Conference at a Glance

Saturday, June 17

4:00 pm - 9:00 pm	On-Site Registration

Sunday, June 18

7:30 am - 5:00 pm	On-Site Registration
9:00 am - 5:00 pm	Tutorial Program
6:00 pm - 7:00 pm	Welcome Reception
7:00 pm - 8:00 pm	Conference Orientation

Monday, June 19

7:30 am - 5:00 pm	On-Site Registration
9:00 am - 5:00 pm	Tutorial Program

Tuesday, June 20

7:30 am - 5:00 pm	On-Site Registration
9:00 am - 5:00 pm	Tutorial Program
6:00 pm - 10:00 pm	Birds-of-a-Feather Sessions

Wednesday, June 21

7:30 am - 6:00 pm	On-Site Registration
9:00 am - 10:30 am	Keynote Address
11:00 am - 5:30 pm	Refereed Papers/Invited Talks/FREENIX
12:00 pm - 7:00 pm	Vendor Exhibition
5:30 pm - 7:00 pm	Happy Hour at the Exhibition
9:00 pm - 11:00 pm	Birds-of-a-Feather Sessions

Thursday, June 22

7:30 am - 5:00 pm	On-Site Registration
9:00 am - 5:30 pm	Refereed Papers/Invited Talks/FREENIX
10:00 am - 4:00 pm	Vendor Exhibition
7:00 pm - 9:00 pm	25th Anniversary Reception
9:00 pm - 11:00 pm	Birds-of-a-Feather Sessions

Friday, June 23

9:00 am - 3:30 pm	Refereed Papers/Invited Talks/FREENIX
4:00 pm - 5:30 pm	Joint Closing Session

USENIX

! PARTY ! PARTY ! PARTY ! PARTY !

USENIX CELEBRATES ITS 25TH ANNIVERSARY!

What would a celebration be without parties, games, and prizes? Please join us for the festivities!

Important Dates to Remember

Pre-Registration Discount Deadline: Friday, May 12, 2000

Hotel Discount Deadline: Friday, May 26, 2000

Contents

2000

Christopher Small

Conference Organizers

Program Chair

Christopher Small, *Osprey Partners LLC*

Program Committee

Ken Arnold, *Sun Microsystems*

Aaron Brown, *University of California at Berkeley*

Fred Douglis, *AT&T Labs—Research*

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Liuba Shrira, *Brandeis University*

Keith A. Smith, *Harvard University*

Mark Zbikowski, *Microsoft*

Invited Talks Coordinators

John Heidemann, *USC/Information Sciences Institute*

John T. Kohl, *Rational Software*

FREENIX Program Chair

Marshall Kirk McKusick, *Author & Consultant*

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Chris Demetriou, *AT&T Labs*

David Greenman, *The FreeBSD Project*

Miguel de Icaza, *Helix Code, Inc.*

Niels Provos, *University of Michigan*

Theodore Ts'o, *VA Linux Systems*

Stephen C. Tweedie, *Red Hat, Inc.*

Victor Yodaiken, *FSMLabs and New Mexico Institute of Technology*

Come Celebrate our 25th!

An Invitation from the Program Chair

Dear Colleague,

The USENIX Annual Technical Conference has always been the gathering place for like minds in the computer industry, a place to meet peers and experts and share solutions to common problems.

Our **tutorials** feature top-of-the-line instructors offering techniques and technologies that you can put to immediate use. Choose from 28 full-day classes. Topics? Hackers and you; how to automate your Web site maintenance; the latest on Sendmail; administering and fine-tuning your systems—Linux, Samba, Solaris, NT; managing people as well as machines; and much more. Our tutorials fill up fast, so register early.

High-quality **refereed papers** are the cornerstone of this conference's reputation for cutting-edge, technically excellent research. This year, the program committee received 92 excellent submissions and selected 27 of them for publication. Presentations will include new work from **Bill Cheswick, Rob Pike,** and **Margo Seltzer,** and the latest research results on operating systems, tools and techniques for dealing with the system infrastructure headaches.

Among the many **invited talks,** you'll hear a report from **the Microsoft Antitrust Case** by expert witness Edward Felten of Princeton University.

The very popular **FREENIX** track is devoted to *BSD, Linux, X11-based graphical user interfaces, and the full range of freely redistributable software. Anyone interested in open-source software will appreciate the technical quality and relevance of the FREENIX track.

In our Keynote, **Bill Joy**, Co-Founder of Sun Microsystems, will discuss his vision of the future of computing. At our Closing Session you'll hear **Thomas Dolby Robertson**, Founder of Beatnik, Inc., as our special guest speaker.

Newcomers and past attendees will find that our Annual Technical Conference has a lot to offer. Join us in San Diego on June 18–23, 2000, as we celebrate our 25th Anniversary and pave the way for future innovators.

For the USENIX 2000 Organizing Committee,

Christopher Small, ***Osprey Partners LLC***
Program Chair

Tutorial Program *June 18–20, 2000*

To meet your needs, the Tutorial Program at USENIX 2000 provides you with in-depth, immediately useful instruction in the latest techniques, effective tools, and best strategies. USENIX tutorials survey the topic, then dive right into the specifics of what to do and how to do it. Instructors are well-known experts in their fields, selected for their ability to teach complex subjects. Attend the tutorials at USENIX 2000 and take valuable skills back to your company or organization. **Register now to guarantee your first choice—seating is limited.**

Tutorial Program at a Glance

Sunday	
S1	UNIX Security Tools: Use and Comparison
S2	Sendmail Configuration and Operation (Updated for Sendmail 8.10)
S3	System and Network Performance Tuning
S4	Advanced Topics in Perl Programming NEW
S5	Windows NT Internals
S6	Hacking Exposed: LIVE! NEW
S7	Introduction to UNIX Administration
S8	Cryptographic Algorithms Revealed NEW

Monday	
M1	Intrusion Detection and Network Forensics
M2	Advanced Solaris Systems Administration Topics
M3	Linux Systems Administration
M4	Windows NT and UNIX Integration: Problems and Solutions
M5	Security from the Inside Out: System Engineering for Security Systems NEW
M6	Topics in Systems Administration I NEW
M7	Administering Windows 2000: A Course for UNIX People UPDATED
M8	Advanced CGI Techniques Using Perl NEW
M9	Modern Security Systems for Intranets, Extranets, and the Internet
M10	Secure Networking: An Introduction to VPN Architecture and Implementation NEW

Tutorial fees include:
- Admission to the tutorials you select
- Lunch
- Tutorial CD-ROM
- Printed and bound tutorial materials from your sessions
- Admission to the Vendor Exhibition

Our guarantee: If you're not happy, we're not happy. If you feel a tutorial does not meet the high standards you have come to expect from USENIX, let us know by the first break and we will change you to any other available tutorial immediately.

