CS551 Syllabus—Spring 2005, Friday Section

John Heidemann

January 4, 2005

Class meets Friday, 9am to 11:50am, beginning January 14 and ending April 29. Spring break is March 18 and the the stop period does not intersect classroom days. The date and time of the final is Friday, May 6, 8–10am.

Changes: This syllabus may be updated over the semester. The most recent version can always be found at `http://www.isi.edu/~johnh/TEACHING/CS551/SP2005/SYLLABUS` (html) and `http://www.isi.edu/~johnh/TEACHING/CS551/SP2005/SYLLABUS/paper.pdf` (pdf).

4-Jan-05: no changes yet

Obtaining these papers: All of these papers are available from the CSci551 web syllabus (see URL above) in PDF format. Because they are copyrighted they are available only for classroom use. The papers on the web site are password protected to enforce this; the password will be given to you on the first day of class, or e-mail the TA to ask about it.

You are encouraged to download and print the papers. Downloaded they take up about 95MB storage. You're encouraged to print them out and make notes on them as you go. Because there are many papers and many, many pages, you are *strongly* encouraged to use a double-sided printer. You will need a 3-inch binder if you keep them that way. (If you have to pay for printing, you may find it cheaper to get together with other students to print one copy and photocopy additional ones.)

Some of the papers were scanned. These tend to have large (2–5MB) PDF files, and may look slightly fuzzy when printed. Some of the paper do not display well in Acrobat on the screen, but they all should look reasonable when printed.

In this syllabus "new" is relative to the last section of CSci551 I taught.

This year the CS Department will make pre-printed, photocopied paper sets available at cost (I don't know what that cost is; ask them, not me). Please contact Jessica Sprague (sprague/usc.edu) for that.

1 Reference and background

Supplementary:

All of the textbooks are *optional*. Peterson and Davies and Keshav provide an overview of some of the topics we talk about. They provide helpful background and are generally broader and more consistent in their coverage of networking, but less deep on the subjects we cover in class. The Stevens book is a very good for socket programming and may be useful for the projects. (The Stevens *TCP/IP Illustrated* books are also excellent references relating the RFCs to the BSD code, but are

less useful for class.)

[1. Peterson00a] Larry L. Peterson and Bruce S. Davie. *Computer Networks: A Systems Approach*. Morgan Kaufmann Publishers, 2000.

[2. Stevens97b] W. Richard Stevens. *Unix Network Programming: Volume 1: Networking APIs, Sockets*. Prentice-Hall, 1997.

Class 1 (Jan. 14): intro and background.

Primary: [Hanson99a, Jamin97b, Levin83a]

[3. Hanson99a] Michael J. Hanson. Efficient reading of papers in science. Brochure of unknown origin, revised 1999 by Dylan J. McNamee, 1989. [class PDF copy]

[4. Jamin97b] Sugih Jamin. Paper reading check list. web page `http://irl.eecs.umich.edu/jamin/courses/eecs589/papers/checklist.html` , 1997. [class PDF copy]

[5. Levin83a] Roy Levin and David D. Redell. An evaluation of the ninth SOSP submissions, or how (and how not) to write a good systems paper. *ACM Operating Systems Review*, 17(3):35–40, July 1983. [class PDF copy]

2 Design principles

Class 2 (Jan. 21): Network design principles. The end-to-end argument. Caching. Addressing.

Primary: [Clark88a, Deering98a, Saltzer81a, Saltzer82a]

[6. Clark88a] David D. Clark. The design philosophy of the DARPA internet protocols. In *Proceedings of the 1988 Symposium on Communications Architectures and Protocols*, pages 106–114. ACM, August 1988. [class PDF copy]

[7. Deering98a] Steve Deering. Watching the waist of the protocol hourglass. Keynote address at ICNP '98, October 1998. [class PDF copy]

[8. Saltzer81a] J. H. Saltzer, D. P. Reed, and D. D. Clark. End-to-end arguments in system design. *Proceedings of the 2nd International Conference on Distributed Computing Systems*, pages 509–512, April 1981. [class PDF copy]

