University of Waterloo

ECE 750-T4 Final Exam, Spring 2009

ECE 750-T4 – Protocols, Software and Issues in Mobile Computing

Instructor: Sagar Naik

Date and time: August 7, 2009, 9:00 AM—11:30 AM

Room: DWE 3516

Instructions

- **You have 2.5 hours to complete the exam.**
- **This is a closed book exam.**
- **Should there be a need, make an assumption and proceed.**

Question	Marks
Q1. GSM + Channel Assignment	**/25**
Q2. Broadcasting Techniques + Ad Hoc Networks	**/25**
Q3. Mobile IP + Mobile TCP + Environment Awareness	**/30**
Q4. General	**/20**
Subtotal Bonus (for legibility and conciseness)	**/100** / 005
Total	**/100**

Student ID **Student Name** **Student Signature**

Best wishes …

1. GSM + Channel Assignment 25

a. [8] Draw the functional architecture of the GSM communication system and briefly explain all the network elements.

b. [5] Explain the concept of a *physical channel* in the GSM communication system. Show the detailed calculation of the data rate of a full physical channel. (A frame is 4.615 ms long and a slot carries 114 bits of user data.)

c. [12] Clearly explain the Geometric dynamic channel assignment protocol. Give a strategy to implement it in GSM networks and discuss its signaling cost.

2. Broadcasting Techniques + Ad Hoc Networking 25

a. [16] Clearly explain a *counter-based probabilistic protocol* for performing message broadcast in ad hoc networks. Discuss the advantages of the protocol and the difficulties faced in estimating the operational parameters of the protocol.

b. [9] Compare the DSDV and AODV protocols by identifying *three* comparison metrics.

3. Mobile IP + TCP + Environment Awareness 30

a. [7] Clearly explain how host mobility is supported with mobile IPv4.
b. [7] Clearly explain the operation of the I-TCP protocol.

c. [16] Modern processors and wireless network interface cards (WNIC) have power saving features. For example, if the WNIC module remains *idle* for more than a certain length of time, then it is switched to a power saving mode such as *sleep* or *off*. A sleeping/off WNIC card saves much energy compared to being idle, and it is brought back to *active* mode after a fixed or tunable time interval. Assume that a wireless handheld device with a WLAN interface is used in downloading streaming media from a YouTube site on the Internet.

By using the concepts of agents (an agent is a general term to denote a home agent, foreign agent, proxy, or supervisory host), buffers, and I-TCP, **give a system model and a protocol to save energy** in wireless handheld devices in YouTube download applications.

4. General (5x4) 20

(1) In the GSM system the time lag between an uplink channel and a downlink channel for the same user is 3 time slots so that the transceiver module of user handsets can operate in half-duplex mode. What are the implications of making the time lag too short (say, 5 microseconds) or too long (say, 1 minute)?

(2) Compare and contrast the ideas of *jitter* and *RAD* in broadcast protocols.

(3) Assume that all the nodes of an ad hoc network are equipped with GPS (Global Positioning System) receivers to know their own absolute locations. Explain how you could modify the dominant pruning broadcast protocol to take advantage of node locations.

(4) How do user devices in wireless local area networks and GSM networks know that they have moved?

(5) Better performing communication systems and applications can be designed by continually monitoring device and network parameters. Give two examples of device parameters and two examples of network parameters that you want to measure, and explain their importance in system design.

Thank you for taking this course… Enjoy the summer break …