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**15-441 (Fall 2012)
Question Set #4**

1. The current lab implements a BitTorrent style file sharing system.
 - a) Assume that you need to extend it to support on-demand video streaming of movies, describe at least one key change that you have to make to your current system. Please be sure to explain the nature of the change, how it affects the system, and why it is essential.

 - b) What is the most important parameter affecting the scalability of the system, as you proposed to modify it? What does this parameter affect? Why is it the most important?

2. A sequence of independent small file HTTP transfers encounters a very high overhead as compared to fewer transfers of larger files. However, for HTTP video streaming protocols, each video is segmented into a set of chunks and each chunk is delivered over a separate HTTP connection. If this represents a flaw in the design of these common HTTP-based streaming systems, please explain how their evolution, and the evolution of the related technologies, lead us into this unfortunate circumstance. If the overhead of the smaller transfer size is worth the cost, please explain the benefits and evaluate the trade-off.

3. DHCP is the most common technique to localize a mobile hosts network configuration. Most of us have enjoyed the benefits of this approach as we have roamed among various hot spots at airports, restaurants, and coffee shops – or even campus.
- a) Would this approach be appropriate if your intention were to use your laptop as a Web server? Why or why not?
- b) A "Mobile IP" approach can be used to provide for mobile server. Please draw a diagram that illustrates the mobile server, the clients, and other essential network components, e.g. Routers.
- c) Augment your drawing to include the path that the requests and replies take as a client makes a request of the mobile Web server and receives the reply.
4. Imagine an uber-ubiquitous CDN has servers deployed within each and every ISP on Earth. Also assume that this CDN utilizes a perfect mapping algorithm, that always maps a request to a CDN server within the same ISP. Are all requests from clients of this ISP for content served by the CDN satisfied by the CDN server(s) located at the same ISP? If so, explain what invariant(s) guarantee this. If not, explain what might cause the request to leave the ISP.

5. Consider *Onion routing*.

a) Why is the the path through the network slected by the client in advance, rather than on a hop-by-hop basis by the network?

b) Why is the distribution of public keys a critical challenge in onion routing?

c) On average, will the paths taken via onion routing be longer or shorter than optimal? Why?

6. Consider *Tor*.

a) Does *Tor* encrypyt traffic entering and/or exiting the system? If so, how? If not, why not?

b) Does *Tor* use a trusted source for distributing information about *Tor* routers? If so, why is this preferable or essential? If not, why not? And, what is done instead?