UNIVERSITY OF DUBLIN CS4CT91

TRINITY COLLEGE

FACULTY OF ENGINEERING & SYSTEMS SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

B.A. (Mod.) Information and Communications Technology
Senior Sophister Examinations

Trinity Term 2002

4ICT9 MOBILE COMMUNICATIONS

Wednesday, 29th May 2002 GMB 9:30–12:30

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Attempt **four** questions out of six.
Attempt at least **one** question from each section.
Please use separate answer books for each question.

SECTION A

Q 1.

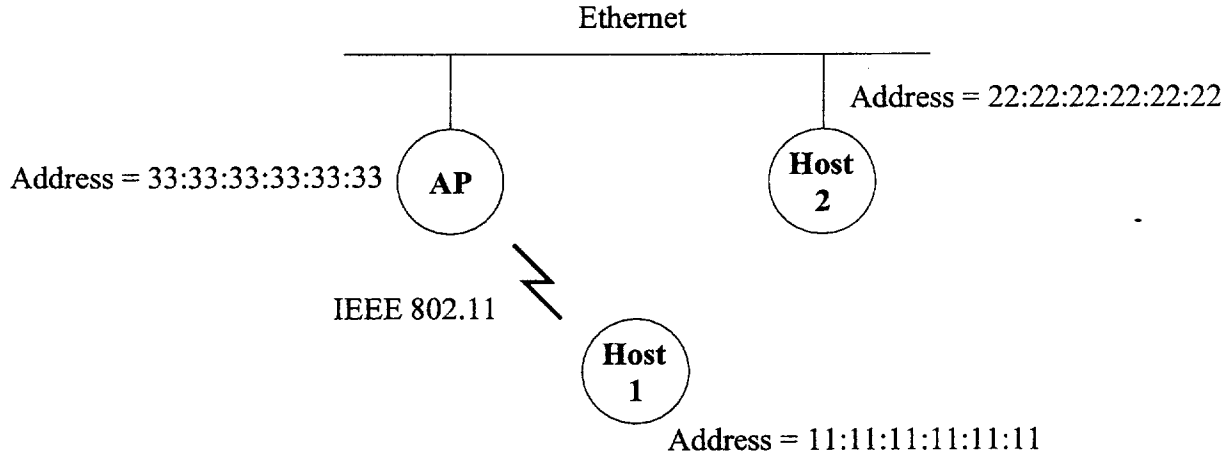
(a) Describe the fundamental aspects of wireless transmission and detail how they may be combined to form wireless communications networks.

(b) Wireless Internet services are often hailed as the future of mobile communications. Third-generation (3G) systems are critical to the provision of these services. Discuss.

Where appropriate, clearly labelled diagrams should be used to illustrate your answers.

Q 2.

(a) Consider a LAN that includes IEEE 802.11 and Ethernet segments as shown below. The MAC-layer address for each host and the access point (AP) is shown in the diagram.



Host 1 wishes to send a frame to Host 2. Specify the values of the address fields used in the IEEE 802.11 frame sent by Host 1. If a field is not used, leave that address blank. Give a brief explanation of what each address field represents.

(b) The beacon serves a number of functions in an IEEE802.11 WLAN. Considering only infrastructure networks, list the three MAC functions for management and/or data transfer that involve the beacon message. For each, briefly indicate the role of the beacon for that function.

(c) The board of Westland Ltd have decide to install a wireless LAN in their main office building. The IT department has yet to decide which wireless LAN technology to use, but have narrowed their choice down to IEEE802.11 and Bluetooth. You have been asked to conduct tests to compare and contrast these two technologies. Outline some of the tests you would perform and what you would expect them to demonstrate.

SECTION B

Q 3. Mobile IP for IPv4 has the aim of enabling seamless mobile networking and computing so that network-dependent activities are not disrupted when devices change their point of attachment to the Internet. The proliferation of network-dependent computing devices has led to IPv6 being designed and proposed as a possible solution to the current global scarcity of IPv4 addresses. Mobile IPv6 has been proposed as a mechanism to enable seamless mobile networking in IPv6-based networks.

- Briefly describe the two-tier addressing scheme used in Mobile IP for IPv4.
- Why is it necessary to authenticate certain messages in Mobile IP for IPv4? Briefly describe how this is done.
- Briefly detail the features of IPv6 that may enable the expansion of global networking.
- Describe in detail both the Mobile IPv6 Notification and Tunnelling/Routing processes, noting the differences with the equivalent processes in Mobile IP for IPv4.

Where appropriate, clearly labelled diagrams should be used to illustrate your answers.

Q 4. There are a number of service discovery protocols, such as Jini, UPnP and the IETF's SLP, in various stages of development, deployment and adoption. These service discovery protocols are frameworks that define structures and mechanisms for client-service interaction with the ultimate aim of simple, seamless and scalable service provision.

Discuss how the networking environment is changing and the effect that this is having on the supply of services that both currently exist and are proposed for the future.

Taking only one of the above-mentioned protocols:

- Briefly discuss the dependence of the chosen protocol on existing Internet standards, noting any associated benefits or drawbacks that arise from this.
- Provide a detailed overview of the architecture of the chosen protocol. In doing so, identify the features of the protocol that allow for the description, querying and provisioning of services.
- Briefly describe a scenario that illustrates an appropriate use of the chosen protocol.

Where appropriate, clearly labelled diagrams should be used to illustrate your answers.

SECTION C

Q 5. An Irish Bank hopes to become a leader in the deployment of mobile "Smart Purse" technology. You are contracted to provide them with technical advice, analysis and recommendations on system and platform requirements.

A "Smart Purse" can be viewed as an electronic device that can store "credit" – similar in concept to an electronic purse. The purse can have credit added to it or removed from it across an air interface. For instance, the purse may be incorporated into a mobile telephone and credit may be added by telling the device to "charge" itself on passing a suitably equipped ATM. Similarly, a suitably equipped retailer Point-Of-Sale terminal can "debit" the purse upon authorisation from the owner.

The deployment has the following requirements:
Be designed to function optimally using GPRS and 3G technologies;
Provide legacy support using existing 2G and WAP technology.

Your deliverable is a report that succinctly outlines possible solutions and associated problems, identifies the optimum solution(s), thoroughly documents the salient technical aspects of the proposed solution and its interactions, and provides a detailed technical basis for management to make an informed decision.

Note:
You may assume that the local mobile telephony service providers offer GSM, SMS, WAP, mobile positioning and GPRS support and will offer 3G support.
You may assume the mobile purse device has a bluetooth interface.
You should also consider the following factors: security, authentication, mobility support and transaction logging.

Q 6. The Global Positioning System (GPS) is a technology infrastructure that provides positioning information using a network of satellites. It is used for both commercial and domestic purposes.

Provide a detailed technical description and analysis of the GPS system – commenting particularly on its accuracy and explaining techniques by which accuracy can be improved.

You should address such usages as (i)mobile handset positioning, (ii)surveying, and (iii)aviation usage – commenting on the suitability of the GPS system in each scenario.

Where appropriate, diagrams should be used to illustrate your answer.