

Reading List and Schedule

9/23

- [Course Overview](#) ↴

Historical Perspective

9/28

- E. W. Dijkstra, [The Structure of the 'THE'-Multiprogramming System](#) ↵, Communications of the ACM, Vol. 11, No. 5, May 1968, pp. 341-346.

(Additional historical background on [semaphores in Wikipedia](#) ↵.)

Q: Dijkstra explicitly states their goals for the THE operating system. How do these goals compare to, say, Microsoft's goals for the Windows operating system? Why do we no longer build operating systems with the same goals as THE?

- P. B. Hansen, [The Nucleus of a Multiprogramming System](#) ↵, Communications of the ACM, Vol. 13, No. 4, April 1970, pp. 238-241, 250.

Optional related paper on a deployment experience of RC 4000:

- P. B. Hansen, [The RC 4000 Real-Time Control System at Pulway](#) ↵, BIT 7, pp. 279-288, 1967.

Q: How does synchronization in the RC 4000 system compare with synchronization in the THE system?

9/30

- D. G. Bobrow, J. D. Burchfiel, D. L. Murphy, and R. S. Tomlinson, [TENEX, a Paged Time Sharing System for the PDP-10](#) ↵, Communications of the ACM, Vol. 15, No. 3, March 1972, pp. 135-143.

Q: What features in TENEX are reminiscent of features in Unix (a later system)?

- W. Wulf, E. Cohen, W. Corwin, A. Jones, R. Levin, C. Pierson, and F. Pollack, [HYDRA: The Kernel of a Multiprocessor Operating System](#) ↵, Communications of the ACM, Vol. 17, No. 6, June 1974, pp. 337-345.

Q: How is a Hydra procedure different from the procedures we are familiar with in a typical language and runtime environment?

Structure

10/5

- B. Lampson, [Protection](#) ↵, Operating Systems Review, Vol. 8, No. 1, January 1974, pp. 18-24.

Q: What are the concepts in HYDRA that correspond to Lampson's definitions of "Domain", "Object", and "Access Matrix"? What about Multics?

- J. H. Saltzer, [Protection and the Control of Information Sharing in Multics](#) ↵, Communications of the ACM, Vol. 17, No. 7, July 1974, pp. 388-402.

Optional Multics paper:

- A. Bensoissan, C. T. Clingen, and R. C. Daley, [The Multics Virtual Memory: Concepts and Design](#) ↵, Communications of the ACM, Vol. 15, No. 5, May 1972, pp. 308-318.

Q: Compare and contrast protected subsystems in Multics with procedures in Hydra.

10/7

- D. M. Ritchie and K. Thompson, [The UNIX Time-Sharing System](#) ↵, Communications of the ACM, Vol. 17, No. 7, July 1974, pp. 365-375.

Q: What aspects of Unix as described in the 1974 paper do not survive today, or have been considerably changed?

- R. Pike, D. Presotto, S. Dorward, B. Flandrena, K. Thompson, H. Trickey, and P. Winterbottom, [Plan 9 From Bell Labs](#) ↵, USENIX Computing Systems, Vol. 8, No. 3, Summer 1995, pp. 221-254.

Q: What does it mean, "9P is really the core of the system; it is fair to say that the Plan 9 kernel is primarily a 9P multiplexer"?

10/12 (Quiz 1, 9/23-10/12, will include the following two papers)

- J. K. Ousterhout, D. A. Scelza, and P. S. Sindhur, [Medusa: An Experiment in Distributed Operating Systems Structure](#) ↵, Communications of the ACM, Vol. 23, No. 2, February 1980, pp. 92-105.

Q: What are the three distributed OS structures outlined in the paper, which structure does Medusa use, and why?

- D. D. Redell, Y. K. Dalal, T. R. Horsley, H. C. Lauer, W. C. Lynch, P. R. McJones, H. G. Murray, and S. C. Purcell, [Pilot: An Operating System for a Personal Computer](#) ↵, Communications of the ACM, Vol. 23, No. 2, February 1980, pp. 81-92.

Q: How do the requirements of the Pilot operating system differ from the systems we have read about so far, and how does the design of Pilot reflect those differences?

Synchronization

10/14

- C. A. R. Hoare, [Monitors: An Operating System Structuring Concept](#) ↵, Communications of the ACM, Vol. 17, No. 10, October 1974, pp. 549-557.