[9. Saltzer82a] Jermome H. Saltzer. On the naming and binding of network destinations. In *International Symposium on Local Computer Networks*, pages 311–317, April 1982. [class PDF copy]

Supplementary: [Lampson83a, Tichy98a]

[10. Lampson83a] Butler Lampson. Hints for computer system design. In *Proceedings of the 9th Symposium on Operating Systems Principles*, pages 33–48, Bretton Woods, New Hampshire, October 1983. ACM. [class PDF copy]

[11. Tichy98a] Walter F. Tichy. Should computer scientists experiment more? *IEEE Computer*, 31(5):32–40, May 1998. [class PDF copy]

More about the end-to-end argument: [Blumenthal01a]

[12. Blumenthal01a] Marjory S. Blumenthal and David D. Clark. Rethinking the design of the Internet: the end-to-end arguments vs. the brave new world. *ACM Transactions on Internet Technology*, 1(1):70–109, August 2001. [class PDF copy]

How "tussles" affect network architecture: [Clark02a]

[13. Clark02a] David D. Clark, John Wroclawski, Karen Sollins, and Robert Braden. Tussle in cyberspace: Defining tomorrow's internet. In *Proceedings of the ACM SIGCOMM Conference*, pages 347–356, Pittsburgh, PA, USA, August 2002. ACM. [class PDF copy]

3 Unicast Routing

Class 3 (Jan. 28): Unicast routing principles. Link-state and distance verctor routing. The importance of hierarchy.

Primary: [Papadopoulos00a, Tsuchiya88a, Labovitz00a]

[14. Papadopoulos00a] Christos Papadopoulos and Ramesh Govindan. Intra-domain routing. (Slides for USC CSci551), 2000. [class PDF copy]

[15. Tsuchiya88a] Paul F. Tsuchiya. The landmark hierarchy: A new hierarchy for routing in very large networks. In *Proceedings of the ACM SIGCOMM Conference*, pages 128–134, Stanford, CA, USA, August 1988. ACM. [class PDF copy]

[16. Labovitz00a] Craig Labovitz, Abha Ahuja, Abhijit Abose, and Farnam Jahanian. Delayed Internet routing convergence. In *Proceedings of the ACM SIGCOMM Conference*, pages 175–187, Stockholm, Sweeden, August 2000. ACM. [class PDF copy]

Supplementary: [Rekhter95a, Floyd94b, Stewart99a]

[17. Rekhter95a] Y. Rekhter and T. Li. A border gateway protocol 4 (BGP-4). RFC 1771, Internet Request For Comments, March 1995. [class PDF copy]

[18. Floyd94b] S. Floyd and V. Jacobson. The synchronization of periodic routing messages. *ACM/IEEE Transactions on Networking*, 2(2):122–136, April 1994. [class PDF copy]

[19. Stewart99a] John W. Stewart. *BGP4 Inter-Domain Routing in the Internet*. Addison-Wesley, 1999.

Other references: `http://www.academ.com/nanog/feb1997/BGPTutorial/` and `http://www.ittc.ku.edu/EECS/EECS_800.ira/bgp_tutorial/`

Class 4 (Feb. 4): Routing convergence, oscillation, and stability. Policy routing.

Primary: [Shaikh00a, Gao02a]

[20. Shaikh00a] Aman Shaikh, Lampros Kalampoukas, Rohit Dube, and Anujan Varma. Routing stability in congested networks: Experimentation and analysis. In *Proceedings of the ACM SIGCOMM Conference*, pages 163–174, Stockholm, Sweeden, August 2000. ACM. [class PDF copy]

[21. Gao02a] Lixin Gao. On inferring automonous system relationships in the internet. *ACM/IEEE Transactions on Networking*, 9(6):733–745, December 2001. [class PDF copy]

Supplementary: [Tangmunarunkit01a, Griffin99a]

[22. Tangmunarunkit01a] Hongsuda Tangmunarunkit, Ramesh Govindan, and Scott Shenker. Internet path inflation due to policy routing. In *Proceedings of the SPIE ITCom*, pages 188–195, Denver, CO, USA, August 2001. SPIE. [class PDF copy]

[23. Griffin99a] Timothy G. Griffin and Gordon Wilfong. An analysis of BGP convergence properties. In *Proceedings of the ACM SIGCOMM Conference*, pages 277–288, Cambridge, MA, USA, September 1999. ACM. [class PDF copy]

4 Transport protocols, Congestion Control, and Queue Management

Class 5 (Feb. 11): TCP, congestion control, TCP variants including SACK and ECN.

