Resource Virtualization

Reading List

Note: We will not read all of these papers in class. The syllabus is the final word on the specific papers that we shall read in class.

Most of these papers are available from the web (use http://www.google.com and http://citeseer.nj.nec.com to find them.   I will make photocopies of the older, non-web papers available as needed.)

Why Virtualization ?

1. R. Goldberg, *Survey of Virtual Machine Research*, IEEE Computer, June 1974, pp 34-45.
2. J. Smith, *An Overview of Virtual Machine Architectures*, 2001.
3. VM/386 (http://www.igcinc.com/vm386.htm)
4. Virtual 8086 mode: http://www.openbg.net/sto/os/xml/v86.html
5. P. Karger, et al, *A Retrospective on the VAX VMM Security Kernel*, IEEE Transactions on Software Engineering, November, 1991.
6. R. Figueiredo, P. Dinda, J. Fortes, *A Case for Grid Computing on Virtual Machines*, Proceedings of ICDCS 2003.
7. S. Hand, et al, *Controlling the XenoServer Open Platform*, OpenARCH 2003.
8. P. Chen, B. Noble, *When Virtual is Better Than Real*, HOT-OS 2001.
9. C. Sapuntzakis, et al, *Virtual Appliances for Deploying and Maintaining Software*, LISA 2003.
10. T. Garfinkel, et al, *Terra: A Virtual Machine-based Platform for Trusted Computing*, SOSP 2003.
11. J. Nieh, O. Leonard. *Examining VMWare*, Dr. Dobb's Journal, August 2000.
12. W. Dobrusky, T. Steel, *UNCOL: Universal Computer-Oriented Language*, Communications of the ACM 4(3), 1961. (abstract only)
13. P. Bagley, *Principles and Problems of a Universal Computer-Oriented Language*, The Computer Journal 4(4), 1962.
14. F. Corbato, V. Vyssostsky, *Introduction and Overview of the Multics System,* Fall Joint Computer Conference, 1965.
15. W. Vogels, *HPC.NET: Are CLI-based Virtual Machines Suitable for High Performance Computing?*, Supercomputing 2003.

OS-Level Virtual Machines

16. R. Goldberg, *Survey of Virtual Machine Research*, IEEE Computer, June 1974, pp 34-45.
17. L. Seawright, R. MacKinnon, *VM/370: A Study of Multiplicity and Usefulness*, IBM Systems Journal 18(1), 1979.

18. R. Creasy, *The Origin of the VM/370 Time-Sharing System,* IBM Systems Journal 25(5), 1981.
19. VM/370: The subject of IBM Systems Journal 18(1), 1979 (9 articles)
20. C. Waldsburger, *Memory Resource Management in VMWare ESX Server*, OSDI 2002.
21. VMWare, Inc., *Introducing the VMWare Virtual Platform*
22. Devine, S., et al, *Virtualization System Including A Virtual Machine Monitor For a Computer With A Segmented Architecture*, U.S. Patent #6397242. (VMWare Patent)
23. J. Honneycutt, *Microsoft Virtual PC 2004 Technical Overview.*
24. K. Lawton, *Running Multiple Operating Systems Concurrently on an IA32 PC Using Virtualization Techniques.*
25. R. Goldberg, *Architecture of Virtual Machines*, Proceedings of the Worshop on Virtual Computer Systems, Cambridge, Mass, 1973, pp 74-112.
26. E. Bugnion, et al, *Disco: Running Commodity Operating Systems on Scalable Multiprocessors,* ACM Transactions on Computer Systems, 18(3), August 2000.
27. Plex/86: http://plex86.sourceforge.net/

Architectural Issues

28. G. Popek, R. Goldberg, *Formal Requirements for Virtualizable Third Generation Architectures*, Communications of the ACM, 17(7), July, 1974, pp 413-421.
29. E. Mallach, *On the Relationship Between Virtual Machines and Emulators*, Proceedings of the Workshop on Virtual Computer Systems, Cambridge, Mass, 1973, pp 117-126.
30. J. Robin, C. Irvine, *Analysis of the Intel Pentium's Ability to Support a Secure Virtual Machine Monitor*, Proceedings of of the 9th USENIX Security Symposium, Denver, CO, August 2000.
31. J. Hall, P. Robinson, *Virtualizing the VAX Architecture*, Proceedings of ISCA 1991, pp 380-389.

Emulation

32. P. Magnusson, et al, *Simics: A Full System Simulation Platform*, IEEE Computer 35(2), 2002.
33. Microsoft Virtual PC for Mac
34. R. Sites, et al, *Binary Translation,* Communications of the ACM, 36(2), February, 1993.
35. E. Mallach, *On the Relationship Between Virtual Machines and Emulators*, Proceedings of the Workshop on Virtual Computer Systems, Cambridge, Mass, 1973, pp 117-126.
36. Bochs IA-32 Emulator: http://bochs.sourceforge.net/

Language-level Virtual Machines

37. UCSD p-system: http://www.threedee.com/jcm/psystem/, http://www.ics.uci.edu/~archive/documentation/p-system/p-system.html
38. T. Lindholm, F. Yellin, *The Java Virtual Machine Specification*, *2nd Edition.* Available from http://java.sun.com/docs/books/vmspec/2nd-edition/html/VMSpecTOC.doc.html
39. E. Meijer, J. Gough, *Technical Overview of the Common Language Runtime*.
40. Microsoft .NET/CLR documentation: http://msdn.microsoft.com/netframework/
41. A. Adl-Tabatabai et al, *Fast, Effective Code Generation in a Just-in-Time Java Compiler*, PLDI 1998.

