**MANCHESTER METROPOLITAN UNIVERSITY**

**FACULTY OF SCIENCE AND ENGINEERING**

**DEPARTMENT OF COMPUTING & MATHEMATICS**

SESSION 2014/2015


Examination for:
Computer and Network Security

UNIT 6G7Z1004 Advanced Computer Networks and Operating Systems

Date: 12 January 2015

Time: 09:30

Instructions to Candidates

1) Answer FOUR QUESTIONS.
    a. TWO questions from PART A (1-3), AND
    b. TWO questions from PART B (4-6)
2) Marks for parts of questions are shown in brackets.

Students may use their own calculators subject to standard Faculty conditions.

## Part A

**Question 1:**

I. Consider two mobile nodes in a foreign network having a foreign agent. Is it possible for the two mobile nodes to use the same care-of address in mobile IP? Explain your answer. **[5]**

II. Consider the following idealised LTE scenario. The downstream channel is slotted in time, across *F* frequencies. There are four nodes, A, B, C, and D, reachable from the base station at rates of 10 Mbps, 5 Mbps, 2.5 Mbps, and 1 Mbps, respectively, on the downstream channel. These rates assume that the base station utilises all time slots available on all *F* frequencies to send to just one station. The base station has an infinite amount of data to send to each of the nodes, and can send to any one of these four nodes using any of the *F* frequencies during any time slot in the downstream sub-frame.

If there is a fairness requirement that any node can receive at most twice as much data as any other node during the sub-frame. What is the average transmission rate by the base station (to all nodes) during the subframe? Explain how you arrived at your answer. *Hint***,** to calculate the average transmission rate for one node only is enough **[10]**.

III. You have a depot in an industrial area without carrier fibre optics. You have 1,000 buses that return to the depot every evening and upload video to a remote site. Each bus has 10 hours of 384 kbps video. Data goes via WiFi (wireless LAN) from each bus to a depot server, and then to the remote server.

Calculate the minimum bandwidth required for all data to transmit in 2 hours **[7]**. Choose between DSL and 4G wireless access. Which of these two can handle it? If they can not, what do you need **[3]**?

**Question 2**

I. Suppose an organisation uses VPN to securely connect its sites over the Internet. Jim, a user in the organisation, uses the VPN to communicate with his boss, Mary. Describe one type of communication between Jim and Mary which would not require use of encryption or other security mechanism, and another type of communication which would require encryption or other security mechanisms. Explain your answer. **[6]**

II. Both the hidden and exposed terminal problems lead to degradation of throughput. Explain how. **[8]**

III. Information is the fuel that powers the twenty-first-century economy, and for most businesses, mission-critical information is housed in applications. The problem is that those applications could be anywhere, in-house, in a private cloud, a public cloud or even in a mobile app. If workers can't efficiently access those applications, the value of the information within erodes. Traditionally, to connect employees with business-critical information, businesses have had two choices: deal with the congestion that plagues the public Internet, or invest in expensive WAN Optimisation hardware. Recently, Network as a Services (NaaS) has been proposed to provide reliable access to cloud networking resources and to help distributed employees stay productive.

a. Explain what is meant by NaaS. Give an example of a platform used for provisioning network resources **[3]**
b. Discuss how NaaS offers optimisation of resource allocations by considering network and computing resources as a unified whole. **[4]**
c. List two *other* advantages/benefits of NaaS. **[4]**

**Question 3**

I. One proposed solution to allow mobile users to maintain their IP addresses as they moved among foreign networks was to have a foreign network advertise a highly specific route to the mobile user and use the existing routing infrastructure to propagate this information throughout the network. We identified scalability as one concern. Suppose that when a mobile user moves from one network to another, the new foreign network advertises a specific route to the mobile user, and the old foreign network withdraws its route. Consider how routing information propagates in a distance-vector algorithm (particularly for the case of interdomain routing among networks that span the globe).

a) Will other routers be able to route datagrams immediately to the new foreign network as soon as the foreign network begins advertising its route? Explain. **[4]**

b) Is it possible for different routers to believe that different foreign networks contain the mobile user? **[5]**

c) Discuss the timescale over which other routers in the network will eventually learn the path to the mobile users. **[4]**

II.

a) A network link between two buildings consists of two routers and an optical fibre cable. The availability of each router is 0.9 and the availability of the cable is 0.99. Determine the overall availability of the link. **[1]**
b) If a second link, with similar components, is connected in parallel with the first link determine the overall availability of the parallel link. **[2]**
c) If one of the links can carry all non-peak traffic but only 60% of peak traffic determine the functional availability of the dual link for both non-peak and peak traffic. **[5]**
d) If peak periods accounts for 70% of the communication requests, determine the overall functional availability for all time periods. **[4]**