

OLLSCOIL NA hÉIREANN
The National University of Ireland

NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATION 1998

FOURTH YEAR EXAMINATION

[CT414]

DISTRIBUTED SYSTEMS

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Candidates are required to answer five questions, at least two from each section.
All questions carry equal marks.
Time allowed: Three hours.

SECTION ONE

1. Develop an executive summary of the main issues involved in the transformation from stand-alone to distributed systems in the context of a hypothetical Irish Small to Medium-sized Enterprise.
2. Discuss in general terms the question of security in distributed systems, treating of several different forms of security in the course of your answer.
3. Discuss in detail the main algorithmic elements of the DES or of the RSA algorithm. When would you specifically recommend the use of your chosen algorithm and why would you so recommend?
4. Give your understanding of the terms 'intranet' and 'extranet', and develop from these explanations a discussion of reliable networking as a critical substrate for successful distributed systems.

SECTION TWO

5.a: Explain briefly how failure recovery mechanisms might cope with the following situations:

- Processor crashes
- Communications failure
- Media failure
- Process failure
- Deliberate *aborts* by users

4 MARKS

b: Outline and discuss the three basic methods of achieving *serial equivalence* in the context of concurrent transaction processing.

8 MARKS

c: Describe the main properties of a *transaction*. Explain how, using the two-phase commit protocol, an atomic commit might be achieved in a distributed system.

8 MARKS

6.a: Describe the semantics of a typical synchronous *Remote Procedure Call* operation. Based on this description, show how an RPC library might implement these semantics on top of a connection-less transport layer (like UDP). In particular, show how this supports *non-idempotent* operations.

8 MARKS

b: Using the JAVA RMI Model and the *rmic* compiler - outline the design of an *ftp* type service called the Simple File Management Service, which will be used to manage the files available on a remote file server.

- The service can be used by authorised users to browse, upload and download files as required (assume that files are serializable objects).
- Files are owned by a particular user and can only be deleted by that user.
- Design should incorporate a *capability* based security mechanism for access to any privileged remote methods (e.g. file deletion), initial user validation can be done using a password.

Full implementation classes are not required but answer should include the necessary JAVA interfaces and specify what classes would be automatically generated by *rmic* in this case.

12 MARKS

7.a: Outline the basic purpose of name resolution services. Using the CORBA standard name service as an example, show briefly how a client program could utilise this service. 4 MARKS

b: Explain the functionality and usage of the following CORBA Components:

- ORB Core
- Dynamic Invocation Interface
- Interface Definition Language

8 MARKS

c: Describe a suitable set of CORBA interfaces that could be used to manage distributed multimedia data streams. In particular, outline the steps required (and the interface interaction) during stream establishment.

8 MARKS

8.a: Outline briefly the main differences between server initiated and source initiated load balancing systems. Why are source initiated systems more common ?

4 MARKS

b: Explain the terms *transfer policy*, *information policy* and *placement policy* as used in distributed systems. Discuss their operation in detail, using appropriate examples where necessary.

8 MARKS

c: Describe how *flooding* might occur in a distributed system and what steps should be taken to avoid flooding processing elements with jobs ?

8 MARKS