TUESDAY	
T1	Designing Resilient Distributed Systems—High Availability
T2	Solaris Internals: Architecture, Tips, and Tidbits
T3	Inside the Linux Kernel
T4	Configuring and Administering Samba Servers NEW
T5	Computer Attacks: Trends and Countermeasures
T6	Network Administration NEW
T7	Practical Web Site Development and Maintenance with Perl: A Cookbook Approach NEW
T8	Managing and Being Managed NEW
T9	Network Security Profiles: A Collection (Hodgepodge) of Stuff Hackers Know About You
T10	Special Topics in Sendmail: Sendmail 8.10 and Sendmail Security NEW

Continuing Education Units (CEUs)

USENIX provides Continuing Education Units for a small additional administrative fee. The CEU is a nationally recognized standard unit of measure for continuing education and training and is used by thousands of organizations. Each full-day tutorial, or two half-day tutorials, qualifies for 0.6 CEUs. You can request CEU credit by completing the CEU section on the registration form. USENIX provides a certificate for each attendee taking a tutorial for CEU credit and maintains transcripts for all CEU students. CEUs are not the same as college credits. Consult your employer or school to determine their applicability.

TUTORIAL DESCRIPTIONS

SUNDAY, JUNE 18, 2000

S1 UNIX Security Tools: Use and Comparison

Matt Bishop, *University of California, Davis*

Who should attend: UNIX system, network, and security administrators who need to better understand the various security tools currently available.

The goal of this course is to assist UNIX security administrators, and other interested users, in locating and using publicly available programs to improve the security of their systems. This course will compare the uses and drawbacks of several different programs, with an emphasis on when to use which. Only free tools with source code available will be discussed.

Topics include:
- Tool checking and analysis
  - What to look for
  - How to analyze a tool
  - Checking downloaded tools for security problems
- Static analysis tools: filesystem auditing (tiger, COPS)
- Network analysis and security tools: monitors (nfsbug, tcp_wrappers), SATAN, Gabriel
- Tools for privilege: managing shells (lsu, smrsh)
- Tools for logging and log analysis tools (swatch, logcheck)
- Libraries (msystem, trustfile)
- Tools for authentication: proactive password changers (passwd+, crack)

S2 Sendmail Configuration and Operation (Updated for Sendmail 8.10)

Eric Allman, *Sendmail, Inc.*

Who should attend: System administrators who want to learn more about the sendmail program, particularly details of configuration and operational issues (this tutorial will not cover mail front ends). This will be an intense, fast-paced, full-day tutorial for people who have already been

exposed to sendmail. This tutorial describes the latest release of sendmail from Berkeley, version 8.10.

We begin by introducing a bit of the philosophy and history underlying sendmail.

Topics include:

- The basic concepts of configuration: mailers, options, macros, classes, keyed files (databases), and rewriting rules and rulesets
- Configuring sendmail using the m4 macro package
- Day-to-day management issues, including alias and forward files, "special" recipients (files, programs, and include files), mailing lists, command-line flags, tuning, and security
- How sendmail interacts with the Domain Name System

S3 System and Network Performance Tuning

Marc Staveley, *Sun Microsystems, Inc.*

Who should attend: Novice and advanced UNIX system and network administrators, and UNIX developers concerned about network performance impacts. A basic understanding of UNIX system facilities and network environments is assumed.

We will explore procedures and techniques for tuning systems, networks and application code. Starting from the single-system view, we will examine how the virtual memory system, the I/O system, and the file system can be measured and optimized. We'll extend the single-host view to include Network File System tuning and performance strategies. Detailed treatment of networking performance problems, including network design and media choices, will lead to examples of network capacity planning. Application issues, such as system call optimization, memory usage and monitoring, code profiling, real-time programming, and techniques for controlling response time will be addressed. Many examples will be given, along with guidelines for capacity planning and customized monitoring based on your workloads and traffic patterns. Question-and-analysis periods for particular situations will be provided.

Topics include:

- Performance tuning strategies
  - Practical goals
  - Monitoring intervals
  - Useful statistics
  - Tools, tools, tools
  - Server tuning
  - Filesystem and disk tuning
  - Memory consumption and swap space
  - System resource monitoring
- NFS performance tuning
  - NFS server constraints
  - NFS client improvements
  - NFS over WANs
  - Automounter and other tricks
- Network performance, design, and capacity planning
  - Locating bottlenecks
  - Demand management
  - Media choices and protocols
  - Network topologies: bridges, switches, routers
  - Throughput and latency considerations
  - Modeling resource usage
- Application tuning
  - System resource usage
  - Memory allocation
  - Code profiling
  - Job scheduling and queuing
  - Real-time issues
  - Managing response time

S4 Advanced Topics in Perl Programming NEW

Tom Christiansen, *Consultant*

Who should attend: Experienced Perl programmers interested in honing their existing Perl skills for quick prototyping, system utilities, software tools, system management tasks, database access, and WWW programming. Participants should have used Perl for basic scripting for several months prior to taking this course.

Topics include:

- Complex data structures
- References
- Memory management and anonymous data structures
- Packages and modules
- Namespaces, scoping, and extent
- Classes and objects
- Object-oriented programming
- Process control and management
- Pipes and signals
- Advanced I/O techniques and file locking
- Assorted tips and tricks to use Perl effectively

Upon completion of this course, students will be able to:

- Develop standard and OO modules for code reuse
- Understand complex and hierarchical data structures
- Understand Perl's facilities for file locking
- Use Perl for multi-process and daemon programming
- Understand inheritance, closures, and scoping in Perl

S5 Windows NT Internals

Jamie Hanrahan, *Kernel Mode Systems*

Who should attend: This tutorial is aimed at operating system developers, applications programmers, and system administrators who need to understand the internal behavior and architecture of Windows NT. (Note: The information presented is valid for both NT Version 4 and Version 5.)

Windows NT is built on a new operating system code base, similar in many ways to well-established OSes such as UNIX and VMS, and very different from Microsoft's DOS/Win16/Windows 9*x* platforms. This tutorial will describe the behavior of Windows NT from a "system architecture" point of view. Using a variety of tools, we will explore internal interfaces and the behavior of the system, show how NT implements fundamental operating-system functions such as scheduling and memory management, and show how NT's architecture affects some of its functionality.

