ITEC850

Network System Design

S1 Evening 2018

Dept of Computing

Contents

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General Information

Unit convenor and teaching staff
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Convener
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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 will focus on the design of network systems such as routers, switches, and virtual machines for building and managing large scale communication networks. Students will learn the applied theoretical and technological principles in network systems design such as packet processing and classification, lookup algorithms, and switching fabrics. The unit will systematise and further develop this knowledge of network systems in the area of cloud computing and virtualization. Students will gain a thorough understanding of cloud computing concepts such as datacentre design, network virtualization for systems and network devices. Students will also learn about the security issues that cloud deployments experience, and how these are addressed.

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:

Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.

Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.

Understand key technologies and principles of virtualisation.

Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.

Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.

Understand key techniques and mechanisms in software defined networking.

General Assessment Information

The two Quizzes constitute **20%** of the total mark and serve as a feedback mechanism to monitor your progress in the unit.

Assignments constitute **30%** of the total mark.**All assignments are individual** assignments. Assignment must be submitted on time. Late submission of the assignment will be accepted, but penalized at the rate of 5% per working day late.

Assignment work must be written clearly, with good grammar, correct word usage, correct punctuation, and lack of spelling errors. Poor or bad expression will be penalized. Wherever required, all written work must be properly referenced and conform to standard stylistic conventions.

General notes on assignment

For all submittable assignment work you are encouraged to:

- set your personal deadline earlier than the actual one;
- keep backup of all important files;
- make sure that no one else picks up your printouts

Assessment Tasks

Name	Weighting	Hurdle	Due
Diagnostic Quiz	0%	No	Week 2
Quiz 1	10%	No	Week 6
Assignment 1	10%	No	Week 8
Assignment 2	20%	No	Week 12

Name	Weighting	Hurdle	Due
Quiz 2	10%	No	Week 12
Exam	50%	Yes	TBA

Diagnostic Quiz

Due: **Week 2**
Weighting: **0%**

Diagnostic Quiz

In this assessment students will be given questions that evaluate their familiarity with key areas of the course. This is an early assessment to give students an opportunity to gain feedback and initial progress in the unit. The assessment will take 40 minutes, be completed in Lecture class in week 2, This test will contribute to 0% of the overall grade.

On successful completion you will be able to:

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.

Quiz 1

Due: **Week 6**
Weighting: **10%**

Quiz 1 is a short test (closed book) that will be based on your previously covered lecture material for weeks 1-5. The quiz questions will be handed over to you at the beginning of your Lecture class.

On successful completion you will be able to:

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.

Assignment 1

Due: **Week 8**
Weighting: **10%**

Assignment 1 will apply to material taught in first five weeks of the course.

Students will analyse implementations of routers and switches in order to maximize throughput and minimize latency with different queuing, switching fabrics, and discard strategies in a number of different scenarios.

On successful completion you will be able to:
- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.

Assignment 2
Due: **Week 12**
Weighting: **20%**

Assignment 2 will apply to material taught from week 7 onwards.

Students will leverage their knowledge of data center design and cloud computing to design or analyse a cloud based application with an emphasis on network design and security.

On successful completion you will be able to:
- Understand key technologies and principles of virtualisation.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.

Quiz 2
Due: **Week 12**
Weighting: **10%**

Quiz 2 is a short test (closed book) that will be based on your previously covered lecture material for weeks 7-12. The quiz questions will be handed over to you at the beginning of your Lecture class.

On successful completion you will be able to:
- Understand key technologies and principles of virtualisation.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.
- Understand key techniques and mechanisms in software defined networking.

Exam

Due: **TBA**

Weighting: **50%**

This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

This is a hurdle assessment: Students must obtain at least 40% in the final exam to be eligible to pass the unit. Students obtaining between 30% and 40% in the first attempt will be automatically given a second attempt to pass the hurdle requirement.

An examination allows us to individually and securely assess student's mastery of the coursework material. The examination will be closed book and three (3) hours in length Regarding the examination process, note that

§ you must attend all required classes and submit all required assessment, otherwise the Executive Dean of the Faculty or delegated authority has the power to refuse permission to attend the final examination

§ the University Examination period for first Half Year 2018 is from Tuesday12th June to Friday 29th June 2018.

§ you are expected to present yourself for examination at the time and place designated in the University Examination Timetable

§ the timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of examinations

§ no early examinations for individuals or groups of students will be set. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period

§ the only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration.

