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

Problem Set 1- Due Wednesday, January 31st, 2002
[Tape-delayed students ONLY: Due February 6th 2001]

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**: Saltzer, Reed, Clark: "End-to-End arguments in System Design"
- **Reading:** Clark: "The Design Philosophy of the DARPA Internet Protocols":
- **Reading:** Cerf, Kahn: "A Protocol for Packet Network Intercommunication"
- **Reading:** Mogul etal: "Fragmentation Considered Harmful"
- **Reading:** Addressing 101: Notes on Addressing (exclude ADVANCED sections)
- **Reading:** Notes for Protocol Design, E2e Principle, IP and Routing (excluding routing)

Questions based upon reading assignments:

a) (10 pts) Discuss why a circuit-switched transmission system in the age of computers does not conform to the end-to-end principle. In the early 1900s (when the telephone technology was first deployed) there were different economic tradeoffs. Argue whether the circuit-switched system did or did not conform to the end-to-end principle in the early 1900s.

b) (10 pts) Consider the quality of service (QoS) problem, where (loosely specified) the "function" expected from the system is a "performance guarantee," which suggests that some kind of network support to guarantee performance is necessary. Discuss how one would go about applying the end-to-end principle for determining the functional decomposition of such a system.

c) (15 pts) Clark's paper has an ordered set of goals that drove the Internet design philosophy. Discuss how the Internet's design would be if the ordering of goals were totally reversed.

d) (10 pts) In order to achieve interconnection across networks, IP makes certain assumptions about individual networks. What are these assumptions? (Cerf-Kahn/Clark papers)

e) (10 pts) Summarize the arguments against doing fragmentation/reassembly as a "common case" function. (Mogul paper)

f) (10 pts) Explain why circuit-switching:

- does not need headers
- does not need to exploit statistical multiplexing gains (esp. temporal multiplexing gains)
- does not need to worry about the congestion control problem

II. ***Addressing***:

a) (15 pts) Assume an ISP has an address block: 128.20.224.0/19. It has two customer networks of size 2000 nodes each, three customers networks of size 1000 nodes each. Assuming that the ISP allocates sequentially from the beginning of its address space, what are the prefix allocations for these customers. The remaining customer networks have a size of 250 nodes each. How many remaining customers can be supported? (Addressing 101: subnet/supernet masks/allocation)

b) (10 pts) Analyze and comment on the structure of the following two MAC addresses:
59:01:47:00:04:00
32:01:54:00:00:01
Can a bridge use the structure in these addresses to intelligently forward packets? Why or why not ?

c) (10 pts) Explain why the address structure in IP enables scalable forwarding and routing, compared to Extended LANs/bridges with IEEE LAN addresses. Explain why classless addressing with CIDR/supernetting allows even more scalability compared to classful addressing.