Homework 6

Due Thursday Dec 9

- **TCP**
  1. TCP uses a host-centric, feedback-based, windows-based resource allocation model. How might TCP have been designed to use instead the following models?
     (a) Host-centric, feedback-based and route-based.
     (b) Router-centric and feedback-based.
  2. Is it possible for TCP Reno to reach a state with the congestion window size much larger than (e.g., twice as large as) RTT x Bandwidth? Is it likely?
  3. Under what circumstances may coarse-grained timeouts still occur in TCP even when the fast retransmit mechanism is being used?
  4. Discuss the relative advantages and disadvantages of marking a packet (as in the DECBit mechanism) versus dropping a packet (as in RED gateways).
  5. Suppose you are downloading a large file over a 3-Kbps phone link. Your software displays an average-bytes-per-second counter. How will TCP congestion control and occasional packet losses cause this counter to fluctuate? Assume that only a third, say, of the total RTT is spent on the phone link.

- **Security**
  1. The Diffie-Hellman key exchange protocol is vulnerable to a "man-in-the-middle" attack. Outline how Diffie-Hellman can be extended to protect against this possibility.
  2. What is the purpose of a nonce in an authentication protocol?
  3. Is the message associated with a message digest encrypted? Explain your answer.
  4. In what way does a message digest provide a better message integrity check than a checksum such as the IP checksum?
  5. What is a certificate authority? What is a key distribution center?
Wireless
1. Why are acknowledgments used in 802.11 but not in wired Ethernet?
2. Explain the difference between CSMA/CA and CSMA/CD; why do they take such different approaches?
3. Describe the hidden terminal problem. How does 802.11 protocol avoid the problem?
4. Explain the difference between the hidden-terminal problem and the exposed terminal problem.

DNS
1. ARP and DNS both depend on caches; ARP cache entry lifetimes are typically 10 minutes, while DNS cache is on the order of days. Justify the difference. What undesirable consequences might there be in having too long a DNS cache entry lifetime?
2. What DNS cache issues are involved in changing the IP address of, say, a web server host name? How might these be minimized?
3. Suppose a host elects to use a name server not within its organization for address resolution. When would this result in no more total traffic, for queries not found in any DNS cache, than with a local name server? When might this result in a better DNS cache hit rate and possibly less total traffic?
4. (a) What is a whois database?
   (b) Use various whois databases on the Internet to obtain the names of two DNS servers. Indicate which whois database you used.
   (c) Use nslookup command on your linuxlab host to send DNS queries to three DNS servers: your local DNS server and two other DNS servers you found in part (b). Try querying for type A, NS, and MX records. Summarize your findings.
   (d) Use nslookup to find a Web server with more than one IP addresses. Does the web server of your institution (UMD) have multiple IP addresses?
   (e) Use ARIN whois database to determine the IP address range used by your university.