On successful completion you will be able to:

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.
- Understand key technologies and principles of virtualisation.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other

virtualised environments.

- Understand key techniques and mechanisms in software defined networking.

Delivery and Resources

ITEC850 is taught via lectures and informal tutorial sessions.

Classes

Classes are held from 6-10 pm Thursday evenings. Lectures/Tutorials and other discussion will be held in the lecture slot.

Lectures

Lectures are used to introduce switch/router design and cloud architectures and protocols and put them in a wider context. You are encouraged to ask questions of the lecturer, both during and outside the lecture, to clarify anything you might not be sure of.

Lecture notes will be made available each week but these notes are intended as an outline of the lecture only and are not a substitute for your own notes or the recommended reading list.

It should be noted that no single text book completely covers the content of this unit. For the first half, a large portion of the lecture material is drawn from research papers, white papers and standard documents . Students are encouraged to read the weekly recommended reading list to gain a solid understanding of the topics that are covered.

Quizzes

There will be three quizzes in the following weeks: 6 and 12. A quiz is a short test that will be based on your previously covered lecture material. For example, week 4 quiz will be based on lectures done in weeks 1-5. The quiz questions will be handed over to you at the beginning of your Lecture class. These quizzes contribute 20% of the total mark and serve as a feedback mechanism to monitor your progress in the unit.

Assignments

Your assignment is to be submitted online using **Turnitin**. There will be a deduction of 5% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late. This penalty does not apply for cases in which an application for special consideration is made and approved. If you cannot submit assignments on time because of illness or other circumstances, please contact the convenor at the earliest possible time.

Tutorial

Problem solving session. Tutorials are posted every Friday on ilearn. Even though these tutorial exercises are not formally assessed, it is important that students solve them on a weekly basis as these questions are often previous exam questions or structured like test/exam questions. The more practice you have at such questions, the more likely you are to do yourself justice in quizzes/exams. Solutions to these exercises will be regularly posted on ilearn unit site. If need be, this will also allow you to discuss the problems effectively with your lecturer/peers and maximise the feedback you get on your work. In case of any difficulty, seek help from the

teaching staff.

Practicals

Practical sessions will be held during the lecture slot. Practical sessions are not scheduled every week. Most practical sessions are scheduled in the second half of the unit. The second half of the course will have two hours of lecture and two hours of practical depending on the content for the week. The practical sessions will be held in E6A - 240 (Engineering Lab).

General Notes

In this unit, you should do the following:

- Attend lectures, take notes, ask questions.
- Attend your tutorial, seek feedback from your lecturer on your work.
- Prepare for and strive to do well in the three quizzes
- Read appropriate sections of the text, add to your notes and prepare questions for your lecturer/tutor.
- Prepare answers to tutorial questions.
- Work on any assignments that have been released.

Each week you should attend the class which is three to four hours. For details of days, times and rooms consult the timetables webpage. The first six weeks will be mainly foundational material covered in lectures and readings and Tutorial discussion. The second part of the course will either consist of four hours of lectures, readings and discussion or will be two hours of lecture and two hours of practical depending on the content for the week.

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. Recordings should not be relied upon and copyrighted material may be omitted. 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.

TEXT

Textbook The textbook for ITEC850 (second Half) is: Dan C. Marinescu Cloud Computing, 2nd Edition Theory and Practice ISBN: 978-0-12-812810-7 eBook ISBN: 9780124046412

These books are also useful:

(second Half) Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach. Morgan Kaufmann, 2nd Edition ISBN: 9780128045558, ebook-ISBN: 97080128045794

(second Half) Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, Morgan Kaufmann, ISBN: 978-0-12-411454-8, Burlington, Massachusetts, USA,

May 2013.