Topics include:

- General system architecture
- Providing operating system functions to user mode
- Thread scheduling
- Memory management internals
- Using and interpreting performance measurement tools

S6 Hacking Exposed: LIVE! NEW

George Kurtz and Eric Schultze, *Rampart Security Group*

Who should attend: Network and system administrators, security administrators, and technical auditors who want to secure their UNIX/NT–based networks.

Is your UNIX/NT–based network infrastructure up to meeting the challenge of malicious marauders? In this tutorial we'll present the methodologies used by today's hackers to gain access to your networks and critical data. We'll demonstrate a typical attack exploiting both well-known and little-known NT-based vulnerabilities. We'll show how NT attackers can leverage UNIX vulnerabilities to circumvent traditional security mechanisms. And we'll identify opportunities to better secure the host and networks against more esoteric attacks. All examples will be demonstrated on a live network of machines.

Topics include:

- Footprinting your site
  - Port scanning
  - Banner grabbing
- Exploiting common configuration and design weaknesses in NT networks
  - Enumerating user and system information from NT 4 and Windows 2000 hosts
  - Exploiting Web services
  - Logging on to NT using only the password hash
  - Routing through IPX and NetBEUI networks
  - Grabbing remote shells on NT
  - Hijacking the GUI
  - Hidden trojans: executing streamed files
- Bypassing routers and firewall filtering
  - Using source ports
  - Leveraging port redirection
  - 101 uses for Netcat
- Linking NT and UNIX vulnerabilities for maximum exploitation
- Securing NT systems to prevent attacks

S7 Introduction to UNIX Administration

Peter Baer Galvin, *Corporate Technologies, Inc.*

Who should attend: UNIX or other operating system users wishing to know more about UNIX administration.

This tutorial is designed to teach UNIX administration skills to those who are experienced with computers but new to UNIX administration. The course covers all of the essential system administration topics and stresses professional methods of administration. It uses Solaris as the example operating system when exploring detailed examples, with some Linux tossed in.

Topics include:

- The role of the system administrator
- Overview of the UNIX file system
- User authorization and control
- The file system
- System startup and shutdown
- Boot process and start-up files
- Installation
  - Installation from a CD
  - Jumpstart
  - Patches
  - Installing layered software
- Crash recovery
- File System Backups
- System tuning and process control
- Configuration and devices
- Devices
  - Device naming
  - Device creation
  - Troubleshooting SCSI problems
- Admintool
  - Admintool overview
  - Printing
  - User management
  - Terminal configuration
- System administration goals
  - transparency
  - interoperability
- TCP/IP and RPC
- Networking
- NFS
- File systems
  - Caching file system
  - AutoFS
  - Vold
- Security
  - Restricted shells
  - Sun security packages
  - Post-installation changes
  - Security tools and ideas
- Monitoring, managing, and troubleshooting
- Performance
  - Performance monitoring tools
  - Tuning via cookbook

S8 Cryptographic Algorithms Revealed NEW

Greg Rose, *QUALCOMM Australia*

Who should attend: Anyone interested in a fairly detailed overview of what makes cryptographic algorithms work, and, when they don't work, how they are broken. The tutorial will be as up-to-the-minute as possible with respect to the development of the Advanced Encryption Standard.

Some mathematical background is required—at the very least, familiarity with common mathematical notation and polynomials, and some elementary statistical knowledge. You've been warned.

Topics include (unless time runs out):

- Brief history
  - substitution and transposition
  - development of DES
  - public-key cryptography
- Symmetric block ciphers
  - Feistel ciphers in general
  - DES
  - SKIPJACK
  - Current AES candidates (Rijndael, Twofish, MARS, RC6, Serpent)
  - Block-cipher modes of operation
- Symmetric stream ciphers
  - Panama
  - A5, SOBER and other LFSR-based constructions
- Cryptanalysis
  - Differential & linear cryptanalysis
  - Attack assumptions and threat models
  - Attacks on stream ciphers
- Public-key systems
  - Group and finite field theory
  - Discrete log systems (El Gamal, Diffie-Hellman, DSS)
  - RSA
  - Elliptic curves
- Other stuff
  - Hash functions, SHA-1

MONDAY, JUNE 19, 2000

M1 Intrusion Detection and Network Forensics

Marcus J. Ranum, *Network Flight Recorder, Inc.*

Who should attend: Network and system managers, security managers, and auditors. This tutorial assumes some knowledge of TCP/IP networking and client/server computing.

What can intrusion detection do for you? Intrusion detection systems are designed to alert network managers to unusual or possibly hostile events within the network. Once you've found traces of a hacker, what should you do? What kinds of tools can you deploy to determine what happened, how they got in, and how to keep them out? This tutorial provides a highly technical overview of the state of intrusion detection software and the types of products that are available, as well as basic principles to apply to building your own intrusion detection alarms. Methods of recording events during an intrusion are also covered.

Topics include:

- What is IDS?
  - Principles
  - Prior art
- Can IDS help?
  - What IDS can and can't do
  - IDS and the WWW
  - IDS and firewalls
  - IDS and VPNs
- Types and trends in IDS design
  - Anomaly detection
  - Misuse detection
  - Traps
  - Future avenues of research
- Concepts for building your IDS
  - What you need to know first
  - Performance issues
- Tools for building your IDS
  - Sniffers and suckers
  - Host logging tools
  - Log recorders
- Reporting and recording
  - Managing alerts
  - What to throw away
  - What to keep
- Network forensics
  - So you've been hacked . . .
  - Forensic tools
  - Brief overview of evidence handling
  - Who can help you
- Resources and references

M2 Advanced Solaris Systems Administration Topics

Peter Baer Galvin, *Corporate Technologies, Inc.*

Who should attend: UNIX administrators who need more knowledge of Solaris administration.

This course covers a variety of topics that matter to Solaris system administrators. We will discuss the major new features of recent Solaris releases, including which to use and how to use them, and which to avoid. This in-depth course will provide the information a system manager/administrator needs to run a Solaris installation effectively.

Topics include:

- Installing and upgrading
  - Architecting an appropriate facility
  - Choosing the best hardware for your needs
  - Planning your installation, filesystem layout, post-installation steps
  - Installing (and removing) patches and packages
- Advanced features of Solaris 2
  - CacheFS: configuring and using AutoFS
  - The /proc file system and commands
  - Useful tips and techniques
- Networking and the kernel
  - Virtual IP: configuration and uses
  - Kernel and performance tuning: new features, adding devices, tuning, debugging commands
  - Devices: naming conventions, drivers, gotchas
- Enhancing Solaris
  - High-availability essentials: disk failures and recovery, RAID levels, uses and performance, H-A technology and implementation
  - Performance: how to track down and break up bottlenecks
  - Tools: useful free tools, tool use strategies
  - Security: locking down Solaris, system modifications, tools
- Resources and references

M3 Linux Systems Administration

Bryan C. Andregg, *Red Hat, Inc.*

Who should attend: This tutorial is directed at system administrators who are planning on implementing a Linux solution in a production environment. Course attendees should be familiar with the basics of systems administration in a UNIX/Linux environment: user-level commands, administration commands, and TCP/IP networking. The novice administrator and the guru should both leave the tutorial having learned something.

