ITEC801

Distributed Systems

S2 Evening 2019

Dept of Computing

Contents

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General Information

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Credit points
4

Prerequisites
ITEC647 or admission to MCyberSec with a specialisation in Internetworking

Corequisites

Co-badged status

Unit description
This unit covers both fundamental issues and recent trends in distributed computing. We examine the complexities of distributed communications systems such as partial failures, shared memory, scheduling problems and multiple clocks. Networking protocols and other industry standards are discussed. Lectures will mostly be expository and conceptual and aim to provide a solid understanding of distributed systems and related enduring issues.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Describe the complexities of distributed system development and approaches to solve those complexities

Distinguish the goals and architectures of distributed systems

Explain important issues in distributed systems, including time, inter-process communication, state management, distributed computing paradigms, data fragmentation and replication, middleware, and naming

Identify applicability of technologies that support distributed applications such as RPC, RMI and object-based technology, message passing, and REST.

Analyze and design distributed systems

General Assessment Information

Late Submission

No extensions will be granted without an approved application for Special Consideration. There will be a deduction of 10% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late. For example, 25 hours late in submission for an assignment worth 10 marks – 20% penalty or 2 marks deducted from the total. No submission will be accepted after solutions have been posted.

Supplementary Exam

If you receive Special Consideration for the final exam, a supplementary exam will be scheduled after the normal exam period, following the release of marks. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
Weekly problems	10%	No	Weekly
Assignment 1	20%	No	Week 7
Assignment 2	20%	No	Week 12
Examination	50%	No	After final lecture

Weekly problems

Due: **Weekly**
Weighting: **10%**

After each lecture a set of tutorial questions will be posted on iLearn. Students need to research and answer these questions which will be marked on a weekly basis.

On successful completion you will be able to:
- Distinguish the goals and architectures of distributed systems
- Explain important issues in distributed systems, including time, inter-process communication, state management, distributed computing paradigms, data fragmentation and replication, middleware, and naming

Assignment 1

Due: **Week 7**
Weighting: **20%**

Assignment 1 assesses progress and understanding of lecture material. It will set a moderate task to write a summary for a closely related research paper.

On successful completion you will be able to:
- Describe the complexities of distributed system development and approaches to solve those complexities
- Identify applicability of technologies that support distributed applications such as RPC, RMI and object-based technology, message passing, and REST.
- Analyze and design distributed systems

Assignment 2

Due: **Week 12**
Weighting: **20%**

Assignment 2 will be researching a couple of topics we have covered and writing a report on those topics.

On successful completion you will be able to:
- Describe the complexities of distributed system development and approaches to solve those complexities
- Identify applicability of technologies that support distributed applications such as RPC, RMI and object-based technology, message passing, and REST.
- Analyze and design distributed systems

Examination

Due: **After final lecture**
Weighting: **50%**

The final examination will consist of questions based on the lecture material, tutorial problems and assignments. The examination will be closed book, three hours long and held in the end of

session examination period.

All learning outcomes will be assessed in the final examination, which will cover the entirety of the lecture material.

On successful completion you will be able to:

- Distinguish the goals and architectures of distributed systems
- Explain important issues in distributed systems, including time, inter-process communication, state management, distributed computing paradigms, data fragmentation and replication, middleware, and naming
- Identify applicability of technologies that support distributed applications such as RPC, RMI and object-based technology, message passing, and REST.
- Analyze and design distributed systems

Delivery and Resources

Classes

Each week you should attend the class which is three to four hours. For details of days, times and rooms consult the timetables webpage.

This course has no extra classes for tutorials or practicals.

Please note it is to your benefit to attend most of the classes, prepared to participate in discussions, ask and answer questions, and provide perspectives from your own background and workplaces.

Resources to assist your learning

Digital recordings of lectures are available as Echo360 through iLearn login. These are provided for review material and in case of missing lectures.

Online discussion. We will have an active online discussion forum in the ED system. It is expected that you contribute to these discussions.

iLearn is used for out-of-class communication as well as forums where active discussion of issues is encouraged. iLearn can be found at can be found at http://learn.mq.edu.au. You are encouraged to review iLearn weekly and to do background reading before each class.