Q: What are "monitor invariant" I and "condition" B, and why are they important in the discussion of monitors?

- B. W. Lampson and D. D. Redell, [Experience with Processes and Monitors in Mesa](#) ↵, Communications of the ACM, Vol. 23, No. 2, February 1980, pp. 105-117.

Q: Compare and contrast synchronization in Java with Hoare monitors and Mesa monitors.

Distribution

10/19

- D. R. Cheriton and W. Zwaenepoel, [The Distributed V Kernel and its Performance for Diskless Workstations](#) ↵, Proceedings of the 9th Symposium on Operating Systems Principles, pp. 129-140, November 1983.

Q: What is the argument for diskless workstations, and do you agree/disagree with the argument?

- J. K. Ousterhout, A. R. Cerenson, F. Dougis, M. N. Nelson, and B. W. Welch, [The Sprite Network Operating System](#) ↵, IEEE Computer, Vol. 21, No. 2, February 1988, pp. 23-36.

Q: How do the caching policies in Sprite differ from those in the V Kernel?

10/21

- M. D. Schroeder, A. D. Birrell, and R. M. Needham, [Experience with Grapevine: The Growth of a Distributed System](#) ↵, ACM Transactions on Computer Systems, Vol. 2, No. 1, February 1984.

Q: In what ways was Grapevine explicitly designed to handle scalability?

- Michael J. Feeley, William E. Morgan, Frederic H. Pighin, Anna R. Karlin, and Henry M. Levy, [Implementing Global Memory Management in a Workstation Cluster](#) ↵, Proceedings of the 15th ACM Symposium on Operating Systems Principles, Dec. 1995, 29(5): 201-212.

Q: How does the implementation of the GMS page replacement algorithm approximate the ideal algorithm?

OS/Architecture Interaction

10/26 (Quiz 2, 10/14-10/26, will include the following two papers)

- H. Haertig, M. Hohmuth, J. Liedtke, S. Schoenberg, J. Wolter, ["The Performance of Micro-Kernel-Based Systems"](#) ↵, Proceedings of the 16th Symposium on Operating Systems Principles, October 1997, pp. 66-77.

Optional related papers on hierarchical address spaces and formally verifying a microkernel:

- J. Liedtke, [On Micro-kernel Construction](#) ↵, In [Proceedings of the Fifteenth ACM Symposium on Operating Systems Principles](#), December 1995, Copper Mountain Resort, Colorado, pp. 237-250.

- G. Klein, K. Elphinstone, G. Heiser, J. Andronick, D. Cock, P. Derrin, D. Elkaduwe, K. Engelhardt, M. Norrish, R. Kolanski, T. Sewell, H. Tuch, S. Winwood, [sel4: Formal Verification of an OS Kernel](#) ↵, In [Proceedings of the 22nd ACM Symposium on Operating Systems Principles](#), October 2009, Big Sky Resort, MT, pp. 207-220.

Q: Compare and contrast the L4 microkernel with the RC4000 Nucleus and the HYDRA kernel in terms of their goals to provide a basis on which higher level OS functionality can be implemented.

- D. R. Engler, M. F. Kaashoek, and J. O'Toole Jr., [Exokernel: An Operating System Architecture for Application-Level Resource Management](#) ↵, In [Proceedings of the Fifteenth ACM Symposium on Operating Systems Principles](#), December 1995, Copper Mountain Resort, Colorado, pp. 251-266.

Optional . the other Exokernel paper:

- M. F. Kaashoek, D. R. Engler, G. R. Ganger, H. M. 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 Sixteenth ACM Symposium on Operating Systems Principles](#), October 1997, St. Malo, France, pp. 52-65.

Q: Compare and contrast an exokernel with a microkernel.

10/28

- R. J. Creasy, [The Origin of the VM/370 Time-Sharing System](#) ↵, In IBM Journal of Research and Development, 25(5):483-490, September 1981.

- P. Barham, B. Dragovic, K. Fraser, S. Hand, T. Harris, A. Ho, R. Neugebauer, I. Pratt, and A. Warfield, [Xen and the Art of Virtualization](#) ↵, In [Proceedings of the 19th Symposium on Operating System Principles](#), October, 2003.

Optional related paper describing VMware virtualization performance (2006-era):

- Keith Adams and Ole Agesen, [A Comparison of Software and Hardware Techniques for x86 Virtualization](#) ↵, In [Proceedings of the 12th International Conference on Architectural Support for Programming Languages and Operating Systems](#), October 2006, pp. 2.13.