Topics include (with special emphasis on security):

- Installation features
- Disk partitioning and RAID
- Networking
- User accounts
- Services
- NFS and NIS
- High-availability environments
- The workplace
- Up and coming in the Linux world (CODA, LVM, etc.)

Upon completion of the course, attendees should feel confident in their ability to set up and maintain a secure and useful Linux network. The tutorial will be conducted in an open manner that allows for questions at all times.

M4 Windows NT and UNIX Integration: Problems and Solutions

Phil Cox, *SystemExperts Corporation;*
Gerald Carter, *Auburn University*

Who should attend: System administrators who are responsible for heterogeneous Windows NT– and UNIX–based systems. Attendees should have user-level knowledge of both UNIX and Windows NT, and it's recommended they have systems administration experience in at least one of these OSes.

Today's organizations choose computing solutions from a variety of vendors. Often, integrating the solutions into a seamless, manageable enterprise is an afterthought, left up to system administrators. This course covers specific problem areas in administering a mixture of UNIX and Windows NT systems. The focus will be on practical solutions that can be applied today to real-world administration problems.

Topics include:

- Overview of NT and UNIX
  - Basic homogeneous setups
  - Services: what's offered, and how
  - Similarities
  - Differences
  - Potential sticking points
- Areas of interest
  - Electronic mail
  - Web servers
  - User authentication
  - File serving
  - Printing
  - Faxes and modems
  - Host-to-host connectivity
  - Remote administration
  - Backup and restore

For each of the areas of interest we will cover:

- Current uses in homogeneous environments
- Available answers—where integration can happen
- Integration solutions, how to choose one, some useful tools
- Security considerations

M5 Security from the Inside Out: System Engineering for Security Systems NEW

Char Sample, *L-3 Network Security;*
Ian Poynter, *Jerboa Inc.*

Who should attend: Consultants, systems architects, information security professionals, system administrators, and anyone responsible for planning, implementing, or evaluating security systems.

There are many different point solutions that address various security issues. Firewalls, IDS, VPNs, authentication devices, and various servers provide tactical point solutions. How do we pull all of these together to form a security system? How do we properly engineer this system and avoid the pitfalls of over-engineering?

You will learn how to quantify values in your networked environment, giving you the information to determine how much security is needed and where.

Topics include the following systems engineering areas as they relate to network security:

- Needs
- Operations, stated and unstated
- Requirements: how to derive and quantify them
- Architecture
- Design
- Implementation and integration
- Testing and evaluation (or reevaluation) of the security system

While these steps may seem obvious to most of us, when we implement security systems we rarely, if ever, follow this process. We will discuss the vision of a security architecture and how to handle all phases of this process, how to engineer the multiple layers of security, and how to navigate politically and technically to create the best solution for your environment.

M6 Topics in Systems Administration I NEW

Ned McClain, *XOR Network Engineering;*
Evi Nemeth, *University of Colorado*

Who should attend: System and network administrators who want to learn real-life solutions to everyday problems.

Overwhelmed by the rapid change in the systems administration field? This tutorial is a potpourri of learning about UNIX topics that will make you more effective in your role as a system administrator.

Topics include:

- LDAP: We'll tell you what it is and how to use it in real life. We'll cover integration of LDAP with an organization directory, sendmail, and firewalls. The major focus will be on choosing a UNIX server that's right for your organization.
- RRDtool: This data management tool (from the author of MRTG) is ideal for site statistics monitoring. The class will explain how to use available front ends to monitor network and host performance.
- Y2K reflections: The year change came and went with very few issues. We'll discuss what did go wrong, and what the UNIX community learned from all the energy that was spent in preparation.
- DHCP: Short on address space? Sick of configuring each and every one of your users' machines? We'll talk about making DHCP work for your organization. We will cover servers and clients, on both UNIX and NT and hosts.
- Disaster planning: In planning for disasters, whether they are physical incidents, security incidents, or just sysadmin errors, hindsight and good backups are invaluable. We will provide some guidelines and a checklist of some of the documentation that you need to maintain to make disasters more recoverable.
- Security tools: A new generation's worth of security management tools are on the loose, and we'll help you understand how to use them to your advantage. We'll examine new scanning tools such as Nessus and nmap, as well as looking at new tools to facilitate security forensics.

M7 Administering Windows 2000: A Course for UNIX People UPDATED

Aeleen Frisch, *Exponential Consulting*

Who should attend: UNIX system administrators who are also responsible for Windows 2000 systems (or who may become responsible for them). Attendees should be comfortable with general systems administration concepts (file systems, processes, user accounts, backups, and the like), as well as the major tools and procedures used to manage them on UNIX systems. As was true with Windows NT 4.0, a sense of humor will be beneficial when initially approaching Windows 2000.

The primary goal of this course is to help you apply what you already know about systems administration under UNIX to the tasks and challenges of the Windows 2000 environment, in an effort to make

that transition as easy and painless as possible. The course will include a variety of real-world examples and will focus on practical techniques and strategies for Windows 2000 systems administration. You can expect a very fast-paced, information-rich course.

Note: People who are familiar with Windows NT 4.0 will find some/much of the material in this course to be a review. Differences between Windows NT 4.0 and Windows 2000 *will* be discussed.

Topics include:

- Windows 2000 overview
- Upgrading Windows NT 4.0 systems
- Booting under Windows NT
- Managing user accounts under Active Directory
- Disks and file systems
- Networking: connecting to UNIX and other systems
- Printing on and from Windows 2000 systems
- Overview of Windows 2000 security
- Integration with UNIX systems

M8 Advanced CGI Techniques Using Perl

NEW

Tom Christiansen, *Consultant*

Who should attend: Experienced Perl programmers and Webmasters interested in learning more about CGI techniques than would be learned in a class on how to write a CGI program in Perl. Attendees are assumed to know the fundamentals of HTML and CGI programming, as well as using (but not writing) Perl modules.

CGI programming is fundamentally an easy thing. The Common Gateway Interface merely defines that a CGI program be able to read stdin and environment variables, and to write stderr. But writing efficient CGI programs of any degree of complexity is a difficult process.

