CS 653: Advanced Computer Networks  
Fall 2015  
Homework #2  
Assigned 10/05, due 10/13  
(changes made after the initial posting are shown in red below)

Please consult the class web site, specifically http://www-net.cs.umass.edu/cs653/homework.htm about how to hand in your homework. Please also consult the class policy on doing your own work, http://www-net.cs.umass.edu/cs653/policies.htm

Problem 1. SS7. We saw in class that SS7 is a packet-oriented control plane for the PSTN. Being packet-switched, it is possible for SS7 signaling to be accomplished using Internet protocols. Indeed, the Internet Engineering Task Force (the body that sets the technical standards for the Internet) is working on this. For this problem, you should obtain Internet RFC (Request for Comments) 2960 (http://www.ietf.org/rfc/rfc2960.txt) which describes the Stream Control Transmission Protocol (SCTP), which is designed to transport PSTN signaling messages over IP networks. Read this RFC (you need not be concerned with all of the nitty gritty details as it is long). Give a half page summary of the functions of the protocol, and an approximately one-page long comparison of the similarities and differences between SCTP and TCP. Why do you think the differences that you have identified exist?

Problem 2. RSVP. On slide 2-31 through 2-34 (RSVP: building up path state), we saw how state was installed when H1 sends the first PATH message, followed by H5 sending the 2nd PATH message.

- Suppose H3 sends the third PATH message, and no other hosts send PATH messages after that. What are the table values after H3 sends its PATH message?
- Now suppose that host H4 wants to reserve bandwidth b with a no-filter filter. Show the reservation state (e.g., as in slide 2-38) after H4's reservation has been processed by all routers. Describe the sequences of actions in the routers as H4's RESV message is forwarded among the routers.

Problem 3. Q.2931, RSVP, SIP. Read the specification of SIP (Session Initiation Protocol) RFC 3261). (BE CAREFUL! It's a long document; you can skim or ignore many parts. But read carefully enough so that you have an idea how SIP works. If you are interested in a tutorial overview of SIP, you can try the SIP webpage). Answer the following questions.

- What are the similarities and differences between SIP and Q.2931?
- What are the similarities and differences between SIP and RSVP?
- What state is stored by SIP endpoints and proxies for a session?
- Would you say that SIP provides for separation of control and data? Why or why not?

Problem 4. LTE. Cellular data ISPs typically use network address translation to share a limited number of public IP addresses among a large number of subscribers. So let’s assume that mobile user
(UE) has a private IP address of say 10.0.0.5, as shown in the figure below of the LTE protocol stack, showing the cellular provider’s LTE core network between the eNodeB and the SGW through which the UE’s traffic is tunneled, as well as a remote web server (outside of the LTE network) that the user wants to access, say http://gaia.cs.umass.edu, with IP address 128.119.40.186.

Answer the following questions:

- Show the IP datagram address fields (for all IP packets – remember that tunneling and encapsulation occurs in this network) contained in the link-layer frame crossing the boundaries A, B, and C. In the cases where an IP packet is encapsulated within another IP packet, indicate the addresses of inner and outer IP packets.
- Why do you think that an IP datagram to/from the UE is tunneled between the eNodeB and the P-GW, rather than being routed directly from the UE to the P-GW without tunneling?

Problem 6. **Hard state.** Given our discussions in class, we would probably classify TCP as a hard state protocol, since it has explicit setup and teardown. What are the mechanisms that TCP uses that allows it to recover when there is a failure "on the other side" of the connection? To answer this question, you will need to use sources outside of our class reading (e.g., Steven's TCP IP Illustrated V1.)