CMPSCI 754: Multimedia Systems

Instructor: PRASHANT SHENOY
Spring 2001
Schedule #: 283566
TuTh 1:00 - 2:15, CS 140

Prerequisites

Familiarity with concepts in graduate computer networks and operating systems design.

Synopsis

CMPSCI 754 is an advanced course covering both theoretical and practical issues in designing multimedia systems. Topics to be covered include introduction to multimedia systems, digital video compression techniques, operating system support for digital audio and video, as well as network and transport protocols for multimedia. An emphasis will be placed on current design issues and research topics.

Textbook

There is no textbook for this course. A collection of recent research articles will be made available by the instructor.

Course Requirements

The instructor will introduce basic concepts on each of the topics. Students will be expected to understand research papers and participate in class discussions. Additionally, students will be expected to carry out a semester-long project. Each student will also need to act as a scribe for one or two lectures.
Grades will be determined by a project (40%), examinations (a mid-term and a final) (40%), two homeworks (10%) and class participation (10%).

Class Home Page

Information about the course, handouts, etc., will be available on the class home page at:
http://www.cs.umass.edu/~shenoy/courses/spring01

Office Hours

Thursday 2:15 - 3:30, CS 336
By appointment: Phone 577-0850, E-mail: shenoy@cs.umass.edu

Reading List for CMPSCI 754: Multimedia Systems

Spring 2001

Video Compression

- R. Steinmetz, “Data Compression Techniques in Multimedia computing”, ACM Multimedia Systems, Vol. 1, Pages 166-172, 187-204, 1994
- G.K. Wallace, “The JPEG Still Picture Compression Standard”, Communications of the ACM, Vol. 34, No. 4, Pages 31-44, April 1991.
- D. Le Gall, “MPEG: A Video Compression Standard for Multimedia Applications”, Communications of the ACM, Vol. 34, No. 4, Pages 46-58, April 1991.
- T. Sikora, “An Overview of MPEG-1 and MPEG-2 Digital Video Coding Standards”, Technical Report, Heinrich-Hertz-Intitut Berlin, 1997.
- R. Koenen, “MPEG-4: Multimedia for our Time”, IEEE Spectrum, Vol 36, No 2, pages 26-33, February 1999.
- F. Nack and A. T. Lindsay, “Everything You Wanted to Know About MPEG-7: Part 1”, IEEE Multimedia, vol 6, no 3, July 1999.

Multimedia File Systems

- *Overview:*
  1. P. Shenoy, P. Goyal, and H.M. Vin, “Issues in Multimedia Server Design”, ACM Computing Surveys, Vol. 27, No. 4, Pages 636-639, December 1995
  2. D J. Gemmel, H M. Vin, D D. Kandlur and P. V. Rangan, “Multimedia Storage Servers: A Tutorial and Survey”, IEEE Computer, Vol. 28, No. 5, Pages 40-49, May 1995
- *Placement:*
  P. Shenoy and H.M. Vin. “Efficient Striping Techniques for Multimedia File Servers”, In Proceedings of the 7th International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV’97), Pages 25-36, May 1997
- *Fault Tolerance:*
  H. M. Vin, P.J. Shenoy, and S. Rao, “Efficient Failure Recovery in Multi-Disk Multimedia Servers”, In Proceedings of the 25th Annual International Symposium on Fault Tolerant Computing (FTCS-25), Pasadena, California, Pages 12-21, June 1995
- *Retrieval:*
  1. H.M. Vin, P. Goyal, A. Goyal and A. Goyal, “A Statistical Admission Control Algorithm for Multimedia Servers”, In Proceedings of the ACM Multimedia’94, San Francisco, Pages 33-40, October 1994
  2. H. M. Vin, A. Goyal and P. Goyal, “Algorithms for Designing Large-Scale Multimedia Servers”, Computer Communications, Vol. 18, No. 3, Pages 192-203, March 1995
- *Caching:*
  A. Dan and D. Sitaram, “Buffer Management Policy for an On-Demand Video Server”, IBM Research Report RC 19347, October 1994

- *Integrated File System Design Issues:*

  1. P. Shenoy and H.M. Vin, "Cello: A Disk Scheduling Framework for Next-generation Operating Systems", In Proceedings of ACM SIGMETRICS'98, the International Conference on Measurement and Modeling of Computer Systems, Madison, WI, Pages 44-55, June 1998
  2. P.J. Shenoy, P. Goyal, S. Rao, and H.M. Vin, "Design and Implementation of Symphony: An Integrated Multimedia File System", In Proceedings of ACM/SPIE Multimedia Computing and Networking 1998 (MMCN'98), San Jose, Pages 124-138, January 1998
  3. P. Shenoy, P. Goyal and H. M. Vin, "Architectural Considerations for Next Generation File Systems" Proceedings of the Seventh ACM Conference on Multimedia, Orlando, FL, pages 457-467, November 1999.