Topics include:

- Multi-stage forms
  - Sequential "shopping cart" systems
  - Undirected "jump page" systems
  - Techniques for recording selections across pages
- Cookies
  - For authentication and authorization
  - For user tracking
  - For data validation
  - For data hiding and indirection
  - Data exchange and efficiency
  - File uploading
  - Redirection and temporary aliasing
- CGI Security
  - Taint checking
  - Denial-of-Service attacks
  - Data security
  - Daemonization of processes
  - Fast CGI and mod_perl
  - Front-end/back-end solutions
  - Backgrounding
  - Invocation and response techniques
  - Statelessness and statefulness
  - PATH_INFO vs. cookies vs. CGI parameters
  - Static vs. dynamic vs. locally cached responses
- Web automation from CGI scripts
  - Fetching remote pages
  - Parsing HTML and extracting data
  - Determining and setting image sizes

In all examples, we will show which Perl modules make these tasks easier. Numerous code examples will be provided, as well as pointers to Web pages containing fully functioning examples for later examination.

M9 Modern Security Systems for Intranets, Extranets, and the Internet

Daniel E. Geer, Jr., *@Stake;*
Jon Rochlis, *SystemExperts Corporation*

In today's fast-moving Internet and client-server world, security is a critical component of most systems. But security systems are complex and confusing. Different systems provide overlapping functionality, and what's popular today may be gone tomorrow. This course describes many of today's most popular network security systems. We describe how the various security protocols work, what value they provide, and how difficult they are to implement. The goal: attendees should become well equipped to understand which protocols are applicable to their environments and systems, which to pursue in more detail, and which are likely to be just a flash in the pan.

Topics include:

- Internet/intranet security: confidentiality, authentication, integrity, authorization
- Fundamental technology: encryption, public key, private key, certification
- Low-security systems: basic WWW/HTTP, cookies, classic remote login (telnet/rlogin/rsh), file transfer
- Secure Socket Layer (SSL) for securing HTTP
- Kerberos-based systems: intranet cross-application private key, including MS-DCE and Microsoft NT5
- Secure Shell (SSH): remote login and lots more
- Email: PGP & S/Mime
- VPNs: IPSec, remote access
- Payment protocols: Digicash, SET (Visa/Mastercard), and more

M10 Secure Networking: An Introduction to VPN Architecture and Implementation

NEW

Tina Bird, *Counterpane Internet Security*

Who should attend: System administrators and network managers responsible for remote access and wide-area networks within their organization. Participants should be familiar with TCP/IP networking and fundamental network security, although some review is provided. The purpose of this tutorial is to provide a step-by-step guide to evaluating an organization's VPN requirements, selecting the appropriate VPN architecture, and implementing it within a preexisting security infrastructure.

Virtual private networking technology provides a flexible mechanism for addressing connectivity needs within many organizations. This class focuses on assessing business and technical requirements for remote access and extranet connections; evaluating VPN technology; integrating VPNs within an existing network

infrastructure; common implementation difficulties; and VPN security issues.

Topics include:

- VPN security features (encryption, access control, NAT) and how they protect against common Internet threats
- Assessing your organization's needs for remote access
- IPSec, PPTP, application-layer VPNs, and where they fit
- A brief review of commercial VPN products
- Implementing VPN technology within your organization's network
- Common VPN difficulties
- VPN security issues

After completing this course, attendees should be ready to evaluate their requirements for remote access and begin testing commercial VPN implementations.

TUESDAY, JUNE 20, 2000

T1 Designing Resilient Distributed Systems—High Availability

Evan Marcus, *VERITAS Software Corporation*

Who should attend: Beginning and intermediate UNIX system and network administrators, and UNIX developers concerned with building applications that can be deployed and managed in a highly resilient manner. A basic understanding of UNIX system programming, UNIX shell programming, and network environments is required.

This course will explore procedures and techniques for designing, building, and managing predictable, resilient UNIX-based systems in a distributed environment. Hardware redundancy, system redundancy, monitoring and verification techniques, network implications, and system and application programming issues will all be addressed. We will discuss the trade-offs among cost, reliability, and complexity.

Topics include:

- What is high availability? Who needs it?
- Defining uptime and cost; "big rules" of system design
- Disk and data redundancy; RAID and SCSI arrays
- Host redundancy in HA configurations
- Network dependencies
- Application system programming concerns
- Anatomy of failovers: applications, systems, management tools
- Planning disaster recovery sites and data updates
- Security implications
- Upgrade and patch strategies
- Backup systems: off-site storage, redundancy, and disaster recovery issues
- Managing the system: managers, processes, verification

T2 Solaris Internals: Architecture, Tips, and Tidbits

Richard McDougall and James Mauro, *Sun Microsystems, Inc.*

Who should attend: Software engineers, application architects and developers, kernel developers, device driver writers, system administrators, performance analysts, capacity planners, Solaris users who wish to know more about the system they're using and the information available from bundled and unbundled tools, and anyone interested in operating system internals.

The installed base of Solaris systems being used for various commercial data-processing applications across all market segments and scientific computing applications has grown dramatically over the last several years, and it continues to grow. As an operating system, Solaris has evolved considerably, with some significant changes made to the UNIX SVR4 source base on which the early system was built. An understanding of how the system works is required in order to design and develop applications that take maximum advantage of the various features of the operating system, to understand the data made available via bundled system utilities, and to optimally configure and tune a Solaris system for a particular application or load.

Topics include the major components of the Solaris operating system, including the process/thread/dispatcher subsystem, virtual memory, file systems, and I/O interfaces. The kernel data structures and algorithms are discussed for all the major subsystems, with descriptions of the data extraction points used by the bundled (e.g., sar(1M), vmstat(1M), mpstat(1M)) and several unbundled tools and utilities (e.g., ProcTool, MemTool). Additional topics of discussion include the implementation of the kernel-locking primitives (e.g., mutexes, condition variables), system clocks (hardware and software), the 64-bit kernel, linkers and libraries, system calls, interprocess communication, and kernel tunable parameters. Solaris versions 2.6 and 7 are covered, with an update section covering the major features of Solaris 8.

After completing this course, participants will have a solid understanding of the internals of the major areas of the Solaris kernel that they will be able to apply to systems performance analysis, tuning, load/behavior analysis, and application development.

T3 Inside the Linux Kernel

Stephen C. Tweedie, *Red Hat, Inc.*; Theodore Ts'o, *VA Linux Systems*

Who should attend: Application programmers and kernel developers. You should be reasonably familiar with C programming in the UNIX environment, but no prior experience with the UNIX or Linux kernel code is assumed.

This tutorial will give you an introduction to the structure of the Linux kernel, the basic features it provides, and the most important algorithms it employs.