Primary: [Jacobson88a, Ramakrishnan90a, Padhye98a, Floyd99b]

[24. Jacobson88a] Van Jacobson. Congestion avoidance and control. In *Proceedings of the ACM SIGCOMM Conference*, pages 314–329, Stanford, California, USA, August 1988. ACM. [class PDF copy]

[25. Ramakrishnan90a] K. K. Ramakrishnan and Raj Jain. A binary feedback scheme for congestion avoidance in computer networks. *ACM Transactions on Computer Systems*, 8(2):158–181, May 1990. [class PDF copy]

[26. Padhye98a] J. Padhye, V. Firoiu, D. Towsley, and J. Kurose. Modeling TCP throughput: A simple model and its empirical validation. In *Proceedings of the ACM SIGCOMM Conference*, pages 303–314, Vancouver, Canada, September 1998. ACM. [class PDF copy]

[27. Floyd99b] Sally Floyd and Kevin Fall. Promoting the use of end-to-end congestion control in the Internet. *ACM/IEEE Transactions on Networking*, 7(4):458–473, August 1999. [class PDF copy]

Supplementary: RFCs: [Postel81b, Ramakrishnan99a, Chiu89a]

[28. Postel81b] Jon Postel. Transmission control protocol. RFC 793, Internet Request For Comments, September 1981. [class PDF copy]

[29. Ramakrishnan99a] K. Ramakrishnan and S. Floyd. A proposal to add explicit congestion notification (ECN) to IP. RFC 2481, Internet Request For Comments, January 1999. [class PDF copy]

[30. Chiu89a] D.-M. Chiu and R. Jain. Analysis of the increase and decrease algorithms for congestion avoidance in computer networks. *Computer Networks and ISDN Systems*, 17(1):1–14, June 1989. [class PDF copy]

Other TCP variants: [Fall96a, Brakmo94a, Jin04a]

[31. Fall96a] K. Fall and Sally Floyd. Simulation-based comparisons of Tahoe, Reno, and SACK TCP. *ACM Computer Communication Review*, 26(3):5–21, July 1996. [class PDF copy]

[32. Brakmo94a] L. S. Brakmo, S. W. O'Malley, and L. L. Peterson. TCP Vegas: New techniques for congestion detection and avoidance. In *Proceedings of the ACM SIGCOMM Conference*, pages 24–35. ACM, September 1994. [class PDF copy]

[33. Jin04a] Cheng Jin, David X. Wei, and Steven H. Low. FAST TCP: Motivation, architecture, algorithms, performance. In *Proceedings of the IEEE Infocom*, page to appear, Hong Kong, China, March 2004. IEEE. [class PDF copy]

Class 6 (Feb. 18): TCP follow-up. XCP and other transport protocols. Queue management. Fair queueing.

Primary: [Demers89a, Floyd93a, Katabi02a]

[34. Demers89a] Alan Demers, Srinivasan Keshav, and Scott Shenker. Analysis and simulation of a fair queueing algorithm. In *Proceedings of the ACM SIGCOMM Conference '89*, pages 1–12, Austin, Texas, September 1989. ACM. [class PDF copy]

[35. Floyd93a] Sally Floyd and Van Jacobson. Random early detection gateways for congestion avoidance. *ACM/IEEE Transactions on Networking*, 1(4):397–413, August 1993. [class PDF copy]

[36. Katabi02a] Dina Katabi, Mark Handley, and Charlie Rohrs. Congestion control for high bandwidth-delay product networks. In *Proceedings of the ACM SIGCOMM Conference*, pages 89–102, Pittsburgh, PA, USA, August 2002. ACM. [class PDF copy]

5 Differentiated and Integrated Services

Class 7 (Feb. 25): QoS. Admission control. Multimedia.