Q: Microkernels and virtual machine monitors are two different ways to support the execution of multiple operating systems on modern hardware. How does the microkernel approach in L4 compare and contrast with the VMM approach in Xen?

Virtual Memory

11/2

- H. M. Levy and P. Lipman, [Virtual Memory Management in VAX/VMS](#) ↵, IEEE Computer, Vol. 15, No. 3, March 1982, pp. 35-41.

Q: The paper states, "VAX/VMS, then, is a collection of procedures that exist in the address space of each process." Explain in your own words what this statement means.

- Richard Rashid, Avadis Tevanian, Michael Young, David Golub, Robert Baronn, David Black, William Bolosky, and Jonathan Chew, ["Machine-Independent Virtual Memory Management for Paged Uniprocessor and Multiprocessor Architectures"](#) ↵, In [Proceedings of the Second International Conference on Architectural Support for Programming Languages and Operating Systems](#), October 1987, pp. 31-39.

Q: How do the caching policies in Sprite differ from those in the V Kernel?

11/9

(Quiz 3, 10/28-11/9, will include the following two papers)

- Gregory R. Ganger, Marshall Kirk McKusick, Craig A.N. Soules, and Yale N. Patt, ["Soft Updates: A Solution to the Metadata Update Problem in File Systems"](#) ↵, ACM Transactions on Computer Systems, Vol. 18, No. 2, May 2000, Pages 127-153.

- P. M. Chen, W. T. Ng, S. Chandra, C. Aycock, G. Rajamani, and D. Lowell, ["The Rio File Cache: Surviving Operating System Crashes"](#) ↵, In [Proceedings of the Seventh International Conference on Architectural Support for Programming Languages and Operating Systems](#), SIGPLAN Notices 31(9):74-83, September 1996.

Optional further readings on Rio:

- David E. Lowell and Peter M. Chen, [Free Transactions with Rio Vista](#) ↵, In [Proceedings of the Sixteenth ACM Symposium on Operating Systems Principles](#), October 1997, St. Malo, France, pp. 92-101.

- G. Klein, K. Elphinstone, G. Heiser, J. Andronick, D. Cock, P. Derrin, D. Elkaduwe, K. Engelhardt, M. Norrish, R. Kolanski, T. Sewell, H. Tuch, S. Winwood, [sel4: Formal Verification of an OS Kernel](#) ↵, In [Proceedings of the 22nd ACM Symposium on Operating Systems Principles](#), October 2009, Big Sky Resort, MT, pp. 207-220.

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Optional . the other Exokernel paper:

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Q: Compare and contrast an exokernel with a microkernel.

11/11

(Veteran's day (Holiday))

Scheduling

11/16

- Thomas E. Anderson, Brian N. Bershad, Edward D. Lazowska, Henry M. Levy, [Scheduler Activations: Effective Kernel Support for the User-level Management of Parallelism](#) ↵, Proceedings of the 13th ACM Symposium on Operating Systems Principles, Sept. 1991, pp. 95-109.

Q: The goal of scheduler activations is to have the benefits of both user and kernel threads without their limitations. What are the limitations of user and kernel threads, and what are the benefits that scheduler activations provide?

- Carl A. Waldspurger and William E. Weihl, [Lottery Scheduling: Flexible Proportional-Share Resource Management](#) ↵, In [Proceedings of the First USENIX Symposium on Operating System Design and Implementation](#), November, 1994.

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Smartphones

11/18

- Jeremy Andrus, Christoffer Dall, Alexander Van't Hof, Oren Laadan, and Jason Nieh, [Cells: A Virtual Mobile Smartphone Architecture](#) ↵, SOSP'11, October 2011.

- W. Enck, P. Gilbert, B.G. Chun, L. P. Cox, J. Jung, P. McDaniel, A. N. Sheth, [TaintDroid: An Information-Flow Tracking System for Realtime Privacy Monitoring on Smartphones](#) ↵, OSDI'10, October 2010

Optional related paper describing VMware virtualization performance (2006-era):

- Keith Adams and Ole Agesen, [A Comparison of Software and Hardware Techniques for x86 Virtualization](#) ↵, In [Proceedings of the 12th International Conference on Architectural Support for Programming Languages and Operating Systems](#), October 20