

Course Schedule

Course Schedule

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Week	Activity	Video Length	Date Due	Notes
1	OS Refresher	2h, 18min	Friday Jan 13	(Optional) Students who need a refresher on AOS topics should take this course
1	Lesson 1: Intro to AOS	46min	Friday Jan 13	
2	Homework		Tuesday Jan 17 (11:59 PM EST)	(1 week)
2	Pre-lab		Tuesday Jan 17 (11:59 PM EST)	(1 week)
2	Lesson 2: OS Structures	2h, 40min	Friday Jan 20	
3	Lesson 3: Virtualization	1h, 53min	Friday Jan 27	
4-5	Lesson 4: Parallel Systems	5h, 34min	Friday Feb 3 / Feb 10	This is the last lesson that will be included in the Test 1.

Week	Activity	Video Length	Date Due	Notes
6	Project1: Virtual Machine Scheduling in KVM		Monday Feb 13 (11:55 PM EST)	(3 weeks)
6-7	Lesson 5: Distributed Systems	3h, 20min	Friday Feb 17 / Feb 20	
6-7	Test 1		Fri Feb 17 (11:55 PM EST) - Mon Feb 20 (11:55 PM EST)	Lesson 1-4
8	Lesson 6: Distributed Objects and Middleware	1h, 56min	Friday Mar 3	
9	Project 2: Barrier Synchronization		Monday Mar 6 (11:55 PM EST)	(3 weeks)
9-10	Lesson 7: Distributed Subsystems	3h, 48min	Friday Mar 10 / Mar 17	
	Spring break		Monday Mar 20 - Tuesday Mar 24	
11	Lesson 9: Internet Computing	2h, 34min	Friday Mar 31	
12	Project 3: Distributed Service using GRPC		Monday Apr 3 (11:55 PM EST)	(3 weeks)
12	Lesson 10: RT and Multimedia	1h, 15min	Friday Apr 7	
12-13	Test 2		Frid Apr 7 (11: 55 PM EST) - Mon Apr 10 (11: 55 PM EST)	Lessons 5-7

Week	Activity	Video Length	Date Due	Notes
13	Lesson 8: Failures and Recovery	1h, 58min	Friday Apr 14	
14	Lesson 11: Security	1h, 17min	Friday Apr 21	
15	Project 4: Implement MapReduce Framework		Monday Apr 24 (11:55 PM EST)	(3 weeks)
17	Test 3 (Final Exam)		Fri Apr 28 (11: 55 PM EST)- May 1 (11:55 PM EST)	Lessons 8-11

Reading List

Reading List

Lecture	Papers
Lesson 2: OS Structures	<ol style="list-style-type: none"> 1. Brian Bershad et al., "Extensibility, Safety and Performance in the SPIN Operating System ", Proceedings of the 15th ACM Symposium on Operating System Principles, December 1995. 2. Dawson R. Engler, Frans Kaashoek and James O'Toole, "Exokernel: An Operating System Architecture for Application-Level Resource Management ", Proceedings of the 15th ACM Symposium on Operating System Principles, ACM, December 1995. 3. J. Liedtke, " On Micro-Kernel Construction ", Proceedings of the 15th ACM Symposium on Operating System Principles, ACM, December 1995. 4. J. Liedtke, "Improved Address-Space Switching on Pentium Processors by Transparently Multiplexing User Address Spaces ", GMD Technical Report No. 933, November 1995 (self-study).
Lesson 3: Virtualization	<ol style="list-style-type: none"> 1. Paul Barham, Boris Dragovic, Keir Fraser, Steven Hand, Tim Harris, Alex Ho, Rolf Neugebauer, Ian Pratt, Andrew Warfield, "Xen and the Art of Virtualization ", SOSP 2003.  2. Carl Waldspurger, "Memory Resource Management in VMware ESX Server", OSDI, 200.