The Linux kernel aims to achieve conformance with existing standards and compatibility with existing operating systems; however, it is not a reworking of existing UNIX kernel code. The Linux kernel was written from scratch to provide both standard and novel features, while taking advantage of the best practice of existing UNIX kernel designs.

Although the material will focus on the release version of the Linux kernel (v. 2.2), it will also address aspects of the

development kernel codebase (v. 2.3), where its substance differs from 2.2. It will not examine the source code in detail but will, rather, offer an overview and roadmap of the kernel's design and functionality.

Topics include:

- Linux kernel organization: scheduler, virtual memory system, filesystem layers, device driver layers, networking stacks
  - The interface between each module and the rest of the kernel, and its functionality
  - Common kernel support functions and algorithms used by each module
  - How modules provide for multiple implementations of similar functionality: network protocols, filesystem types, device drivers, architecture-specific machine interfaces
- Basic ground rules of kernel programming, such as races and deadlock conditions
- Implementation of the most important kernel algorithms and their general properties (aspects of portability, performance, and functionality)
- The main similarities and differences between Linux and traditional UNIX kernels, with special attention to significantly different algorithms in Linux
- Details of the Linux scheduler, its VM system, and the ext2fs filesystem
- The strict requirements for ensuring that kernel code is portable among the many architectures Linux supports

T4 Configuring and Administering Samba Servers NEW

Gerald Carter, *Auburn University*

Who should attend: System and network administrators who wish to integrate Samba running on a UNIX-based machine with Microsoft Windows clients. No familiarity with Windows networking concepts will be assumed.

Samba is a freely available suite of programs that allows UNIX-based machines to provide file and print services to Microsoft Windows PCs without installing any third-party software on the clients. This allows users to access necessary resources from both PCs and UNIX workstations. As Samba makes its way into more and more network shops all over the world, it is common to see "configuring Samba servers" listed as a desired skill on many job descriptions for network administrators.

This tutorial will use real-world examples taken from daily administrative tasks.

Topics include:

- Installing Samba from the ground up
- Understanding the basic Microsoft networking protocols and concepts, such as NetBIOS, CIFS, and Windows NT domains (including Windows 2000)
- Configuring a UNIX box to provide remote access to local files and printers from Microsoft Windows clients
- Utilizing client tools to access files on Windows servers from a UNIX host
- Configuring Samba as a member of a Windows NT domain in order to utilize the domain's PDC for user authentication
- Using Samba as a domain controller
- Configuring Samba to participate in network browsing
- Automating the daily tasks of managing Samba

T5 Computer Attacks: Trends and Countermeasures

Tina Darmohray, *Consultant;*
Phil Cox, *SystemExperts Corporation*

Who should attend: System and network administrators who implement or maintain networks, and site managers charged with selecting and setting site security requirements. Familiarity with TCP/IP networking is a plus.

Many classic security problems, such as perimeter and host security, have become well defined and are routinely addressed by a wide range of product offerings. However, computer and network attacks are still on the rise. How to combat these attacks effectively is a network and security management discipline with emerging strategies and solutions. This tutorial will cover the latest trends in computer attacks and the security precautions you can take against them, including defensive penetration analysis, host auditing, network logging solutions, and intrusion detection.

After taking this tutorial, attendees will understand the important areas of security management. They will be able to defensively assess their system and network security. Additionally, they will have an appreciation for auditing and monitoring hosts and networks for intrusions, and for storing critical information required for network forensics.

Topics include:

- Trends in computer attacks
- Defensive penetration analysis
- Host and network auditing tools
- Intrusion detection
- Network forensics
- Ethics, policies, and legal concerns of auditing computer communications

T6 Network Administration NEW

Bryan C. Andregg, *Red Hat, Inc.*

Who should attend: This tutorial is directed at system administrators who are implementing network services and are looking for a background in the configuration of those services, and for the basics of the protocols and performance tuning. Attendees should have used or been the client of an IP network and have a basic knowledge of systems administration, but do not need to be experienced network administrators. Both new network administrators and gurus will leave the tutorial having learned something.

System administrators are increasingly being tasked with bringing their office environments on-line, with "on-line" ranging from a stand-alone client attached to the Internet to a distributed network of Web servers. The prospect of the network services to be configured can be daunting to administrators who aren't familiar with the applications. Configuration examples, discussed with brief overviews of the underlying protocols, can be taken away for direct application after the conference.

Topics include (with a special emphasis on security):

- Networking overview
- Client networking

- Serving networked clients
- Network services
  - SSH
  - FTP
  - HTTP
  - SMTP
  - NFS
  - DHCP
- Network troubleshooting
- Neat network tricks
- Up-and-coming topics
  - VPN
  - IPv6

Attendees should leave the course feeling confident in their ability to set up and maintain secure network services. The tutorial will be conducted in an open manner that allows for questions at all times.

T7 Practical Web Site Development and Maintenance with Perl—A Cookbook Approach

NEW

Mark-Jason Dominus, *Consultant*

Who should attend: Programmers moderately experienced in Perl and CGI/HTML who would like to automate their Web sites so that they can get more done with less work. This is *not* a class for non-programmers—we will be doing a lot of Perl code-reading.

With the proliferation of Web sites, the problem of maintenance has become almost unmanageable. Every Web site needs a person to update databases, send and answer mail, and handle membership sign-ups and account expiration, password protection, and a host of other tasks. Or do they? This tutorial will show, with numerous real-life examples, how a Web site can be largely automated, leaving the site maintainer free to handle only the exceptional cases.

Topics include:

- Dynamically creating and expiring user accounts
- Checking for password sharing
- Sending out membership newsletters
- Responding to "remove" requests
- Automatic site updates (images and text)
- Automatic newsgroup posting (e.g., monthly FAQ posting)
- Daily/weekly/monthly reporting
- Referral tracking/reporting
- Link exchanges (and checking for dead links)
- Database synchronization, searching, and updating

We'll use Web-based modules from CPAN and explain their interfaces. We will also pay special attention to file locking, synchronization, error checking, reporting, and recovery, and to the special needs of the asynchronous environment the Web provides. For each example we will present a problem, discuss the conceptual overview, and delve into the code to solve it. Using these examples, attendees will easily be able to implement solutions on their own sites. In all cases, issues of scalability will be discussed. The instructor's wide range of experience will give the students the perspective they need to plan for their needs.

T8 Managing and Being Managed NEW

Steve Johnson, *Transmeta;*
Dusty White, *Consultant*

Technical people develop and communicate facts. Facts tend to be discussed in terms of "black or white" or "right or wrong." As a manager, there is a need to develop and communicate in a way that addresses less objective issues such as intentions, visions, plans, and processes. Managers find themselves concerned with issues such as trust, support, and compromise, which are difficult to quantify.

