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 2003

4ICT9 MOBILE COMMUNICATIONS

Tuesday, 3rd June 2003 SAMUEL BECKETT ROOM 09:30 – 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. Global access and delivery of information services of all possible kinds to the mobile community at large can be seen as a vision of third generation mobile systems.

Delivering this 3G future will depend on user expectations and application development, and will have implications for the type of service provided. The evolution of internet protocols and the guarantee of quality of service are seen as critical technical issues in the development of 3G. Discuss.

Where appropriate, clearly labelled diagrams may be used to illustrate your answer.

Q 2. The Super Sibling television program places a number of contestants in a fixed location called the Super Sibling House. The contestants live in this house for a number of weeks and one contestant is evicted from the house each week. The contestant to be evicted is chosen by viewers from a shortlist drawn up using votes cast by those living in the house. Nominations are collected in the following way: Each contestant enters the Diary Room on their own and while there must nominate two contestants they would like to see evicted from the house. The rules for the eviction process are clear: Contestants are not allowed to discuss possible nominees for eviction with each other or with those outside the house. Moreover, they must not be able to hear what is being said in the Diary Room.

The program makers have decided to design a new Super Sibling House for the next series. They are very concerned about the recent growth in mobile and wireless communications, fearing that contestants will be able to use such technologies to circumvent the rules governing the eviction process.

You have been called on to act as a consultant in the design of the new Super Sibling House. Your brief is to explore possible mobile and wireless communications methods that contestants may attempt to use to break the eviction process rules and to suggest cost effective ways in which the building may be constructed to limit the chances of such communication occurring.

Write a technical report outlining how wireless communication can occur and detailing how these methods are used in the formation of wireless communications networks. Identify possible design features for the house that would help to restrict the likelihood of such communication occurring should contestants succeed in smuggling any necessary devices into the house.

SECTION B

Q 3. *Mobile IP was designed with the aim of providing seamless mobile networking and computing so that network-dependent activities are not disrupted when devices change their point of attachment to the Internet. Mobile IP exists in two main variants, Mobile IPv4 for IPv4-based networks and Mobile IPv6 for IPv6-based networks.*

(i) Briefly describe the two-tier addressing scheme used in Mobile IPv4.

(ii) Describe the Mobile IPv4 processes that allow mobile computing devices to detect a change in their point of attachment to the Internet and to discover Mobile IPv4 agents when they have detected such a move.

(iii) Briefly describe the features of IPv6 that may enable the expansion of global networking.

(iv) Describe both the Mobile IPv6 Notification and Tunnelling/Routing processes, noting the differences with the equivalent processes in Mobile IPv4.

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

Q 4. Both (a) and (b) must be attempted

(a) The use of both IEEE 802.11 enabled devices and Bluetooth enabled devices has become more widespread in recent years. Both of these technologies attempt to provide varying levels of wireless connectivity and data services to users.

Briefly discuss both of the above-mentioned technologies under **3** of the following headings, comparing and contrasting them where relevant:

(i) Radio frequency spectrum usage

(ii) Data speeds and communication range

(iii) Network formation and medium access control

(iv) Current or foreseen usage scenarios

(b) *In the absence of fixed, centralised, infrastructure-based networks such as the Internet or a LAN, there is perceived need for mobile computing devices with wireless communication abilities to have in-built mechanisms that enable the formation of dynamic temporary ad hoc networks. The route discovery mechanisms that enable such ad hoc networks have evolved from the routing mechanisms employed by the original static, wired, hierarchical networks.*

Outline the evolution of these route discovery algorithms, highlighting the effects that changes to underlying network characteristics have had on the design of new and evolving route discovery algorithms.

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

SECTION C

Q 5. The year is 2006 and 'Big Brother' is watching you. The Irish Government's 2003 data retention bill is enshrined in law and virtually all electronic information produced by, or pertaining to, you is being retained for up to seven years and being analysed and mined extensively. State, semi-state and commercial bodies have largely unfettered access to this information. The incumbent Government is still not satisfied. They want more. In particular they want to be able to track, in real time, the movements of all citizens within the state. The purported justification is the implementation of pre-emptive crime prevention measures.

The Government is also extremely interested in newly developed microscopic tagging technology. Such technology incorporates a fully functional positioning device, with memory, in a 3 millimetre, sterile, hermetically sealed capsule. The positioning device can both transmit and receive across existing mobile telephony networks and can receive satellite transmissions. The device also contains identifying information that uniquely and irrevocably identifies each capsule and, thus, its bearer. In the future, all citizens may have these capsules inserted at birth or in lieu of traditional passports.

You have been commissioned to produce a detailed technical analysis to support the Government position and identify possible solution(s). Your analysis should be as complete as possible and address, but not be limited to, the following issues:
(i) possible approaches; (ii) technical feasibility; (iii) accuracy; (iv) social issues.

Note:
You may assume that the local mobile telephony service providers offer GSM, SMS, WAP, mobile positioning, GPRS and 3G support.
You may assume the GPS satellite network now provides global WAAS and LAAS data.

Q 6. Secure Sockets Layer (SSL) is a technology that provides encryption, integrity and authentication services for data traffic on the Internet. Newer standards such as Transaction Layer Security (TLS) and Wireless TLS (WTLS) have evolved from SSL.

Provide a detailed technical description and analysis of WTLS.

In doing so you should show how it evolved from SSL and TLS. You should also highlight, and comment on, the strengths and weaknesses of each approach, with particular emphasis on WTLS. Where appropriate, diagrams should be used to illustrate your answer.