<p>Lesson 4: Parallel Systems</p>	<ol style="list-style-type: none"> 1. Mellor-Crummey, J. M. and Scott, M., "Algorithms for Scalable Synchronization on Shared-Memory Multiprocessors ", ACM Transactions on Computer Systems, Feb. 1991. 2. [SEP] B. N. Bershad, T. E. Anderson, E. D. Lazowska, and H. M. Levy. Lightweight Remote Procedure Call . ACM Transactions on Computer Systems, 8(1):37--55, Feb. 1990. 3. [SEP] (partial reading: skip system modeling) M.S. Squillante and E.D. Lazowska, " Using Processor-Cache Affinity Information in Shared Memory Multiprocessor Scheduling ", IEEE Transactions on Parallel and Distributed Systems, Feb. 1993, pgs. 131-143. 4. [SEP] Alexandra Fedorova, Margo Seltzer, Christopher Small and Daniel Nussbaum. Performance of Multithreaded Chip Multiprocessors and Implications for Operating System Design. Usenix 05. 5. [SEP] Ben Gamsa, Orran Krieger, Jonathan Appavoo, and Michael Stumm, Tornado: Maximizing Locality and Concurrency in a Shared Memory Multiprocessor Operating System , 1999 Symposium on Operating System Design and Implementation. 6. [SEP] (partial reading: Sec 1, 2, 3, and 10) S. Boyd-Wickizer, H. Chen, R. Chen, Y. Mao, F. Kaashoek, et. al, "Corey: An Operating System for Many Cores", OSDI 2008. 7. [SEP] (partial reading: Sec 1, 2, 3, and 8) Kinshuk Govil, Dan Teodosiu, Yongqiang Huang, and Mendel Rosenblum. Cellular Disco: resource management using virtual clusters on shared-memory multiprocessors. In Proceedings of 17th Symposium on Operating Systems Principles, 1999.
<p>Lesson 5: Distributed Systems</p>	<ol style="list-style-type: none"> 1. Lamport, L., " Time, Clocks, and the Ordering of Events in a Distributed System ", Communications of the ACM, 21, 7, pgs. 558-565, July 1978. [SEP] 2. C.A. Thekkath and H.M. Levy, " Limits to Low-Latency Communications on High- Speed Networks ", ACM Transactions on Computer Systems, May 1993. [SEP] 3. Hutchinson N.C., Peterson, L.L., " The x-Kernel: An Architecture for Implementing Network Protocols ", IEEE Transactions on Software Engineering, 17, 1, pgs. 64-76, January 1991. [SEP] 4. David Wetherall, " Active Networks: Vision and Reality: Lessons from a Capsule-based System ", 17th ACM Symposium on Operating System Principles, OS Review, Volume 33, Number 5, Dec. 1999. [SEP] 5. Liu, Kreitz, van Renesse, Hickey, Hayden, Birman, Constable, "Building Reliable High Performance Communication Systems from Components ", 17th ACM Symposium on Operating System Principles, OS Review, Volume 33, Number 5, Dec. 1999. [SEP] 6. (partial reading) Schroeder, M., and Burrows, M., " Performance of the Firefly RPC", Proceedings of the Twelfth ACM Symposium on Operating

	Systems Principles, pgs. 83- 90, December 1989.
Lesson 6: Distributed Objects and Middleware	<ol style="list-style-type: none"> 1. Mitchell, J. G., et al., " An Overview of the Spring System ", Proceedings of Comcon, Feb. 1994. [L] [SEP] 2. Hamilton, G., Powell, M.L., and Mitchell, J.J., "Subcontract: A Flexible Base for Distributed Programming ", Proceedings of the Fourteenth ACM SOSP, pgs. 69-79, December 1993. [L] [SEP] 3. Wollrath, A., Riggs, R., and Waldo, J., "A Distributed Object Model for the Java System ", Usenix Conference on Object Oriented Technologies and Systems, May 1996. [L] [SEP] 4. Emmanuel Cecchet, Julie Marguerite, Willy Zwaenepoel, "Performance and Scalability of EJB Applications", Proceedings of the 17th ACM SIGPLAN conference on Object- oriented programming, systems, languages, and applications.
Lesson 7: Distributed Subsystems	<ol style="list-style-type: none"> 1. Feeley, Morgan, Pighin, Karlin, Levy, Thekkath,, "Implementing Global Memory Management in a Workstation Cluster ", Fifteenth ACM Symposium on Operating System Principles, Dec. 1995. 2. [L] [SEP] C. Amza, A. Cox, S Dwarkadas, P Keleher, H Lu, R. Rajamony, W. Yu and W. Zwaenepoel, " TreadMarks: Shared Memory Computing on Networks of Workstations " IEEE Computer, February, 1996. [L] [SEP] 3. Anderson, T. et al., " Serverless Network File System ", ACM Transaction on Computer Systems, February 1996. [L] [SEP] 4. (partial reading) Mahadev Satyanarayanan, "Coda: A Highly Available File System for a Distributed Workstation Environment", IEEE Trans. Computers, vol 39, no 4, Apr 1990
Lesson 8: Failures and Recovery	<ol style="list-style-type: none"> 1. Satyanarayanan, M., et al., " Lightweight Recoverable Virtual Memory ", The Proceedings of Fourteenth ACM Symposium on Operating System Principles, pgs. 146- 160, December 1993. [L] [SEP] 2. David E. Lowell and Peter M. Chen, " Free Transactions With Rio Vista ", Proceedings of the Sixteenth ACM Symposium on Operating System Principles, October 1997. [L] [SEP] 3. R. Haskin et. al., " Recovery Management in QuickSilver ", ACM Transactions on Computer Systems, February 1988. [L] [SEP] 4. (read on your own) J. N. Gray, P. McJones, M. W. Blasgen, R. A. Lorie, T. G. Price, G. R. Putzolu, and I. L. Traiger. " The Recovery Manager of a Data Management System ", ACM Computing Surveys, Vol. 13, No. 2, June 1981, pp. 223-242. [L] [SEP] 5. (partial reading: first 3 sections of the paper) D. Porter, O. Hofmann, C. Rossbach, A. Benn, E. Witchel, "Operating System Transactions“, SOSP'09. [L] [SEP]

