THE UNIVERSITY OF WINNIPEG

APPLIED COMPUTER SCIENCE

Graduate Course No - ACS-7301/3-001
Graduate Course Title - The Implementation and Impact of Peer-to-Peer Systems

Instructor Information

Instructor:	Alex Brodsky	**Office: 3D17**
E-mail:	abrodsky@acs.uwinnipeg.ca	**Office Hours:** TBA
Class Meeting Time:	Monday and Wednesday, 14:30 - 15:45	**Class Room:** 3D06
Course Group:	Email abrodsky@acs.uwinnipeg.ca to receive an invite.	
Course Home Page:	`www.soyuz.acs.uwinnipeg.ca/~abrodsky/7301`	

Important Dates

1. Midterm Exam: No midterm
2. Final Exam: No final exam
3. Final Withdrawal Date w/o academic penalty: March 6, 2009
4. Other deadlines:

Assignment	Project Proposal	Project Presentation	Project Report
February 2, 2009	March 2, 2009	April 1 & 6, 2009	April 23, 2009

Course Objectives and Learning Outcomes

Peer-to-peer systems have become cheap and effective mechanisms for tasks such as content delivery, replication, preserving anonymity. These systems are not only good representatives of the changing face of technology but are also an excellent catalyst for addressing issues such as content ownership and protection, privacy and anonymity, and security.

First, this course examines the foundations, implementation, and characteristics of various peer-to-peer systems (both research and production). Students will be presented with an overview of what peer-to-peer systems are and the context in which they exist. A variety of mechanisms used by peer-to-peer systems will be discussed and analyzed within the context of existing peer-to-peer systems.

Second, this course examines the social issues that arise from the manner in which peer-to-peer systems are structured and used. Issues that will be discussed include: copyright-related issues such as the Napster and Grokster decisions; anonymity and privacy, with respect to systems such as Tor; and security-related issues in systems such as LOCKSS.

Students will design and implement various functions of peer-to-peer systems and will analyze the technical and social consequences of their design decisions. Students will present their systems and defend the design decisions they make.

Note to Student: This course assumes that you are comfortable with basic networking and operating system concepts and that you are fluent in a programming language such as Java, C, or C++. In order to gain first-hand experience in the implementation and design of peer-to-peer systems you are expected to write a significant amount of complex code as part of your assignment and final project.

Evaluation Criteria

1. Programming Assignment: 10%
2. Project proposal: 15%
   - Selection of a topic dealing with implementation of peer-to-peer systems
   - Brief (5 page) literature survey on the selected topic.
3. Paper Summaries: 10%
   - 300 word summaries of the papers discussed in class posted to the course group by 5pm of the preceding day.
   - Summaries should answer the questions from "How to Read an Engineering Research Paper", posted on the course website.
4. Paper Discussion Participation: 10%
   - Students must read and be prepared to discuss the specified papers during the lectures designated for class discussion.
   - Students must contribute to the discussion, preparing, contributing, and discussing questions about the papers.
5. Project: 45%, entailing
   - Implementation or extension of a system with respect to chosen topic
   - Analysis of implementation from a technical and/or social perspective
   - Written report on the implementation and analysis
6. Project Presentation (in class): 10%
7. Notes:
   - **Late submissions will not be accepted.**
   - Submissions must be done both in paper and by email.
   - All submissions must be in English.
   - There are no tests and no final examination in this course.
   - The instructor reserves the right to adjust a student's evaluation criteria, with the student's consent, if the instructor deems than an adjustment is warranted.

Required Text

No text book is required for this course. Readings will be provided from a list of research papers and articles. Students are responsible for completing the following readings to be discussed on the specified days. The papers are available for download on the course website:

Date	Papers
January 19, 2009	[CSWH00], [AH00]
January 26, 2009	[DKK+01], [RD01b]
February 2, 2009	[RFH+01], [RD01a], [SMK+01]
February 9, 2009	[Coh03], [SBB04], [AG04]
February 23, 2009	[MRR+03], [DN93]
March 2, 2009	[DMS04], [DM06]
March 9, 2009	[Dou02], [CDG+02]
March 16, 2009	[Les01], [Les04]
March 23, 2009	[Les07b], [vL03], [Sam04], [Sam05], [Ger05, recommended]
March 30, 2009	[GWB97],[Gol02],[Les07a]

References

[AG04] K. Anagnostakis and M. Greenwald. Exchange-based incentive mechanisms for peer-to-peer file sharing. In *IEEE 24th International Conference on Distributed Computing Systems*, pages 524–533, 2004.

[AH00] E. Adar and B. Huberman. Free riding on gnutella. *First Monday*, 5(10), 2000.

[CDG+02] M. Castro, P. Druschel, A. Ganesh, A. Rowstron, and D. Wallach. Secure routing for structured peer-to-peer overlay networks. In *Proc. of the 5th ACM Symposium on Operating System Design and Implementation*, 2002.

[Coh03] B. Cohen. Incentives build robustness in bittorrent. In *Proceedings of the Workshop on Economics of Peer-to-Peer Systems*, Berkeley, CA, USA, 2003.

[CSWH00] I. Clarke, O. Sandberg, B. Wiley, and T. Hong. Freenet: a distributed anonymous information storage and retrieval system. In *ICSI Workshop on Design Issues in Anonymity and Unobservability*, pages 311–320, 2000.

