ITEC850

Network System Design

S1 Evening 2017

Dept of Computing

Contents

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General Information

Unit convenor and teaching staff
Unit Convener, Lecturer
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Lecturer
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By appointment

Credit points
4

Prerequisites
ITEC647

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.

Assessment Tasks

Name	Weighting	Hurdle	Due
Quiz 1	10%	No	Week 7
Assignment 1	15%	No	Week 7
Assignment 2	15%	No	Week 12
Quiz 2	10%	No	Week 13
Exam	50%	Yes	TBA

Quiz 1

Due: **Week 7**
Weighting: **10%**

Quiz 1 is a short test (closed book) that will be based on your previously covered lecture material for weeks 1-6. 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 7**
Weighting: **15%**

Assignment 1 will apply to material taught in first six 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: **15%**

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 13**
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 45% in the final exam to be eligible to pass the unit. Students obtaining between 35% and 45% 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 2017 is from Wednesday 14th June to Friday 30th June 2017.

§ 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

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 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.

Textbook The textbook for ITEC850 is: Dan C. Marinescu Cloud Computing, 1st Edition Theory and Practice ISBN: 9780124046276 eBook ISBN: 9780124046412

These books are also useful:

Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach. Morgan Kaufmann, ISBN: 9780124166844

Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, Morgan Kaufmann, ISBN: 978-0-12-411454-8, Burlington, Massachusetts, USA, May 2013.

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

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

Comer, D.E., Internetworking with TCP/IP, Sixth Edition. Pearson

Comer, D.E., Network Systems Design using Network Processors. Pearson (Prentice Hall)

Unit Schedule

Lecture Schedule (Tentative)

Week	Lecture	Reading	Practical
1	Unit Introduction, Review of networking and computer architecture	To be provided	None

2	Switches: Switching Design and Switched Architectures	To be provided	None
3	Router Architectures	To be provided	None
4	Packet Classification and Address Lookup Algorithms	To be provided	None
5	Network Processors	To be provided	None
6	Guest Lecturer	N/A	None
7	Cloud Computing	Chapters 3 & 4	Quiz 1, Assignment 1 Due
8	Virtualisation	Chapter 5	Virtualisation
9	Virtualisation	Chapter 9	Virtualisation
10	Datacenter Design	Chapter 7	Overlay Networks
11	Datacenter Design	Chapter 8	Cloud Storage
12	Software Defined Networking	To be provided	SDN, Assignment 2 Due
13	Exam Prep	N/A	Quiz 2

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/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.

Disruption

If you apply for Disruption to Study for your final examination, you must make yourself available for the week of July 24 – 28, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

Second-chance hurdle examinations

Second-chance hurdle examinations will also be offered in the week of July 24 - 28. Results will be released on July 13. You will be notified shortly after that date of your eligibility for a hurdle retry and you must also make yourself available during that week to take advantage of this opportunity.

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.

Grading

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 45% in the examination to pass the unit. If you get a mark between 35% and 45% 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 45% 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.

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.

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

- 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

- 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.
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Assessment tasks

- 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.
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Assessment tasks

- Quiz 1

- Assignment 1
- Assignment 2
- Quiz 2
- Exam

- Assignment 1
- Assignment 2
- Quiz 2
- Exam