Textbook

The main textbook for ITEC801 is:

Maarten van Steen and Andrew s Tanenbaum Distributed Systems 3rd Edition (2017) (M&A)

Available for free at:

https://www.distributed-systems.net/index.php/books/distributed-systems-3rd-edition-2017/

References

- "Distributed Systems: Concepts and Design" by George Coulouris, Jean Dollimore, and Tim Kindberg, Addison Wesley, 5th edition. (Coulouris). Available free at https://www.gecg.in/papers/ds5thedn.pdf
- "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things" by Geoffrey C. Fox, Jack Dongarra, and Kai Hwang, 1st edition. (Geoffrey). Recommended but not required

Unit Schedule

The detailed unit schedule will be available on iLearn. The following is an approximate schedule and is subject to change. In all cases, refer to iLearn for up-to-date information.

Week	Topic	Textbook	Assignment
1	Introduction to Distributed Systems	M&A Ch 1, Coulouris Ch 1	
2	System models, Architectures and Networks	M&A Ch 2, Coulouris Chs 2 and 3	
3	Communications	M&A Ch 4, Coulouris Ch 4	
4	Naming and Distributed file systems	Coulouris Ch 13 and M&A Ch 5, and Coulouris Ch 12	
5	Synchronisation and concurrency	M&A Ch 6, Coulouris Chs 14 and 16	
6	Fault tolerance and Security	M&A Chs 8&9, Coulouris Ch 15	
7	Cluster, Grids and Volunteer computing projects	Geoffrey Chs 2 and 7	Assignment 1 Due
Mid-semester break 1			
Mid-semester break 2			
8	Virtualisation: VMs and Containers	Coulouris Chs 19 and 7, and Geoffrey Ch 3	
9	Data centres and Clouds	Geoffrey Ch 4	
10	Mobile computing: including mobile clouds and vehicular clouds	Coulouris Ch 19 and Geoffrey Ch 9	

11	Ubiquotous computing and IoT: edge/fog computing	Coulouris Ch 19 and Geoffrey Ch 9	
12	Real-world distributed systems		Assignment 2 Due
13	Review		

* Note that the schedule is indicative only and subject to change.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- Describe the complexities of distributed system development and approaches to solve those complexities
- Distinguish the goals and architectures of distributed systems
- Identify applicability of technologies that support distributed applications such as RPC,

RMI and object-based technology, message passing, and REST.

Assessment tasks

- Weekly problems
- Examination

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- Distinguish the goals and architectures of distributed systems
- Identify applicability of technologies that support distributed applications such as RPC, RMI and object-based technology, message passing, and REST.
- Analyze and design distributed systems

Assessment tasks

- Assignment 1
- Assignment 2
- Examination

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- Describe the complexities of distributed system development and approaches to solve those complexities
- Explain important issues in distributed systems, including time, inter-process communication, state management, distributed computing paradigms, data fragmentation and replication, middleware, and naming
- Identify applicability of technologies that support distributed applications such as RPC,

RMI and object-based technology, message passing, and REST.

- Analyze and design distributed systems

Assessment tasks

- Weekly problems
- Assignment 1
- Assignment 2
- Examination

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- Describe the complexities of distributed system development and approaches to solve those complexities
- Explain important issues in distributed systems, including time, inter-process communication, state management, distributed computing paradigms, data fragmentation and replication, middleware, and naming
- Analyze and design distributed systems

Assessment tasks

- Weekly problems
- Assignment 1
- Assignment 2
- Examination

Standards and Grading

In this unit, the final mark will be calculated by combining the marks for all assessment tasks according to the percentage weightings shown in the assessment tasks.

Students obtaining a higher grade than a pass in this unit will

- have a total mark of 85% or higher to obtain High Distinction;
- have a total mark of 75% or higher to obtain Distinction;
- have a total mark of 65% or higher to obtain Credit.

A more detailed interpretation of the Grade is below:

- **Fail (F)**: does not provide evidence of attainment of all learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; and incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.

- **Pass (P)**: provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; and communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

- **Credit (Cr)**: provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; plus communication of ideas fluently and clearly in terms of the conventions of the discipline.

- **Distinction (D)**: provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.

- **High Distinction (HD)**: provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application.

You are encouraged to:

- set your personal deadline earlier than the actual one;
- keep backups of all important assessed tasks;.
- make sure no one else picks up your printouts.

All work submitted should be readable and well presented.

PRESENTING YOUR OWN WORK IS ESSENTIAL. You should **never commit plagiarism or copying** in any of your submitted work. In particular, you must put any web sources in your own words. **DO NOT COPY BLOCKS OF TEXT FROM THE WEB** – you will be penalised for this, depending on the extent of copying.