



UNIVERSITY of LIMERICK

O L L S C O I L L U I M N I G H

COLLEGE of Science and Engineering

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	2008/2009	Semester:	Spring
Module Title:	Telecommunication Networks Architectures	Module Code:	CS4228
Duration of Exam:	2½ Hours	Percent of Total Marks:	85
Lecturer(s):	Dr Séamus O'Shea	Paper marked out of :	100

Instructions to Candidates:

Answer any 3 questions.

Q1.

- Consider the air interface in a GSM digital mobile network. Describe the multiplexing schemes used by GSM on the air interface to optimise the use of the available spectrum. What constitutes a physical channel? (4 marks)
- Briefly discuss the purpose of the common downlink control channels. (4 marks)
- Describe the features of the SACCH. What use does a GSM MS make of the SACCH? Compare the bandwidth of the SACCH with that of its associated traffic channel. (5 marks)
- Briefly describe the process of handover. Give examples of events which may lead to a handover. (4 marks)
- When an MS is instructed to perform handover, what are the first signals it exchanges with the new BTS? (4 marks)
- What control channel is used between an MS and a BTS in the process of handover? Briefly indicate how this channel is implemented. (5 marks)
- Suppose an ongoing telephone call requires a handover which involves a new MSC. Describe the features of this type of handover, alluding especially to the role of the MSCs. (7 marks)

Q2

- (a) Give three examples of data that are stored on the GSM SIM card within the MS, and for each explain how that data is used by the network. When the MS is used in a foreign PLMN, how does the serving PLMN discover the HLR of the visiting MS? (5 marks)
- (b) Explain what a 'location area' is. Describe the advantages of keeping location-related data for each MS on a cell basis rather than on a location area basis. Any disadvantages? (5 marks)
- (c) How does an MS, in the process of roaming, discover that a location area update may be necessary? (4 marks)
- (d) Give examples of events which may lead the GSM network to force an MS to perform location area registration. (5 marks)
- (e) Suppose an O₂-registered business-man, normally resident in Limerick, goes to Rome on a business trip. On arrival in Rome, he makes a mobile call to arrange a Taxi. While in Rome, a friend, in Limerick, dials the business-man's mobile number using a fixed telephone. Describe the major steps involved in connecting the friend's call, making special reference to how the location of the called party is established. (7 marks)
- (f) In relation to (e) above, draw a diagram to show the SS7 protocol stack configuration in each interacting node involved in the call set up. (7 marks)

Q3.

- (a) Draw a diagram to show the relationship between MAP, TCAP, SCCP, and MTP in the SS7 protocol stack. (4 marks).
- (b) What services does TCAP provide?. Give examples of Database transactions which use TCAP services, both in fixed and mobile networks. (5 marks)
- (c) Describe the TCAP API available at the service interface. (5 marks)
- (d) If TCAP requires a connection oriented SCCP transport service, how is this invoked at the service interface. Give an example of an event which may require this type of service. (5 marks)
- (e) Suppose the serving MSC in a foreign PLMN requires to retrieve your service profile from your home HLR. MAP on the MSC specifies the TCAP remote operation and initiates a dialogue with the HLR, while TCAP invokes a class 0 connectionless transport service. Draw a diagram to show the structure of the SCCP UDT message which is received at the home HLR. In particular show how the MAP, and TCAP messages are encapsulated in the UDT message, and show also the UDT header fields. When there are several TCAP users present on the target node, how does TCAP at the destination decide which user should receive the message? (9 marks)
- (f) Give an example of a situation where there may be several concurrent TCAP dialogues in existence between a pair of SS7 nodes. (5 marks)

Q4

- (a) Describe the speech encoding process used in GSM. What is the sampling rate and how many bits are used to encode each sample? After compression, what is the resulting data rate? (5 marks)
- (b) Discuss the role of interleaving over the air interface in GSM and also in VOIP. (5 marks)

- (c) Draw a diagram to show the contents of a normal transmission burst from an MS in GSM. Briefly explain the purpose of each field. How many bursts are required to transmit 20 msec worth of interleaved speech? (5 marks)
- (d) How is the maximum cell size in GSM determined by the MS's initial transmission burst on the RACH? (6 marks)
- (e) Mobile users can be variable distances from the BTS with which they communicate. What are the implications for the MS? How are those effects addressed in GSM? (6 marks)
- (f) How are the hazards of the mobile wireless channel minimized in GSM? Refer especially to the use of the training sequence. Give examples of how diversity techniques can be helpful. (6 marks)

Q5.

- (a) Compare the 'Intserv' and the 'Diffserv' approaches to QoS provision in the developing Internet, alluding to the advantages and disadvantages of each approach. (8 marks)
- (b) Outline some of the measures that can be taken, on an end-to-end basis, to alleviate the effects of 'best effort' IPv4 transport of streamed audio or video material. (4 marks)
- (c) How does Weighted Fair Queueing (WFQ) router scheduling differ from the traditional FIFO discipline? (5 marks)
- (d) What is the role of RSVP in implementing both 'Intserv' and 'Diffserv' QoS in IP networks? (6 marks)
- (e) Give an example of a situation where content to be streamed may originate at several sources, and may have to be delivered to several receivers. Describe the role of RSVP in this type of situation. (6 marks)
- (f) What is the purpose of the 'Path' and 'Resv' messages in RSVP? (5 marks)