People who get asked to manage others typically have strong technical and leadership skills. Perhaps you know such a person who, shortly after becoming a manager, seemingly became "a different person," even felt like a failure as a manager. And you know it wasn't for lack of trying to do a good job. They appeared not to know what to expect, seemed unprepared to deal with the issues that confronted them daily, apparently didn't get the bigger picture, and showed no sign of understanding how to use the power and influence that (apparently) went with the job.

We believe that becoming an effective technical manager requires:

- Understanding the differences between management and technical work, even technical leadership.
- Realizing that management skills can be learned and developed.
- Accepting responsibility for your own growth as a manager—focusing on communication, being open to feedback, always trying and evaluating new ways of managing.

We give an overview of the management process, concentrating on techniques that can be applied immediately. These should help managers manage better. Non-managers will learn to understand and relate better to managers and will get a feeling for what a managerial job might be like for them in the future.

Topics include:

- Communication
  - How to communicate better
  - How to know when you have been heard
  - Reaching agreement through negotiation
  - Giving and receiving feedback
  - Dealing with difficult people
- The difference between leadership and management
- Technical people managing other technical people: common mistakes and how to avoid them
- Trust: how to build it and keep it
- Power: what it is, and its role in management
- How to make decisions gracefully
- Meetings: why they are deadly, and how to improve them
- Getting everyone "on the same page"
- The war between process and content

T9 Network Security Profiles: A Collection (Hodgepodge) of Stuff Hackers Know About You

Brad Johnson, *SystemExperts Corporation*

Who should attend: Network, system, and firewall administrators; security auditors and those who are audited; people involved with responding to intrusions or responsible for network-based applications or systems that might be targets for hackers. Participants should understand the basics of

TCP/IP networking. Examples will use actual tools and will also include small amounts of HTML, JavaScript, and Tcl.

This course will be useful for anyone with any TCP/IP-based system—a UNIX, Windows NT, or mainframe operating system, or a router, firewall, or gateway network host.

Whether network-based host intrusions come from the Internet, an extranet, or an intranet, they typically follow a common methodology: reconnaissance, vulnerability research, and exploitation. This tutorial will review the tools and techniques hackers (determined intruders) use to perform these activities. You will learn what types of protocols and tools they use, and you will become familiar with a number of current methods and exploits. The course will show how you can generate vulnerability profiles of your own systems. Additionally, it will review some of the important management policies and issues related to these network-based probes.

The course will focus primarily on tools that exploit many of the common TCP/IP–based protocols, such as WWW, SSL, DNS, ICMP, and SNMP, that underlie virtually all Internet applications, including Web technologies, network management, and remote file systems. Some topics will be addressed at a detailed technical level. This course will concentrate on examples drawn from public domain tools, because these tools are widely available and commonly used by hackers (and are free for you to use).

Topics include:

- Profiles: what can an intruder determine about your site remotely?
- Review of profiling methodologies: different "viewpoints" generate different types of profiling information
- Techniques: scanning, on-line research, TCP/IP protocol "mis"uses, denial of service, hacking clubs
- Important intrusion areas: discovery techniques, SSL, SNMP, WWW, DNS
- Tools: scotty, strobe, netcat, SATAN, SAINT, ISS, mscan, sscan, queso, curl, Nmap, SSLeay/upget
- Management issues: defining policies and requirements to minimize intrusion risk

Topics *not* covered:

- Social engineering
- Buffer overflow exploits
- Browser (frame) exploits
- Shell privilege escalation

T10 Special Topics in Sendmail: Sendmail 8.10 and Sendmail Security NEW

Eric Allman and Gregory Neil Shapiro, *Sendmail, Inc.*

Who should attend: UNIX system and network administrators familiar with or responsible for sendmail. This tutorial is targeted at those who want to learn how to convert their sites to sendmail 8.10, and at those who want to better understand sendmail security, particularly on firewalls and other similar systems. This two-part tutorial is *not* an introduction to sendmail.

Sendmail 8.10, the latest release of Open Source sendmail from Sendmail, Inc., has many new features. In many cases mail administrators can just compile the new release of sendmail and use their old configuration files, but "power users" may wish to utilize the many new capabilities. This tutorial discusses the new features in version 8.10 of sendmail.

Topics include:

- SMTP Authentication, allowing cryptographic authentication in SMTP to gain additional privileges, such as ability to relay
- Performance improvements, including multiple queues, memory-buffered pseudo-files, and more control over resolver timeouts
- The new "message submission agent" port, as defined by RFC 2476
- Ability to connect to servers running on named sockets
- Changes to support IPv6
- Better LDAP integration and support for LDAP-based routing
- Improved support for virtual hosting
- Several new map classes, including ph, arith, and macro

Time permitting, musings on the future direction of sendmail will be indulged in.

Sendmail is a powerful Mail Transport Agent that can be configured for many different environments, from firewalls through workstation mail servers. These environments have different security requirements; in particular, in a pure relay configuration (with no local user accounts or delivery) sendmail can be configured to relinquish root permissions. This is a fast-paced tutorial intended for system and network administrators who are already familiar with configuring and administering sendmail.

Topics include:

- Principles of sendmail security
- How to configure sendmail on systems that have special security requirements, such as firewalls
  - Configuring sendmail to run as a non-root user
  - Running sendmail in a "chroot"ed jail
- How to (and when to) relax sendmail's file security checks

Eric Allman (S2, T10) Eric Allman wrote sendmail, leads sendmail.org, and is CTO of Sendmail, Inc. Eric was the lead programmer for the INGRES database management and the Mammoth infrastructure projects and authored syslog, tset, the -me troff macros, and trek, developed a commercial client/server implementation, helped develop a first-generation window system, and contributed to the Ring Array Processor Project. He has been a member of the Board of Directors of the USENIX Association. Eric received his M.S. in Computer Science from U.C. Berkeley. He collects wines, which he stashes in the cellar of the house he shares with Kirk McKusick, his partner of 20-and-some-odd years.

Bryan C. Andregg (M3, T6) is the Director of Networks at Red Hat Inc. He has been with the company for three years and in that time has moved from being the only systems administrator through almost every job in IS. Bryan's next round of business cards will give his job title as "firefighter."

