The University of Melbourne
COMP90015 Distributed Systems: Principles and Paradigms
Semester 2, 2014 Final Examination

Department of Computing and Information Systems
COMP90015 Distributed Systems: Principles and Paradigms
Reading Time: 15 minutes
Writing Time: 3 hours

Open Book Status: Closed Book

This paper has 3 pages including this page

Identical Examination Papers: none
Common Content: none

Authorized Materials:
No materials are authorized.

Instructions to invigilators:
No papers may be taken from the exam room.

Instructions to students:
All answers are to be written in the script book(s) provided. Attempt all questions - partial credit is available. The examination is worth 60% of the subject assessment.

Paper to be held by Baillieu Library: no

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Q.1. (**a**) [**1 marks**] When considering the definition of a distributed system, a *computer network* in unto itself is often **not** said to be a distributed system. Why is this the case?

(**b**) [**1 marks**] What is the difference between *availability* and *reliability*?

(**c**) [**3 marks**] Instead of having an non-shared printer attached to each computer in a computer network, a single printer can be used and shared among all of the computers.

i. Is this an example of a distributed system? Explain.

ii. Explain a reason for, and a reason against this approach.

Q.2. [**5 marks**] List and briefly explain four general approaches to *failure handling* in a distributed system. Give an example for each approach.

Q.3. (**a**) [**4 marks**] What is an *architectural model*? In your explanation include the important aspects or steps when developing an architectural model.

(**b**) [**4 marks**] What is a *fundamental model*? In your explanation discuss three aspects of distributed systems that are described using a fundamental model.

(**c**) [**2 marks**] Explain the following classes of failure:

i. Fail-stop

ii. Crash

iii. Omission

iv. Arbitrary

Q.4. [**3 marks**] Consider a server process that has a single TCP server socket, bound and listening on port 4242.

(**a**) While listening for incoming TCP connections on port 4242, can the process also receive UDP packets on port 4242?

(**b**) Assuming that each client is connecting from a different host, what operating system aspect limits the number of concurrent client connections that the server process can handle?

(**c**) Assuming the server process has 5 concurrently open connections from clients how many ports does the server process require? Explain your answer.

(**d**) Is it possible for a client to connect from port 4242 to the server process? Explain your answer.

Q.5. [**2 marks**] What is a benefit of XML over JSON format? What is a benefit of JSON over XML format?

Q.6. [**5 marks**] Explain the exchange protocol used in the first project. Draw an interaction diagram and explain the messages that are sent. What was the purpose of using a *counter*?

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Q.7. (a) [**2 marks**] Discuss two advantages and two disadvantages of using high level middleware (e.g. Java RMI middleware) compared to socket APIs in a distributed system.

(b) [**4 marks**] Describe the *Tuple Space* paradigm. Use a diagram and include a description of the API used in a Tuple Space.

(c) [**4 marks**] Describe the *Publish/Subscribe* paradigm. Use a diagram and include and include a description of the API used in a Publish/Subscribe system.

Q.8. (a) [**4 marks**] Discuss *centralized* and *decentralized* architectures for distributed load management. Critically compare them.

(b) [**1 marks**] Explain the difference between *virtualization* and *emulation*.

Q.9. (a) [**3 marks**] Explain what is a *digital certificate* and what is a *certificate chain*.

(b) [**3 marks**] Give three *worst-case* assumptions when designing a secure system.

Q.10. (a) [**5 marks**] Describe the caching policy used by NFS at the client. What parameters are used? What checks are done, in what order and why?

(b) [**2 marks**] Explain how DNS can be used to distribute the load of incoming requests over a set of servers.

(c) [**1 marks**] What is meant by *pure name*?

(d) [**1 marks**] What is meant by *unification*?

END OF EXAMINATION