CN8826: Storage Networking

Calendar Description

The course objective is to explore the design and configuration of intelligent storage systems interconnected in SAN infrastructure. The prevailing SAN configurations based on the Fibre Channel protocol will be studied in the context of Cisco Systems and Brocade implementations. Once the students have a good grasp of the fundamental storage technologies, the attention will be shifted to the advanced SAN traffic engineering and management topics. We will investigate the new SAN development trends driven by the data center virtualization and cloud computing, explore the storage and data networks relationship, and look into the storage virtualization techniques and performance objectives. The concepts covered in class will be reinforced with the laboratory exercises using Cisco, Brocade, Qlogic and EMC devices.

Course Details

Fibre Channel SAN

- Learning Fibre Channel protocol
- Becoming familiar with Cisco MDS and Nexus 5k switches
- NXOS features
- Fibre Channel Addressing
- VSANs, DPVM and Trunking
- MDS Ports
- BB_Credits
- Port Channels
- FSPF
- FC Security Features
- In Order Delivery (IOD)
- Fabric Login
- Generation 2,3 and 4 modules
- Zoning
- Enhanced Zoning
- Interoperability
- Management and AAA
- RBAC
- N Port Identifier Virtualization (NPIV)
- N Port Virtualization (NPV)

IP SAN
- Fibre Channel over IP (FCIP)
- iSCSI
- iSNS
- iSCSI Security
- IP QOS and High Availability Features

Unified Fabric SAN
- NXOS Unified Fabric
- FCoE
- QOS
- FCoE NPV
- Multihop FCoE

Recommended Texts
- *Storage Networking Protocol Fundamentals by James Long, Cisco Press, 2006, ISBN 1-58705-160-5*
- *Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs , Second Edition by Tom Clark, Addison Wesley Professional, 2003, ISBN 0-321-13650-0*
- *Storage Virtualization: Technologies for Simplifying Data Storage and Management by Tom Clark, Addison Wesley Professional, 2005, ISBN 0-321-26251-4*
- *IP SANs: A Guide to iSCSI, iFCP, and FCIP Protocols for Storage Area Networks by Tom Clark, Addison Wesley Professional, 2001, ISBN 0-201-75277-8*
- *Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and Filing Systems by Marc Farley, Cisco Press, 2004, ISBN 1-58705-162-1*
- *InfiniBand Network Architecture by MindShare, Inc. , Tom Shanley, Addison Wesley Professional, 2002 ISBN 0-321-11765-4*
- *Information Storage and Management: Storing, Managing, and Protecting Digital Information by EMC, Wiley, John & Sons, Incorporated, 2009, ISBN 0470294213*
- *Fibre Channel Bench Reference, Second Edition by Ralph O. Weber, Jeffrey D. Stai, ENDL Publications, 2005, ISBN-1879936186*

Course Evaluation

Lab Participation and Reports	35%
Mid-Term Test	25%
Final Exam	40%

Missed Classes and/or Evaluations

Students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any considerations and accommodations according to the relevant policies and well in advance. Failure to do so will jeopardize any academic appeals.

- *Medical certificates* – If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component because of illness, he or she must submit a Ryerson Student Medical Certificate AND an Academic Consideration form within 3 working days of the missed date. Both documents are available at www.ryerson.ca/senate/forms/medical.pdf. If you are a full-time or part-time degree student, then you submit your forms to your own program department or school. If you are a certificate or non-certificate student, then you submit your forms to the staff at the front desk of the Chang School.
- *Religious observance* – If a student needs accommodation because of religious observance, he or she must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the required absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the required absence. Both documents are available at http://www.ryerson.ca/senate/forms/relobservforminstr.pdf. If you are a full-time or part-time degree student, then you submit the forms to your own program department or school. If you are a certificate or non-certificate student, then you submit the forms to the staff at the front desk of the Chang School.
- *Students with disabilities* – In order to facilitate the academic success and access of students with disabilities, they should register with the Access Centre http://www.ryerson.ca/studentservices/accesscentre/index.html. Before the first graded work is due, students should also inform their instructor through an "Accommodation Form for Professors" that they are registered with the Access Centre and what accommodations are required.

Academic Integrity and Plagiarism

Ryerson's Policy 60 (the *Student Code of Academic Conduct)* applies to all students at the University. The policy and its procedures are triggered in the event that the there is a suspicion that a student has engaged in a form of academic misconduct.

Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism. Plagiarism is a serious academic offence and penalties can be severe. In any academic exercise, plagiarism occurs when one offers as one's own work the words, data, ideas, arguments, calculations, designs or productions of another without appropriate attribution or when one allows one's work to be copied.

All academic work must be submitted using the citation style approved by the instructor. The most common citation style is APA. Students may refer to the Ryerson Library for APA style guide references: http://library.ryerson.ca/guides/toolbox/style/

It is assumed that all examinations and work submitted for evaluation and course credit will be the product of individual effort, except in the case of group projects arranged for and approved

by the course instructor. Submitting the same work to more than one course, without instructor approval, is also considered a form of plagiarism.

Students are advised that suspicions of academic misconduct may be referred to the Academic Integrity Office (AIO). Students who are charged with academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will be assigned one or more of the following penalties:

- A grade reduction for the plagiarized work
- A zero for the plagiarized work
- An F in the course
- More serious penalties up to and including expulsion from the University

For more detailed information on these issues, please refer to the full online text for the *Student Code of Academic Conduct* at http://www.ryerson.ca/senate/policies/pol60-F2014.pdf and the Academic Integrity Website at www.ryerson.ca/ai.