Primary: [Shenker95a, Stoica03a]

[37. Shenker95a] Scott Shenker. Fundamental design issues for the future internet. *IEEE Journal of Selected Areas in Communication*, 13(7):1176–1188, September 1995. [class PDF copy]

[38. Stoica03a] Ion Stoica, Scott Shenker, and Hui Zhang. Core-stateless fair queueing: a scalable architecture to approximate fair bandwidth allocations in high-speed networks. *ACM/IEEE Transactions on Networking*, 11(1):33–46, February 2003. [class PDF copy]

Supplementary: [Blake98a, Zhang93a, Nichols99a]

[39. Blake98a] S. Blake, D. Black, M. Carlson, E. Davies, and W. Weiss Z. Wang. An architecture for differentiated service. RFC 2475, Internet Request For Comments, December 1998. [class PDF copy]

[40. Zhang93a] L. Zhang, S. Deering, D. Estrin, and D. Zappala. RSVP: A new resource ReSerVation Protocol. *IEEE Network Magazine*, pages 8–18, September 1993. [class PDF copy]

[41. Nichols99a] K. Nichols, V. Jacobson, and L. Zhang. A two-bit differentiated services architecture for the Internet. RFC 2638, Internet Request For Comments, July 1999. [class PDF copy]

6 Wireless and Mobile Networking

Class 8 (Mar. 4): Basestations. Mobile IP. Ad hoc routing. Sensor networking. Performance optimizations: TCP packet replay and connection splicing.

Primary: [Johnson96c, Intanagonwiwat00a, Bharghavan94a]

[42. Johnson96c] David B. Johnson and David A. Maltz. *Dynamic Source Routing in Ad Hoc Wireless Networks*, chapter 5, pages 153–181. Kluwer Academic Publishers, 1996. in Mobile Computing, edited by Tomasz Imielinski and Hank Korth. [class PDF copy]

[43. Intanagonwiwat00a] Chalermek Intanagonwiwat, Ramesh Govindan, and Deborah Estrin. Directed diffusion: A scalable and robust communication paradigm for sensor networks. In *Proceedings of the ACM International Conference on Mobile Computing and Networking*, pages 56–67, Boston, MA, USA, August 2000. ACM. [class PDF copy]

[44. Bharghavan94a] Vaduvur Bharghavan, Alan Demers, Scott Shenker, and Lixia Zhang. MACAW: A media access protocol for wireless LAN's. In *Proceedings of the ACM SIGCOMM Conference*, pages 212–225, London, UK, September 1994. ACM. [class PDF copy]

NEW: [Aguayo04a]

[45. Aguayo04a] Daniel Aguayo, John Bicket, Sanjit Biswas, Glenn Judd, and Robert Morris. Link-level measurements from an 802.11b mesh network. In *Proceedings of the ACM SIGCOMM Conference*, pages 121–132, Portland, Oregon, USA, August 2004. ACM. [class PDF copy]

Supplementary: [Johnson96b, Waldo99a, Balakrishnan95b]

[46. Johnson96b] David B. Johnson. *Scalable Support for Transparent Mobile Host Internetworking, in Mobile Computing*, chapter 3, pages 103–128. Kluwer Academic Publishers, 1996. in Mobile Computing, edited by Tomasz Imielinski and Hank Korth. [class PDF copy]

[47. Waldo99a] Jim Waldo. The Jini architecture for network-centric computing. *Communications of the ACM*, 42(10):76–82, October 1999. [class PDF copy]

[48. Balakrishnan95b] H. Balakrishnan, S. Seshan, and R. Katz. Improving reliable transport and handoff performance over wireless networks. *Wireless Networks Journal*, 1(4):469–481, December 1995. [class PDF copy]

NEW: [Heidemann04a]

[49. Heidemann04a] John Heidemann and Ramesh Govindan. An overview of embedded sensor networks. Technical Report ISI-TR-2004-594, USC/Information Sciences Institute, November 2004. book chapter to appear in *Handbook of Networked and Embedded Control Systems*, D. Hristu-Varsakelis and W.S. Levine, editors, Springer-Verlag, 2004. [class PDF copy]

7 Midterm and Spring Break

Class 9 (Mar. 11): **midterm exam** The midterm exam will be half of the class period, with lecture the other half.