	<p>6. (partial reading) D. Peng, F. Dabek, "Large-scale Incremental Processing Using Distributed Transactions and Notifications", OSDI'10</p>
Lesson 9: Internet Computing	<ol style="list-style-type: none"> 1. Dean, J., and Ghemawat, S. "MapReduce: Simplified Data Processing on Large Clusters". 2. (partial reading) Brewer, E. "Lessons from Giant-Scale Services" . 3. (partial reading) Luis Andre Barroso, Jeffrey Dean, Urs Holzle, " Web Search for a Planet: The Google Cluster Architecture ", IEEE Micro. 4. Freedman, M., Freudenthal, E., and Mazières, D. "Democratizing content publication with Coral" . 5. G. DeCandia, D. Hastorun, et. al., "Dynamo: Amazon's Highly Available Key-value Store", SOSP'07. 6. (read on your own for learning about Web Technologies) (2 short papers) <ol style="list-style-type: none"> 1. Curbera, F., Duftler, M., Khalaf, R., Nagy, W., Mukhi, N., Weerawarana, S., " Unraveling the Web services web: an introduction to SOAP, WSDL, and UDDI ", IEEE Internet Computing, Volume: 6 Issue: 2, March-April 2002, pgs. 86 -93. 2. Curbera, F., Khalaf, R., Mukhi, N., Tai, S., Weerawarana, S., " The Next Step in Web Services ", Communications of the ACM, Volume 46 Issue 10 ,October 2003, pgs. 29-34.
Lesson 10: RT and Multimedia	<ol style="list-style-type: none"> 1. Ashvin Goel, Luca Abeni, Charles Krasic, Jim Snow, Jonathan Walpole, Supporting Time-Sensitive Applications on a Commodity OS, OSDI 2002. 2. T. Broomhead, L. Cremean, J. Ridoux, D. Veitch, "Virtualize Everything but Time", OSDI'10. 3. David Hilley and Umakishore Ramachandran, Persistent Temporal Streams . ACM/IFIP/USENIX 10th International Middleware Conference, Urbana Champaign, Illinois, USA , November 30 - December 4, 2009. 4. Shahabi, Zimmermann, Fu, and Yao. "Yima: A Second-Generation Continuous Media Server ", IEEE Computer Magazine, June 2002.
Lesson 11: Security	<ol style="list-style-type: none"> 1. Saltzer, J.H. and Schroeder, M.D., " Protection and the Control of Information in Computer Systems ", Proceedings of the IEEE, 63(9):1278-1308, Sept. 1975. 2. M. Satyanarayanan, " Integrating Security in Large Scale Distributed Systems ", ACM TOCS, Aug. 1989.

Grade Distribution (under construction)

- Pre-lab: 2%
- Homework (on required background): 3%

- **Projects**

- **Project 1: 12% (This project has to be done individually)**
- **Project 2: 12%**
- **Project 3: 12%**
- **Project 4: 12%**

(Note: Projects 2-4 can be done in groups of 2. It is your own responsibility to find a project partner and work out the logistics of working together. The teaching team will not arbitrate on such matters (e.g., partner dropping the course, etc.). Our assumption is that both partners contribute equally to the project. We will do random sampling of project teams to verify that the project was done with full participation by both members.