(First and Second Half) References. Tannenbaum, A. S and Wetherall, J., Computer Networks, Fifth Edition. Pearson (Prentice Hall)

(First and Second Half) Stallings, W., Data and Computer Communications, Ninth Edition. Pearson (Prentice Hall)

(First and Second Half) Comer, D.E., Internetworking with TCP/IP, Sixth Edition. Pearson

(First and Second Half) Comer, D.E., Network Systems Design using Network Processors. Pearson (Prentice Hall)

Unit Schedule

Lecture Schedule (Tentative)

Week	Lecture	Reading	Practical
1	Unit Introduction, introduction to network systems: Switch architecture and scheduling	To be provided	None
2	Router Architectures	To be provided	None
3	Interconnection Networks	To be provided	None
4	Address Lookup Algorithms	To be provided	None
5	Packet Classification Algorithms	To be provided	None
6	Cloud Computing	Chapters 3 & 4	Quiz 1,
7	Cloud Computing	Chapter 5	Virtualisation
	Mid-Semester Break		
8	Virtualisation	Chapter 9	Virtualisation, Assignment 1 Due
9	Virtualisation	Chapter 7	Overlay Networks
10	Datacenter Design	Chapter 8	Cloud Storage

11	Datacenter Design	To be provided	SDN, Assignment 2 Due
12	Software Defined Networking	To be provided	Quiz 2
13	Exam Prep/ Guest Lecture		

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 shown in *iLearn*, 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.

Special Consideration

Special Consideration is intended for a student who is prevented by serious and unavoidable

disruption from completing any unit requirements in accordance with their ability. This application form needs to be filled and submitted to the Science Centre along with some evidence to support your case. Depending on the circumstances presented, the convenor may choose to give you an alternate assessment, additional time for an assessment, make-up exam, etc. If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. For details of the Special Consideration policy specific to the Department of Computing, see the Department's policy page.

Note

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. 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. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

And additionally, for ITEC850 with a final examination hurdle:

If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the same supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit.

Late Submission

There will be a deduction of 5% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late. This penalty does not apply for cases in which an application for special consideration is made and approved.

Grade Appeal

In case of problems arising with your final grade, the first step is to organise a review. The Department recommends that you request an appointment with the convenor of the unit in order to review your grade. If the review does not solve the problem, a formal Grade Appeal can be lodged. For more information please refer to the grade appeal policy page at:

http://www.mq.edu.au/policy/docs/gradeappeal/policy.html

Academic Honesty

Plagiarism involves using the work of another person and presenting it as one's own. The Department, in line with University policy, treats all cases seriously. In particular, the Department, keeps a record of all plagiarism cases. This record is referred to so that an appropriate penalty can be applied to each case.

For concrete examples, refer to Academic Honesty Policy at: http://www.mq.edu.au/policy/docs/

academic_honesty/policy.html

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

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

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.

- Understand key technologies and principles of virtualisation.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.
- Understand key techniques and mechanisms in software defined networking.

Assessment tasks

- Diagnostic Quiz
- Quiz 1
- Assignment 1
- Assignment 2
- Quiz 2
- Exam

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

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.
- Understand key technologies and principles of virtualisation.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.

Assessment tasks

- Diagnostic Quiz
- Quiz 1
- Assignment 1

- Assignment 2
- Quiz 2
- Exam

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

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.
- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.

Assessment tasks

- Diagnostic Quiz
- Quiz 1
- Assignment 1
- Assignment 2
- Quiz 2
- Exam

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

- Analyse different designs of network systems such as routers, switches, and hosts for design and managing large-scale networks.

- Analyse different strategies for packet processing, classification, lookup algorithms, and switching fabrics.
- Competence in analysis and evaluation of network, storage, and compute technologies and designs as they apply to cloud datacenters.
- Appreciate key issues related to security as it applies to cloud computing and other virtualised environments.
- Understand key techniques and mechanisms in software defined networking.

Assessment tasks

- Quiz 1
- Assignment 1
- Assignment 2
- Quiz 2
- Exam

Grading

Grades

At the end of the semester, you will receive a grade that reflects your achievement in the unit

- **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.

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 summary.The final examination in this unit is a hurdle requirement; you must get a mark of at least 40% in the examination to pass the unit. If you get a mark between 30% and 40% in your first attempt at the final examination, you will be given a second and final attempt.

Concretely, **in order to pass the unit**, you must obtain an overall total mark of 50% or higher, and a mark of 40% or higher in the final examination.

Students obtaining a higher grade than a pass in this unit will (in addition to the above)

- ◦ 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.

NOTE

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. 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. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

And additionally, for ITEC850 with a final examination hurdle:

If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the same supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit.

 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.

You should **never commit plagiarism** in any of your submitted work, including tutorial and practical answers.

Changes since First Published

Date	Description
27/02/ 2018	Break period: appears after week 7 now in the schedule. Previously it was after week 6.