Spring break: March 18, no class.

8 Modeling Network Traffic

Class 10 (Mar. 25): Self-similarity. Route stability. Topology.

Primary: [Leland94a, Paxson99b, Crovella97a]

[50. Leland94a] W.E. Leland, M.S. Taqqu, W. Willinger, and D.V. Wilson. On the self-similar nature of Ethernet traffic (extended version). *ACM/IEEE Transactions on Networking*, 2(1):1–15, February 1994. [class PDF copy]

[51. Paxson99b] Vern Paxson. End-to-end internet packet dynamics. *ACM/IEEE Transactions on Networking*, 7(3):277–292, June 1999. [class PDF copy]

[52. Crovella97a] Mark E. Crovella and Azer Bestavros. Self-similarity in world wide web traffic: evidence and possible causes. *ACM/IEEE Transactions on Networking*, 5(6):835–846, December 1997. [class PDF copy]

NEW: [Li04a]

[53. Li04a] Lun Li, David Alderson, Walter Willinger, and John Doyle. A first-principles approach to understanding the internet's router-level topology. In *Proceedings of the ACM SIGCOMM Conference*, pages 3–14, Portland, Oregon, USA, August 2004. ACM. [class PDF copy]

Supplementary: [Willinger98a, Balachandran02b, Feldmann99a]

[54. Willinger98a] W. Willinger and V. Paxson. Where mathematics meets the Internet. *Notices of the American Mathematical Society*, 45(8):961–970, August 1998. [class PDF copy]

[55. Balachandran02b] Anand Balachandran, Goeffrey M. Voelker, Paramvir Bahl, and Venkat Rangan. Characterizing user behavior and network performance in a public wireless LAN. In *Proceedings of the ACM SIGMETRICS*, pages 195–205, Marina del Rey, CA, USA, June 2002. ACM. [class PDF copy]

[56. Feldmann99a] Anja Feldmann, Anna C. Gilbert, Polly Huang, and Walter Willinger. Dynamics of IP traffic: A study of the role of variability and the impact of control. In *Proceedings of the ACM SIGCOMM Conference*, pages 301–313, Cambridge, MA, USA, August 1999. ACM. [class PDF copy]

9 Web Protocols and Caching

Class 11 (Apr. 1): HTTP/1.0 and HTTP/1.1. Caching and cache consistency. Service location.

Primary: [Padmanabhan95a, Wolman99a]

[57. Padmanabhan95a] Venkata N. Padmanabhan and Jeffrey C. Mogul. Improving HTTP latency. In *Proceedings of the Second International World Wide Web Conference*, October 1994. [class PDF copy]

[58. Wolman99a] Alec Wolman, Geoffrey M. Voelker, Nitin Sharma, Neal Cardwell, Anna Karlin, and Henry M. Levy. On the scale and performance of cooperative web proxy caching. In *Proceedings of the 17th Symposium on Operating Systems Principles*, pages 16–31, Kiawah Island, SC, USA, December 1999. ACM. [class PDF copy]

Supplementary: [Fan98a, Freier96a]

[59. Fan98a] Li Fan, Pei Cao, Jussara Almeida, and Andrei Broder. Summary cache: A scalable wide-area web cache sharing protocol. In *Proceedings of the ACM SIGCOMM Conference*, pages 254–265, Vancouver, Canada, September 1998. ACM. [class PDF copy]

[60. Freier96a] Alan O. Freier, Philip Karlton, and Paul C. Kocher. The SSL protocol version 3.0. Work in progress (Internet draft draft-freier-ssl-version3-02.txt), November 1996. [class PDF copy]

10 Multicast Routing, Transport, and Applications

Class 12 (Apr. 8): Multicast routing: flood-and-prune, rendezvous, source-specific.

