DUBLIN INSTITUTE OF TECHNOLOGY

DT211 BSc. (Honours) Degree in Computing

Year 4

DT228 BSc. (Honours) Degree in Computer Science

Year 4

SUPPLEMENTAL EXAMINATIONS 2014/2015

Distributed Systems [CMPU4021]

[DT211/4, DT228/4]

Ms. E. Hatunic-Webster
Dr. D. Lillis
Mr. T. Nolan – DT211
Mr. K. Foley – DT228

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Time allowed: 2 hours

Attempt **3 questions**
All questions carry **equal** marks
One complimentary mark is available

1. (a) Describe and illustrate with examples the *mobile agents* architectural model.

(8 marks)

(b) An enterprise application uses a mix of fixed and mobile clients to deliver services to its customers. List and discuss the four key challenges faced by the distributed system, and suggest how these challenges can be met.

(12 marks)

(c) Explain the purpose of *MobileIP* and with the help of a diagram outline its operation discussing in detail the roles of the *home agent*, *foreign agent* and *care-of-address*.

(13 marks)

2. (a) Explain the term *middleware* as it applies to distributed systems and discuss the services it provides. Use examples to illustrate your answer.

(8 marks)

(b) Consider a design for an application that would need to be distributed across at least three computers.

Discuss which *middleware* products would be suitable for linking the distributed parts.

(12 marks)

(c) Consider the code below that sends a packet containing the string "Hello DIT" to another process:

```
import java.io.*;
import java.net.*;

public class q2c {

      public static void main(String[] args) {
            try {
                  DatagramSocket datagramSocket =
                        new DatagramSocket();
                  DatagramPacket packet =
                        new DatagramPacket("Hello DIT".getBytes(),
                        5, InetAddress.getLocalHost(),11114);
                  datagramSocket.send(packet);
            } catch(Exception e) {}
      }
}
```

Provide the code for the process which will receive the packet and print out the string.

(13 marks)

3. (a) Describe, using examples, what is meant by the terms *marshalling* and *unmarshalling* in relation to distributed systems.

(8 marks)

(b) A software team wishes to develop a distributed application using Java RMI. Part of the design specification includes the following:

- Initially the *rmiregistry* will be used as the naming service. However, future system changes may involve migrating to a new naming service. The application should be designed in such a way as to minimise the impact of this possible change.
- It is foreseen that there will be numerous updates of remote objects once the application has been deployed. Clients will need access to these updated remote objects with minimal disruption.
- Remote objects will need to proactively contact the clients when certain events occur.

Discuss the facilities you would use to address each of the above three design criteria explaining how they would meet the design specifications.

(12 marks)

(c) Describe the *three* different types of *invocation semantics* for remote objects and discuss how and why each of those invocation semantics could be implemented in a middleware platform intended to support Remote Method Invocations.

(13 marks)

4. (a) Describe the failure model for which commit protocols are designed to work in. Explain the main difference between one-phase and two-phase commit protocol.

(8 marks)

(b) With the help of a diagram discuss the operations of *two-phase commit protocol* in distributed transactions.

(12 marks)

(c) Discuss why security is critical for networked Java applications and in particular for Java *mobile code* such as Java applets. Explain in detail the role and composition of the Java *sandbox* in providing this security.

(13 marks)