You can choose to do the projects on your own as well without a partner. But there is no special consideration for doing it by yourself as opposed to doing it with a partner.)

- **Class participation**

- **Ed Discussion Participation: 3%**

(Provide answers to peer questions; Ask questions; Work out past exams collaboratively, etc.); Note: We will use the summary stats from the forum in the following categories: "views", "contributions", "questions", "answers". The exact weight of each is not revealed to the students, but I am sure the students are savvy enough to know which would count for more!

- **Two paper summaries: 2%**

(Students sign up on the Wiki and choose two papers from the reading list to write summaries - approximately 1 page for each summary)

- **Tests**

- **Test 1: 16%**
- **Test 2: 14%**
- **Test 3: 12 %**

The tests will be conducted using Honorlock. You are allowed ONE sheet of BLANK SCRATCH paper at the time of the test for you to do scratch work. You have to show both sides of the paper to the webcam before starting the exam.

Extra Credit

- **Video Hangout attendance: 0.5% if at least 10 appearances through the semester for the weekly hangout.**
- **We recognize that due to time zone differences it may not be possible for some of you to attend the weekly hangouts at all. We will create an "extra credit assignment" worth 0.5% for students who cannot attend the hangouts on Tuesdays.**
 - **You are to summarize any 10 hangout recordings.**

- Each summary should not be more than a page.
- You must aggregate all 10 summaries in a single pdf document and upload it.
- Note: You can eligible for this extra credit option ONLY if you are unable to attend hangouts and mark your attendance through Turning Point during the hangout.
- CIOS completion rate at the end of the semester if it exceeds 95% everyone will get 1% added to their course total.

Course Summary:

Date














Details











Due



[Class participation - instructor use only](#)

(<https://gatech.instructure.com/courses/297032/assignments/1221446>)

Date	Details	Due
	 Diagnostic (https://gatech.instructure.com/courses/297032/assignments/1221448)	
	 Diagnostic Test (https://gatech.instructure.com/courses/297032/assignments/1221450)	
	 Extra Credit - Consolidated Hangout Score (https://gatech.instructure.com/courses/297032/assignments/1221452)	
	 Hangout Summaries (https://gatech.instructure.com/courses/297032/assignments/1221454)	
	 Homework 0 (https://gatech.instructure.com/courses/297032/assignments/1221456)	
	 Homework 0 due (https://gatech.instructure.com/calendar?event_id=3810721&include_contexts=course_297032)	
	 Honorlock Test Quiz (https://gatech.instructure.com/courses/297032/assignments/1221416)	
	 Paper Summary 1 - Instructor Use Only (https://gatech.instructure.com/courses/297032/assignments/1221458)	
	 Paper Summary 2 - Instructor Use Only (https://gatech.instructure.com/courses/297032/assignments/1221460)	
	 Pre-Lab (https://gatech.instructure.com/courses/297032/assignments/1221462)	
	 Pre-lab due (https://gatech.instructure.com/calendar?event_id=3810719&include_contexts=course_297032)	
	 Project 1 (https://gatech.instructure.com/courses/297032/assignments/1221464)	
	 Project 1 - One Time Forgiveness Policy	

Date	Details	Due
	(https://gatech.instructure.com/courses/297032/assignments/1221466)	
	 Project 2 (https://gatech.instructure.com/courses/297032/assignments/1221468)	
	 Project 2 - One Time Forgiveness Policy (https://gatech.instructure.com/courses/297032/assignments/1221470)	
	 Project 3 (https://gatech.instructure.com/courses/297032/assignments/1221472)	
	 Project 3: One Time Forgiveness Policy (https://gatech.instructure.com/courses/297032/assignments/1221474)	
	 Project 4 (https://gatech.instructure.com/courses/297032/assignments/1221476)	
	 Project 4: One Time Forgiveness (https://gatech.instructure.com/courses/297032/assignments/1221478)	
	 Test 1 (https://gatech.instructure.com/courses/297032/assignments/1221418)	
	 Test 2 (https://gatech.instructure.com/courses/297032/assignments/1221420)	
	 Test 3 (https://gatech.instructure.com/courses/297032/assignments/1221424)	
	 Video Hangout Attendance (Extra Credit) (https://gatech.instructure.com/courses/297032/assignments/1221482)	