

## CN8815 – Network Architecture

### Course Description

This course covers the design aspects of large scale internets. It introduces the concept of route distribution and examines the use of Border Gateway Protocol (BGP) for inter-domain routing. The applications of MPLS on Virtual Private Networks (VPNs) and traffic engineering are also studied.

### Course Details

- **References:**

#### Books

1. "Communication Networks", by Leon-Garcia and Widjaja, McGraw Hill, 2004, ISBN 0-07-246352-x.
2. "Internet Routing Architectures", 2nd Edition, by Sam Halabi with Danny McPherson, Cisco Systems, Cisco Press, ISBN 1-57870-233-X.
3. "MPLS and VPN Architectures", by Ivan Pepelnjak and Jim Guichard, Cisco System, Cisco Press, ISBN 1-58705-002-1.
4. "MPLS Traffic Engineering" By Umesh Lakshman, Lancy Lobo, Cisco Systems, Cisco Press.

#### RFC Documents

1. RFC 4271: BGP-4
2. RFC 1772: Application of the BGP in the Internet
3. RFC 2545: Use of BGP multiprotocol Extensions for IPv6 Inter-Domain Routing
4. RFC 4364: BGP/MPLS VPN Fundamentals
5. RFC 4659: BGP/MPLS IP VPN Extension for IPv6 VPN
6. RFC 2858: Multiprotocol Extension for BGP-4
7. RFC 3031: MPLS Architecture

#### Cisco Documents

1. Configuring a Gateway of Last Resort Using IP Command
2. Redistributing Routing Protocols
3. Configuring BGP
4. Configuring a Basic MPLS VPN

- The teaching consists of 6 hours of lecture and open labs per week.
- Course objectives: To introduce the Advanced concepts in Inter-domain routing and MPLS-VPN technologies. To help students to develop technical skills on design and implement service-provider networking environments.

### **Lecture Schedule**

<b>Topics</b>	<b>Hours</b>
1) Controlling routing update: default route and route filtering (notes)	6
2) Border Gateway Protocol basics (BGP) (Chapters 1-6 (2), Section 8.7.3 (1), notes)	6
3) Manipulation of BGP attributes (Chapters 6, 11 (2), notes)	6
4) Configuration Scenarios and Large-scale AS configuration (Chapters 7,8,9,12 (2), notes)	6
5) MPLS/VPN (Chapters 1-4 (4), notes)	6
6) MPLS and Traffic Engineering (Chapter 10.3 (1), Chapter 1-3, 7-9 (3), notes)	6

### **Lab Schedule**

Week 4: Lab 1 Demonstration

Week 6: Lab 2 Demonstration

### **Labs**

1. Controlling Routing Updates
2. BGP Labs
  - a. IBGP Characteristics and Synchronization
  - b. Route Filtering
  - c. Manipulation of BGP Attributes
  - d. Route Aggregation
  - e. Configuration of Single-Home and Multi-Home ASs.
3. MPLS and VPN
4. MPLS - Traffic Engineering

### **Evaluation**

Lab Demonstrations	10%
Lab examination	25%
Quiz 1	10%
Quiz 2	10%
Final Examination	45%

The quiz and examination grades will be available within 10 business days after the tests.

## **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](http://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/reobservforminstr.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/studentervices/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 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](http://www.ryerson.ca/ai).

Students who do not want their work submitted to TurnItIn, by the end of the second week of class, consult with the instructor to make alternate arrangements.

Turnitin.com is a plagiarism prevention and detection service to which Ryerson subscribes. It is a tool to assist faculty members in determining the similarity between student work and the work of other students who have submitted papers to the site (at any university), internet sources, and a wide range of journals and other publications. While it does not contain all possible sources, it gives faculty some assurance that students' work is their own. No decisions are made by the service; it simply generates an "originality report". Faculty must evaluate that report to determine if something is plagiarized.

### **Important Resources Available at Ryerson**

Use the services of the University when you are having problems writing, editing or researching papers, or when you need help with course material:

- **The Library** (LIB 2<sup>nd</sup> floor) provides research workshops and individual assistance. Inquire at the Reference Desk or at [www.ryerson.ca/library/info/workshops.html](http://www.ryerson.ca/library/info/workshops.html)
- **The Writing Centre** (LIB 272- B) offers one-on-one tutorial help with writing and workshops [www.ryerson.ca/writingcentre/workshops.htm](http://www.ryerson.ca/writingcentre/workshops.htm)
- **Learning Success** (VIC B-15) offers individual sessions and workshops covering various aspects of researching, writing, and studying. You must book these directly through their website <http://www.ryerson.ca/studentservices/learningsuccess/>

- **English Language Support** (VIC B-17) offers workshops to improve overall communication skills [www.ryerson.ca/student-services/els/](http://www.ryerson.ca/student-services/els/)

**There is one general site where you may see and register for all of the workshops offered by all of these areas:** <http://www.ryerson.ca/academic-integrity/workshops.html>