Virtual Servers

42. Whitaker, et al, *Scale and Performance in the Denali Isolation Kernel*, OSDI 2002.
43. Ensim, Inc, *Virtual Private Servers*
44. *Free VSD: http://www.freevsd.org*
45. *Linux V-server: http://www.linux-vserver.org/*
46. D. Engler, et al, *Exokernel: An Operating System Architecture for Application-Level Resource Management,* SOSP 1995.
47. P. Barham, et al, *Xen and the Art of Virtualization*, SOSP 2003.
48. S. Osman, *The Design and Implementation of Zap: A System for Migrating Computing Environments,* OSDI 2002.
49. J. Dike, *A User-mode Port of the Linux Kernel*, Linux Showcase and Conference 2000. (see also http://user-mode-linux.sourceforge.net/)
50. H. Hoxer, et al, *Implementing a User-mode Linux with Minimal Changes from the Original Kernel*, 2002 Linux System Technology Conference.

Virtual Devices

51. J. Sugarman, G. Venkitachalam, B-H Lim, *Virtualizing I/O Devices on VMWare Workstation's Virtual Machine Monitor*, USENIX 2001.
52. S. King, et al, *Operating System Support for Virtual Machines*, USENIX 2003.
53. [assorted unpublished papers]

Virtual Storage / SANs

54. G. Alvarez, et al, *MINERVA: An Automated Resource Provisioning Tool for Large-Scale Storage Systems*, ACM Transactions on Computer Systems 19(4), 2001.
55. M. Beck, et al, *An End-to-end Approach to Globally Scalable Network Storage*, SIGCOMM 2002. (see also http://loci.cs.utk.edu/)

56. C. Lumb, et al, *Façade: Virtual Storage Devices with Performance Guarantees*, USENIX FAST 2003.

Virtual Services

57. R. Figueiredo, et al, *The PUNCH Virtual File System: Seamless Access to Decentralized Storage Services in a Computational* Grid, HPDC 2001.
58. J. Weissman, B. Lee, *The Virtual Service Grid: an architecture for delivering high-end network services*, Concurrency: Practice and Experience, 14(4), 2002.
59. X. Jiang, D. Xu, *SODA: A Service-on-demand Architecture for Application Service Hosting Platforms*, HPDC 2003.
60. See also papers from the "Why Virtualization" section

Virtual Networking

61. P. Ferguson, G. Huston, *What is a VPN?*, Technical Report, Cisco Systems, March 1998.
62. B. Gleeson, et al, *A Framework for IP-based Virtual Private Networks*, IETF RFC 2764, February 2000.
63. G. Italiano, et al, *Restoration Algorithms for Virtual Private Networks in the Hose Model*, INFOCOM 2002.
64. IEEE 802.1Q Working Group, *802.1q: Virtual LANs,* IEEE, 2001.
65. J. Jannotti, et al, *Overcast: Reliable Multicasting With An Overlay Network,* OSDI 2000.
66. S. Shi, J. Turner, *Routing In Overlay Multicast Networks*, INFOCOM 2002.
67. A. Sundararaj, P. Dinda, *Towards Virtual Networks for Virtual Machine Grid Computing,* USENIX VM 2004.
68. X. Jiang, D. Xu, *VIOLIN: Virtual Internetworking on Overlay Infrastructure*, Technical Report CSD TR 03-027, Department of Computer Science, Purdue University.

Security

69. S. Madnick, J. Donovan, *Application and Analysis of the Virtual Machine Approach to Information System Security and* Isolation, Proceedings of the Workshop on Virtual Computer Systems, Cambridge, Mass, 1973, pp 210-224.
70. G. Popek, C. Kline, *A Verifiable Protection System*, Proceedings of the International Conference on Reliable Software, LA, CA, 1975, pp 294-304.
71. T. Bressoud and F. Schneider, *Hypervisor-based Fault Tolerance,* ACM Transactions on Computer Systems, 14(1), 1996.
72. T. Garfinkel, M. Rosenblum, *A Virtual Machine Introspection-based Architecture for Intrusion Detection,* NDSS 2003.

73. G. Dunlop, et al, *ReVirt: Enabling Intrusion Analysis Through Virtual Machine Logging and Replay*, OSDI 2002.

Migration of Virtual Machines

74. C. Sapuntzakis, et al, *Optimizing the Migration of Virtual Computers*, OSDI 2002.
75. S. Osman, *The Design and Implementation of Zap: A System for Migrating Computing Environments,* OSDI 2002.
76. T. Boyd, P. Dasgupta, *Process Migration: A Generalized Approach Using a Virtualizing Operating System*, ICDCS 2002.

Economies, others

77. C. Waldsburger. T. Hogg, *Spawn: A Distributed Computational Economy*, IEEE Transactions on Software Engineering, 18(2), 1992.
78. B. Schmidt, et al, *The Interactive Performance of SLIM: A Stateless Thin-client Architecture*, SOSP 1999.
79. W. Tetzlaff, *State Sampling of Interactive VM/370 Users*, IBM Systems Journal 18(1), 1979.