UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering & Systems Sciences

Department of Computer Science

BA(Mod.) Computer Science
Senior Sophister Examination

Trinity Term 1998

4BA8 - Distributed Systems

Monday 25th May Luce Hall 14.00 - 17.00.

Mr. Brendan Tangney, Mr. Stephen Barrett, Dr. Vinny Cahill

Answer 5 Questions

1. Why are distributed algorithms difficult? Illustrate your answer using the American Airlines pre-computer ticket reservation system.

2. Design an algorithm to implement a name server for a distributed system. The server must be implemented as a number of co-operating nodes which co-ordinate with each other to present a consistent view of the name space to clients. The description of the name server should include an Orbix IDL definition of the client-server and server-server interfaces as well as a psuedo-code description of the main algorithms used in the server.

3. In the MACH IPC mechanism what is the purpose of each of the following: out of line data; send once rights; port message queue; handoff scheduling and port data set.

   Explain in detail how MACH send port rights are transmitted across the network.

4. Outline the facilities that should be provided by any toolkit that supports the use of process groups to build distributed applications.

Outline the design of a bulletin board system to be implemented using ISIS process groups and providing the ability to read a message posted to one of many news groups; post a new message; and follow-up to an existing message. Pay particular attention to the choice of the most appropriate multicast primitive for each operation.

5. Design an algorithm for taking a consistent checkpoint of the state of a set of communicating processes. The algorithm should be initiated when one of the processes decides to checkpoint and should attempt to minimise the number of processes that need to checkpoint. Remember that the state of a distributed system is consistent when no message has been received that has not also been sent in that state.

6. Outline the design of a new theatre/concert ticket booking system for use in a retail ticket outlet (e.g. HMV, Virgin, etc). The system should be designed to interwork with existing systems operated by individual venues to keep track of ticket sales for that venue. The system should be designed to provide appropriate levels of performance, robustness, security, and scalability.

Your solution should emphasise what you perceive to be the main requirements on the system and the choice of an appropriate distributed systems paradigm (or paradigms) for implementing the system.

7. Answer **all** of the following.

i) What is meant by each of the following types of transparency: access; location; concurrency; failure; execution.

ii) In the GNS naming system why is the table of well-known identifiers maintained?

iii) What is a "nested transaction" and why is support for nested transactions particularly useful in a distributed system?

iv) Compare and contrast logical time with vector time.