Primary: [Deering88b, Holbrook99a]

[61. Deering88b] Stephen E. Deering. Multicast routing in internetworks and extended LANs. In *Proceedings of the ACM SIGCOMM Conference*, pages 55–64, Stanford, CA, August 1988. ACM. [class PDF copy]

[62. Holbrook99a] Hugh W. Holbrook and David R. Cheriton. IP multicast channels: EXPRESS support for large-scale single-source applications. In *Proceedings of the ACM SIGCOMM Conference*, pages 65–78, Cambridge, MA, USA, September 1999. ACM. [class PDF copy]

NEW: [Chu02b]

[63. Chu02b] Yang hua Chu, Sanjay G. Rao, Srinivasan Seshan, and Hui Zhang. A case for end system multicast. *IEEE Journal of Selected Areas in Communication*, 20(8):1456–1471, October 2002. [class PDF copy]

Reliable multicast (SRM, bulk file transfer). Multicast video/audio and real-time multimedia.

Primary: [Floyd97c, McCanne96a]

[64. Floyd97c] Sally Floyd, Van Jacobson, Ching-Gung Liu, Steven McCanne, and Lixia Zhang. A reliable multicast framework for light-weight sessions and application level framing. *ACM/IEEE Transactions on Networking*, 5(6):784–803, December 1997. [class PDF copy]

[65. McCanne96a] S. McCanne, V. Jacobson, and M. Vetterli. Receiver-driven layered multicast. In *Proceedings of the ACM SIGCOMM Conference '96*, pages 117–130, Stanford, CA, August 1996. ACM. [class PDF copy]

Supplementary: [Deering96a]

[66. Deering96a] Stephen Deering, Deborah L. Estrin, Dino Farinacci, Van Jacobson, Ching-Gung Liu, and Liming Wei. The PIM architecture for wide-area multicast routing. *ACM/IEEE Transactions on Networking*, 4(2):153–162, April 1996. [class PDF copy]

[Bolot98a]

[67. Bolot98a] Jean-Chrysostome Bolot, Thierry Turlettil, and Ian Wakeman. Scalable feedback control for multicast video distribution in the Internet. In *Proceedings of the ACM SIGCOMM Conference*, pages 58–68, Vancouver, Canada, September 1998. ACM. [class PDF copy]

11 Security

Class 13 (Apr. 15): Denial of service attacks.

Primary: [Hussain03b]

[68. Hussain03b] Alefiya Hussain, John Heidemann, and Christos Papadopoulos. A framework for classifying denial of service attacks. In *Proceedings of the ACM SIGCOMM Conference*, pages 99–110, Karlsruhe, Germany, August 2003. ACM. [class PDF copy]

NEW: [Kuzmanovic03b, Moore03a]

[69. Kuzmanovic03b] Aleksandar Kuzmanović and Edward W. Knightly. Low-rate TCP-targeted denial of service attacks (the shrew vs. the mice and elephants). In *Proceedings of the ACM SIGCOMM Conference*, pages 75–86, Karlsruhe, Germany, August 2003. ACM. [class PDF copy]

[70. Moore03a] David Moore, Colleen Shannon, Geoffrey M. Voelker, and Stefan Savage. Internet quarantine: Requirements for containing self-propagating code. In *Proceedings of the IEEE Infocom*, pages 1901–1910, San Francisco, CA, USA, March 2003. IEEE. [class PDF copy]

Supplementary: [Savage00a, Yegneswaran03a]

[71. Savage00a] Stefan Savage, David Wetherall, Anna Karlin, and Tom Anderson. Practical network support for IP traceback. In *Proceedings of the ACM SIGCOMM Conference*, pages 295–306, Stockholm, Sweeden, August 2000. ACM. [class PDF copy]

[72. Yegneswaran03a] Vinod Yegneswaran, Paul Barford, and Johannes Ullrich. Internet intrusions: Global characteristics and prevalence. In *Proceedings of the ACM SIGMETRICS*, pages 138–147, San Diego, California, USA, June 2003. ACM. [class PDF copy]

Unfortunately there is not time to talk about security and network protocols in CSci551. CSci555 provides a good coverage of security from an operating systems perspective; see the papers by Voydock and Kent and Needham and Schroder there.

12 Current topics

Class 14 (Apr. 22): Peer-to-peer storage and search. Geographically distributed networks.