Multimedia Operating Systems

- *I/O Subsystem:*

  1. P. Druschel, "Operating System Support for High-Speed Networking", Communications of the ACM, Vol. 39, No. 9, Pages 41-51, September 1996.
  2. P. Druschel and G. Banga, "Lazy Receiver Processing (LRP): A Network Subsystem Architecture for Server Systems", In Proceedings of the 2nd Symposium on Operating System Design and Implementation (OSDI), Seattle, Washington, Pages 261-275, October 1996
  3. J. Brustoloni and P. Steenkiste, "Effects of Buffering Semantics on I/O Performance", In Proceedings of the 2nd Symposium on Operating System Design and Implementation (OSDI), Seattle, Washington, Pages 266-291, October 1996

- *Processor Scheduling:*

  1. P. Goyal, X. Guo, and H.M. Vin, "A Hierarchical CPU Scheduler for Multimedia Operating Systems", In Proceedings of the Second Symposium on Operating Systems Design and Implementations (OSDI'96), Seattle, Washington, Pages 107-122, October 1996
  2. J. Nieh and M. Lam, "The Design, Implementation, and Evaluation of SMART: A Scheduler for Multimedia Applications", In Proceedings of the Symposium on Operating Systems Principles, Saint-Malo, France, Pages 184-197, December 1997

- *OS Structure/Architecture:*

  1. R. Govindan and D.P. Anderson, "Scheduling and IPC Mechanisms for Continuous Media", Proceedings of 13th ACM Symposium on Operating Systems Principles, Pacific Grove, CA, Pages 68-80, October 1991
  2. V. Sundaram, A. Chandra, P. Goyal, P. Shenoy, J. Sahni and H. Vin, "Application Performance in the QLinux Multimedia Operating System", Proceedings of the Eighth ACM Conference on Multimedia, Los Angeles, CA, pages 127-136, November 2000.
  3. M. Frans Kaashoek, D. Engler, G. Ganger, H. Briceno, R. Hunt, D. Mazieres, T. Pinckney, R Grimm, J. Jannotti, and K. Mackenzie, "Application Performance and Flexibility on Exokernel Systems", In Proceedings of the Symposium on Operating Systems Principles, Saint-Malo, France, Pages 52-65, December 1997

Multimedia Networks

- *Protocols for Video Transport:*

1. S.S. Lam, S. Chow, and D.K.Y. Yau, “An Algorithm for Lossless Smoothing of MPEG Video”, In Proceedings of ACM SIGCOMM’94, London, September 1994
2. J. Salehi, Z. Zhang, J. Kurose, and D. Towsley, “Supporting Stored Video: Reducing Rate Variability and End-to-End Resource Requirements through Optimal Smoothing”, In Proceedings of ACM SIGMETRICS’96, Philadelphia, PA, May 1996
3. P. Goyal and H.M. Vin, “Network Algorithms and Protocol for Multimedia Servers”, In Proceedings of INFOCOM’96, San Francisco, Pages 1371-1379, March 1996
4. J. Paris, D. Long and P. Mantey, “Zero-Delay Broadcasting Protocols for Video-on-Demand”, In Proceedings of ACM Multimedia’99, Orlando, Fl, pages 188-198 November 1999.
5. S.K. Kasera, S. Bhattacharyya, M. Keaton, D. Kiwior, S. Zabele, J. Kurose, D. Towsley, “Scalable Fair Reliable Multicast using Active Services”, IEEE Networks Magazine, von 14, no. 1, pages48-57, January 2000

- *Issues in Designing Integrated Services Networks:*

1. S. Shenker, “Fundamental Design Issues for the Future Internet”, IEEE Journal of Selected Areas in Communications, Vol. 13, Pages 1176-1188, September 1995
2. H. Zhang and S. Keshav, “Comparison of Rate-Based Service Disciplines”, In Proceedings of ACM SIGCOMM’91, August 1991.¡LI¿ P. Goyal, H.M. Vin, and H. Cheng, “Start-time Fair Queuing: A Scheduling Algorithm for Integrated Services Packet Switching Networks”, In Proceedings of ACM SIGCOMM’96, San Francisco, Pages 157-168, August 1996
3. P. Goyal, S.S. Lam, and H.M. Vin, “Determining End-to-End Delay in Heterogeneous Networks”, ACM Multimedia Systems, Vol. 5, No. 3, Pages 157-163, 1997
4. D. Wetherall, “Active Network Vision and Reality: Lessons from a Capsule-based System” Proceedings of 17th ACM Symposium on Operating System Principles (SOSP’99), Kiawah Island, SC, December 1999.

Multimedia Databases

- M. Flickner, et al., “Query by Image and Video Content: The QBIC System”, IEEE Computer, Vol 28, Num 9, pp 23-32, Sept. 1995