[DKK+01] F. Dabek, F. Kaashoek, D. Karger, R. Morris, and I. Stoica. Wide-Area cooperative storage with CFS. In *Proceedings of the 18th ACM Symposium on Operating Systems Principles*, volume 35 of *ACM SIGOPS Operating Systems Review*, pages 202–215, October 21–24 2001.

[DM06] R. Dingledine and N. Mathewson. Anonimity lovees company: Usability and the network effect. In *The Fifth Workshop on the Economics of Information Security*, 2006.

[DMS04] R. Dingledine, N. Mathewson, and P. Syverson. Tor: The second-generation onion router. In *USENIX Security Symposium*, pages 303–320. USENIX, 2004.

[DN93] C. Dwork and M. Naor. Pricing via processing or combatting junk mail. In *Advances in Cryptology – CRYPTO ' 92*, volume 740 of *Lecture Notes in Computer Science*, pages 139–147, 1993.

[Dou02] J. Douceur. The sybil attack. In *Peer-to-Peer Systems, First International Workshop, IPTPS*, volume 2429 of *Lecture Notes in Computer Science*, pages 251–260, 2002.

[Ger05] D. Gervais. Use of copyright content on the internet: Considerations on excludibility and collective licensing. In M. Geist, editor, *In the Public Interest: The Future of Canadian Copyright Law*. 2005.

[Gol02] I. Goldberg. Privacy-enhancing technologies for the internet, II: Five years later. In *Privacy Enhancing Technologies*, volume 2482 of *Lecture Notes in Computer Science*, pages 1–12, 2002.

[GWB97] I. Goldberg, D. Wagner, and E. Brewer. Privacy-enhancing technologies for the internet, October 20 1997.

[Les01] L. Lessig. The internet under siege. *Foreign Policy*, November/December 2001.

[Les04] L. Lessig. The laws of cyberspace. In R. Spinello and H. Tavani, editors, *Readings in Cyberethics, 2nd ed.* 2004.

[Les07a] L. Lessig. Code of privacy. *151 Proceedings of the American Philosophical Society*, 283, 2007.

[Les07b] L. Lessig. Does copyright have limits? eldred v. ashcroft and its aftermath. In B. Fitzgerald, editor, *Open Content Licensing: Cultivating the Creative Commons*. 2007.

[MRR+03] P. Maniatis, D. Rosenthal, M. Roussopoulos, M. Baker, T. Giuli, and Y. Muliadi. Preserving peer replicas by rate-limited sampled voting. In *Proc. of the 19th ACM Symposium on Operating Systems Principles*, 2003.

[RD01a] A. Rowstron and P. Druschel. Pastry: Scalable, decentralized object location, and routing for large-scale peer-to-peer systems. In *(Middleware 2001) 10th IFIP/ACM International Conference on Distributed Systems Platforms*, volume 2218 of *Lecture Notes in Computer Science*, pages 329–350, 2001.

[RD01b] A. Rowstron and P. Druschel. Storage management and caching in PAST, A large-scale, persistent peer-to-peer storage utility. In *Proceedings of the 18th ACM Symposium on Operating Systems Principles*, volume 35 of *ACM SIGOPS Operating Systems Review*, pages 188–201, October 21–24 2001.

[RFH+01] S. Ratnasamy, P. Francis, M. Handley, R. Karp, and S. Shenker. A scalable Content-Addressable network. In *Proceedings of the ACM SIGCOMM Conference*, volume 31 of *Computer Communication Review*, pages 161–172, August 27–31 2001.

[Sam04] P. Samuelson. Legally speaking: What's at stake in *MGM v. Grokster*? *Communications of the ACM*, 47(2):15–20, 2004.

[Sam05] P. Samuelson. Did MGM really win the grokster case? *Communications of the ACM*, 48(10):19–24, 2005.

[SBB04] R. Sherwood, R. Braud, and B. Bhattacharjee. Slurpie: A cooperative bulk data transfer protocol. In *Proceedings of the IEEE INFOCOM '04*, 2004.

[SMK+01] I. Stoica, R. Morris, D. Karger, M. F. Kaashoek, and H. Balakrishnan. Chord: A scalable peer-to-peer lookup service for internet applications. In *Proc. of the ACM SIGCOMM Conference*, 2001.

[vL03] F. von Lohmann. Peer-to-peer file sharing and copyright law: A primer for developers. In *Peer-to-Peer Systems, Second International Workshop*, volume 2735 of *Lecture Notes in Computer Science*, pages 108–117, 2003.

Prerequisites

Good standing in the graduate program or approval of instructor.

Misuse of Computer Facilities, Plagiarism, and Cheating

Academic dishonesty is a very serious offense and will be dealt with in accordance with the University's discipline bylaw. Be sure to read Chapter VII, Section 7a of the 2008/2009 UW General Calendar.

Tentative List of Topics to be Covered

1. Introduction
   - Distributed systems
   - What is a peer-to-peer system
   - Applications
   - Design goals and issues
2. Mechanisms in Peer-to-Peer Systems
   - Early peer-to-peer systems
   - Distributed Hash Tables
   - Routing
   - Incentive-based systems
   - Reputation based systems
   - Computation-limited systems
3. Implementations of Specific Systems
   - Napster, Grokster, Gnutella, and Freenet
   - The Past, CFS, and DHASH Systems
   - The CAN, Patry, and Chord Systems
   - The LOCKSS System
   - The Bit-torrent System
   - The Tor System
4. Social Issues and Impacts
   - The Internet Context
   - Liability and the Internet
   - The Napster and Grokster Decisions
   - Anonymity and Privacy