Primary: NEW: [Clarke02a]

[73. Clarke02a] Ian Clarke, Theodore W. Hong, Scott G. Miller, Oskar Sandberg, and Brandon Wiley. Protecting free expression online with freenet. *IEEE Internet Computing*, 6(1):40–49, February 2002. [class PDF copy]

[Stoica00a, Ratnasamy02b]

[74. Stoica00a] Ion Stoica, Robert Morris, David Karger, M. Frans Kaashoek, and Hari Balakrishnan. Chord: A scalable peer-to-peer lookup service for internet applications. In *Proceedings of the ACM SIGCOMM Conference*, Stockholm, Sweden, September 2000. ACM. [class PDF copy]

[75. Ratnasamy02b] Sylvia Ratnasamy, Brad Karp, Li Yin, Fang Yu, Deborah Estrin, Ramesh Govindan, and Scott Shenker. GHT: A geographic hash table for data-centric storage. In *Proceedings of the ACM Workshop on Sensor Networks and Applications*, pages 78–87, Atlanta, Georgia, USA, September 2002. ACM. [class PDF copy]

Supplementary: [Zhang03a]

[76. Zhang03a] Hui Zhang, Ashish Goel, and Ramesh Govindan. Incrementally improving lookup latency in distributed hash table systems. In *Proceedings of the ACM SIGMETRICS*, pages 114–125, San Diego, California, USA, June 2003. ACM. [class PDF copy]

Class 15 (Apr. 29): Overlay networks. Traffic engineering. Crazy ideas.

Primary: [Andersen01a, Gummadi03a]

[77. Andersen01a] David G. Andersen, Hari Balakrishnan, M. Frans Kaashoek, and Robert Morris. Resilient overlay networks. In *Proceedings of the Symposium on Operating Systems Principles*, pages 131–145, Chateau Lake Louise, Alberta, Canada, October 2001. ACM. [class PDF copy]

[78. Gummadi03a] Krishna P. Gummadi, Richard J. Dunn, Stefan Saroiu, Steven D. Gribble, Henry M. Levy, and John Zahorjan. Measurement, modeling, and analysis of a peer-to-peer file-sharing workload. In *Proceedings of the 19th Symposium on Operating Systems Principles*, pages 314–329, Bolton Landing, NY, USA, October 2003. ACM. [class PDF copy]

NEW: [Wang04b, Clark03a]

[79. Wang04b] Randolph Y. Wang, Sumeet Sobti, Nitin Garg, Elisha Ziskind, Junwen Lai, and Arvind Krishnamurthy. Turning the postal system into a generic digital communication mechanism. In *Proceedings of the ACM SIGCOMM Conference*, pages 159–166, Portland, Oregon, USA, August 2004. ACM. [class PDF copy]

[80. Clark03a] David D. Clark, Craig Partridge, J. Christopher Ramming, and John T. Wroclawski. A knowledge plane for the Internet. In *Proceedings of the ACM SIGCOMM Conference*, pages 3–10, Karlsruhe, Germany, August 2003. ACM. [class PDF copy]

Supplementary: [Duffield00a, Feldmann00a, BenFredj01a]

[81. Duffield00a] Nick Duffield and Matthias Grossglauser. Trajectory sampling for direct traffic observation. In *Proceedings of the ACM SIGCOMM Conference*, pages 179–191, Stockholm, Sweeden, August 2000. ACM. [class PDF copy]

[82. Feldmann00a] Anja Feldmann, Albert Greenberg, Carsten Lund, Nick Reingold, and Fred True Jennifer Rexford. Deriving traffic demands for operational IP networks: Methodology and experience. In *Proceedings of the ACM SIGCOMM Conference*, pages 257–270, Stockholm, Sweeden, August 2000. ACM. [class PDF copy]

[83. BenFredj01a] S. Ben Fredj, T. Bonald, A. Proutiere, G. Régnié, and J. W. Roberts. Statistical bandwidth sharing: A study of congestion at flow level. In *Proceedings of the ACM SIGCOMM Conference*, pages 111–122, San Diego, CA, USA, August 2001. ACM. [class PDF copy]