

CSE 4215/5431 Final exam  
Winter 2011  
April 7, 2011  
Instructor: S. Datta

Name (LAST, FIRST): \_\_\_\_\_

Student number: \_\_\_\_\_

**Instructions:**

1. If you have not done so, put away all books, papers, cell phones and pagers. Write your name and student number NOW!
2. Check that this examination has 12 pages. There should be 5 questions together worth 90 points.
3. You have 180 minutes to complete the exam. Use your time judiciously.
4. If you need to make an assumption to answer a question, please state the assumption clearly.
5. Show all your work. Partial credit is possible for an answer, but only if you show the intermediate steps in obtaining the answer.
6. Points will be deducted for **vague and ambiguous** answers.
7. Your answers MUST be LEGIBLE.

<p>Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.</p>
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1. (18 points) One of the major features of GSM is the seamless handling of mobility of users.
  - (a) (4 points) What part does the BSC (base station controller) play in handling mobility?
  - (b) (2+2 points) Why does GSM run different protocol stacks at MS, BTS, BSC and MSC? Why does the BSC run dual protocol stacks?
  - (c) (4 points) There are many reasons why a GSM network can provide quality of service guarantees while the Internet cannot. List two reasons for this that you think are the most important.

- (d) (4 points) How are signal strengths used in handover decisions in GSM? What are the tradeoffs in the choice of the handover margin value?
- (e) (2 points) GSM runs on devices as weak as old cellular handsets and as powerful as the latest iPhones and Blackberry phones. What does GSM do to ensure that devices that are not capable of sending and receiving at the same time can use GSM?

2. (18 points) This question is on satellite communications and broadcast systems.

(a) (6 points) What are the advantages and disadvantages of geostationary orbit satellites?

(b) (4 points) What is a broadcast disk? In what scenarios (not applications) is this most useful?

- (c) (6 points) Suppose that a company has a network of low earth orbit satellites and a network of geostationary orbit satellites. The former can provide better performance (e.g. lower latency) but at a higher cost (both compared to the latter). Suppose the company does not want to implement a GSM-like localization system for mobile users because continuous updates to HLR's would be too expensive. Describe how a mobile user can be localized and how locations can be cached and transmitted to minimize localization costs. Assume that mobile nodes can communicate with the LEO satellites but not the GEO satellites.

- (d) (2 points) What is the motivation for using highly elliptical orbit satellites?

3. (18 points) This question is on network layers for mobile communications.
- (a) (6 points) Explain the terms tunneling and reverse tunneling, and describe when/how they are used. What is the role of foreign agents (FA) in tunneling?
- (b) (4 points) To what extent does the cellular IP gateway (CIPGW) make mobility transparent to fixed nodes?

- (c) (4 points) Suppose mobile hosts need to exchange data. This can be done in two ways – directly between them (perhaps with all communication taking place on the wireless network) or through a fixed node (perhaps a server). Describe a scenario when the former is better (in terms of performance and for handling mobility) and a scenario when the latter is more preferable.
- (d) (4 points) What is the difference between soft state and hard state? How are routing table updates, path selection and packet delivery influenced by the choice of soft vs hard states in routing tables?

4. (18 points) This question is on the Transport layer.

(a) (4 points) Describe the main advantages and disadvantages of Snooping TCP.

(b) (2 points) Describe an advantage and a disadvantage of changing the TCP congestion control algorithm to a additive-increase-additive-decrease scheme in the wireless parts of the network.



- (c) (6 points) Describe how mobile TCP uses the flow control window to maintain continuous communication sessions between mobile hosts. Your answer must include what happens when a mobile host moves while the session is in progress.

- (d) (6 points) In almost all the scenarios we have assumed that the wireless hosts are connected through a wireless network to a wired network, i.e. from the point of view of a fixed node the wireless part is the last part of the path to a mobile node. Would solutions like Indirect TCP or Snooping TCP work if instead a path contained several wireless parts interleaved with wired paths? Give reasons.

5. (18 points) This question is on the Application layer and other general issues.
- (a) (4 points) In the CODA and Little Work file systems, to what extent does the applications developer have to think about mobility? How do these systems manage this?
- (b) (5 points) Describe the role of network and client proxies in improving performance of applications on mobile hosts. Include a few concrete tasks these proxies perform.

- (c) (4 points) We have read that the level of security provided in cell phones (e.g. GSM) may be less than what is usually implemented on fixed nodes. What can a cell phone company do to add extra security to its users wishing to do ecommerce over phones?

- (d) (5 points) Suppose you were designing an alternative for TCP for a network of cars. Recall that cars can move fast and battery power is not a big concern. Cars pass by each other and exchange data as they come within range of each other.

What kind of a transport protocol are you going to design to maximize performance and why? Your network should perform as a stand-alone network and need not interface with existing cellular and satellite communication networks.

Use this page if you need extra space