CSci 555 Midterm Exam

Fall 2012

Instructions:

Show all work. No electronic devices are allowed. This exam is open book, open notes. You have 100 minutes to complete the exam.

Please prepare your answers on separate sheets of paper. You may write your answers on the sheet of paper with the question (front and back). If you need more space, please attach a separate sheet of paper to the page with the particular question. Do NOT extend your answer on the back of the sheet for a different question, and do NOT use the same extra sheet of paper to answer more than one question. In particular, each numbered questions must appear on separate pieces of paper so that the exam can be split for grading. If you write part of your answer on the back of a page for another question, then the grader will not see the extra text for your answer and will not consider that part of your answer when assigning a grade.

Be sure to include your name and USC ID number on each page.

There are 100 points in all and 3 questions.

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1. (30 points) Matching

For each of the following characteristics, techniques, methods, or systems, match the numbered characteristics with the lettered method or system. This is not a one-to-one mapping. So more than one characteristic may match a method or system, and vice versa. We are looking for specific matches for which you will receive credit. If you list what is a minor or redundant match, while you will not lose credit, you will not get credit either. You will lose a point if you associated a method with a characteristic that does not apply to the method. There are more blanks in the page below than actual correct answers, so you do not need to fill in all the blanks.

1. Naming is global
2. Naming is centered
3. Naming is implemented iteratively
4. Uses broadcast (in one way or another)
5. Naming is host based

a) Amoeba: _____ _____ _____ _____
b) Prospero: _____ _____ _____ _____
c) Grapevine: _____ _____ _____ _____
d) Domain names: _____ _____ _____ _____
e) Email Addresses: _____ _____ _____ _____
f) URLs / The Web: _____ _____ _____ _____
g) Host tables: _____ _____ _____ _____
2. (30 points) Security

In three or four sentences each, describe the use or benefit of each of the following technologies for providing security in a computer system.

(5 points each)

a) Virtual Memory:

b) Capabilities:

c) Rings or User/System mode:

d) Encryption:

e) The Trusted Platform Module (TPM):

f) Virtualization
3. (40 points) Design Problem

You have been hired to design a system supporting the next generation of interactive management of vehicles (cars and trucks). Vehicles will keep track of data regarding use, navigation, location, and maintenance. Vehicle owners will be able to query such information, and send controls such as locking, unlocking, remote start, charging schedules, etc. Vehicles in proximity to one another will be able to exchange data to avoid collisions, and eventually to support automated operation (such as caravanning, etc). Data will be “crowd sourced” to learn about road conditions, maintenance issues, and realistic efficiency statistics. The system must be usable in both “infrastructure” mode, meaning that communication from the vehicle will be via cellular data channels to a central server, and in “ad hoc” mode, where communication with the vehicle uses available wi-fi and Bluetooth channels to communicate both with central infrastructure, but also with paired “apps” on customer owned devices such as smart-phones.

a. Naming (10 points) - What are the requirement for naming (and addressing) in the system you are designing? Will you provide a single approach to naming or more than one approach? Describe any approaches you decide to use (at the least, tell me if they are global, host-based, centered, or attribute based). What are the objects to be named and who or what will use those names?

b. Security (10 points) - What are the security issues that need to be addressed in the system you are designing? In particular what are the problems that can be caused by various attacks against confidentiality, integrity, and availability? For those attacks against confidentiality and integrity, list techniques that you might employ to protect the system. For attacks against availability, mention what in your system design will allow continued safe operation even when other parts of the system (communication) are not available?
c. Synchronization (10 points) - What kinds of data must be synchronized across different parts of the system. For each class of data, would you employ a weakly consistent or strongly consistent approach, why? Give one example of an application that requires atomicity, and identify the commit point in your implementation.

d. Scalability (10 points) - Once such systems are commonplace, there will be hundreds of millions of vehicles using such a system. Discuss the number of components that will interact for different “applications” or “functions” implemented by your system. Suggest your use of replication, distribution, and caching to ensure that the implementation is scalable (in part by reducing the number of interacting components for such applications or functions).