assignments:

- **Reading:** Geoff Huston, [Commentary on Inter-domain Routing in the Internet](#)
- Chapters 12, 13, 14, 15 in Comer's book
- **Reading:** Hari Balakrishnan [Wide-Area Unicast Internet Routing \(MIT Class Notes\)](#)
- **Reading:** Norton, [Internet Service Providers and Peering](#)
- **Reading:** Floyd and Jacobson ["Random Early Detection gateways for Congestion Avoidance"](#)
- **Reading:** Ramakrishnan and Jain, [A Binary Feedback Scheme for Congestion Avoidance in Computer Networks with a Connectionless Network Layer](#),
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Questions based upon reading assignments:

- a) (10 pts) What are the reasons for the continued growth of the routing table as argued in Geoff Huston's paper?
- b) (15 pts) Discuss the differences between peering and transit. When would two parties agree to peer and when would they set up a transit agreement. What are exchange points and why do they have a growing role in the future of peering and transit.
- c) (10 pts) If TCP had chosen a packet-oriented reliability model, and did not care about re-ordering, what aspects of the protocol would be simplified.
- d) (15 pts) Why do Ramakrishnan/Jain's DECbit receivers filter the feedback from the network in a special way (why not react to all feedback bits, or one feedback per RTT)? Why do the sources decrease only by a factor of 0.875 unlike TCP's factor of 0.5?
- e) (10 pts) Make a list of AQM problems. What AQM problems does RED solve well, and what problems does it leave unsolved or unsatisfactorily solved?

II. Congestion Control:

- a) [10 pts] Discuss briefly why and how the duality optimization framework explains the behavior of TCP and AQM schemes.
- b) [10 pts] In the future of the Internet, say require flows to behave in a TCP friendly or compatible way. What notions of compatibility could you think of, other than the approach of requiring flows to implement exactly the same algorithm as TCP or obey the TCP formula?
- c) [10 pts] Discuss how the accumulation-based congestion control framework is fundamentally different (in terms of capabilities and dynamics) from the loss-based framework of TCP.
- d) [10 pts] Discuss the key differences between TCP Reno, TCP NewReno, TCP Vegas, and TCP SACK.