Tina Bird (M10) is a senior security analyst at Counterpane Internet Security. She has implemented and managed a variety of wide-area-network security technologies and has developed, implemented, and enforced corporate IS security policies. She is the moderator of the VPN mailing list and the owner of "VPN Resources on the World Wide Web," a vendor-neutral source of information about VPN technology. Tina has a B.S. in physics from Notre Dame and an M.S. and Ph.D. in astrophysics from the University of Minnesota.

Matt Bishop (S1) began working on problems of security inUNIX systems at Purdue, where he earned his doctorate. He subsequently worked at the Research Institute for Advanced Computer Science at NASA and taught courses in operating systems, computer security, and software engineering at Dartmouth College. Matt chaired the first USENIX Security Workshop and has been on the faculty at UC Davis since 1993.

Gerald Carter (M4, T4) has been a member of the SAMBA Team since 1998 andhas been maintaining SAMBA servers for the past four years. As a network manager at Auburn University, Gerald maintains approximately 700 PCs and 30 Solaris 2.*x* servers. He is the lead author of *Teach Yourself SAMBA in 24 Hours* (Sams Publishing) and has worked as an instructor or technical reviewer for major publishers.

Tom Christiansen (S4, M8) has been involved with Perl since day zero of its initial public release in 1987. Lead author of *The Perl Cookbook*, co-author of *Programming Perl*, *Learning Perl*, and *Learning Perl on Win32 Systems*, Tom is also the major caretaker of Perl's online documentation. He holds undergraduate degrees in computer science and Spanish and a Master's in computer science. He now lives in Boulder, Colorado.

Phil Cox (M4, T5) is a consultant for SystemExperts Corporation. Phil frequently writes and lectures on issues bridging the gap between UNIX and Windows NT. He is a featured columnist in *;login;*, the magazine of USENIX & SAGE, and has served on numerous USENIX program committees. Phil holds a B.S. in computer science from the College of Charleston, South Carolina.

Tina Darmohray (T5) is a network and security consultant with over a decade of experience in administration and programming UNIX/TCP-based computers. She specializes in firewalls, Internet connections, sendmail/DNS configurations, and defensive intrusion management. Previously Tina was the lead for the UNIX support team at Lawrence Livermore National Laboratory. Tina was a founding board member of SAGE, the System Administrators Guild. She is the author of the popular SAGE jobs booklet *Job Descriptions for System Administrators,* she's co-editor of *;login:*, the magazine of USENIX & SAGE, and she co-chaired the USENIX LISA IX conference. Tina holds a B.S. and an M.S. from the University of California, Berkeley.

Mark-Jason Dominus (T7) has been using Perl for Web application development and site management since 1994, for large organizations such as Estee Lauder, the University of Pennsylvania, and Time-Warner. He is a regular contributor to the *Perl Journal* and is the managing editor of www.perl.com.

Aeleen Frisch (M7) has been a system administrator for over 15 years. She currently looks after a very heterogeneous network of UNIX and Windows NT systems. She is the author of several books, including *Essential Windows NT System Administration.*

Peter Baer Galvin (M2) is the chief technologist for Corporate Technologies, a systems integrator and VAR. Previously, he was the systems manager for Brown University's Computer Science Department. He has written articles for *Byte* and other magazines and is a regular columnist for *SunWorld.* He is co-author of the *Operating Systems Concepts* and the *Applied Operating Systems Concepts* textbooks. As a consultant and trainer, Peter has taught tutorials on security and system administration and has given talks at many conferences.

Daniel E. Geer, Jr. (M9), is CTO of @Stake. Dr. Geer has a long history in network security and distributed computing management as an entrepreneur, consultant, teacher, and architect. He holds a B.S. in electrical engineering and computer science from MIT, and an Sc.D. in biostatistics from Harvard University. In USENIX he has participated in virtually every activity, including serving as technical program chair for the San Diego, California, 1993 Winter Technical Conference, as well as conference chair for both the First Symposium on Mobile and Location Independent Computing and the First USENIX Workshop on Electronic Commerce. He was elected to the Board of Directors in June 1994 and began an elected two-year term as vice-president in June 1996. He is the co-author of Wiley's *Web Security Sourcebook* (June 1997).

Jamie Hanrahan (S5) provides Windows NT driver development, consulting, and training services to leading companies. He is co-writing a book on Windows NT device drivers (O'Reilly and Associates). He also has an extensive background in VMS device drivers and internals. He is co-author of *VMS Advanced Driver Techniques*, and he received Digital's Instructor of the Year award for his courses in VMS device drivers and internals.

Brad Johnson (T9) is a principal of SystemExperts Corporation, a consulting firm that specializes in systems security and management. He is a well-known authority in the field of secure distributed systems and has recently served as a technical advisor to both Dateline NBC and CNN on network security matters. He has participated in seminal industry initiatives, including the Open Software Foundation, X/Open, and the IETF, and has often published about open systems.

Steve Johnson (T8) has been a technical manager for nearly two decades, in both large and small companies. At AT&T, he is best known for writing Yacc, Lint, and the Portable C Compiler. He served as the head of the UNIX Languages Department at AT&T's Summit Labs and has been involved in a number of Silicon Valley startup companies. He served for ten years on the USENIX Board of Directors, four of them as president. He presented an invited talk on management at LISA '97, he has taught USENIX tutorials on technical subjects, and he has led management training seminars at Transmeta.

George Kurtz (S6) has performed hundreds of firewall, network, and e-commerce–related security assessments throughout his security consulting career. He is a regular speaker at many security conferences and is frequently quoted in *The Wall Street Journal*, *InfoWorld*, *USA Today*, and the Associated Press.

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He is the co-author of the widely acclaimed *Hacking Exposed: Network Security Secrets and Solutions*.

Evan Marcus (T1) is a senior systems engineer and high availability specialist with VERITAS Software Corporation. Evan has more than 12 years of experience in UNIX systems administration. While employed at Fusion Systems and OpenVision Software, Evan worked to bring the first high availability software application for SunOS and Solaris to market. Evan is the author of several articles and talks on the design of high availability systems.

James Mauro (T2) is an enterprise IT architect for Sun Microsystems, focusing on multi-tier and distributed application platforms, with an eye to availability and scalable growth. He works extensively with Solaris application development, performance tuning, capacity planning, and general systems behavior analysis. Jim, who has 20 years of UNIX industry experience, writes a monthly column on Solaris internals for *SunWorld* and is co-author of *Solaris Internals: Architecture Tips and Techniques* (Sun Microsystems Press/Prentice Hall, forthcoming).

Ned McClain (M6) is a lead engineer at XOR Network Engineering. He is currently helping with the 3rd edition of the *UNIX System Administration Handbook* (by Nemeth, Snyder, and Hein). He has a degree in computer science from Cornell University and has done research with both the CS and Engineering Physics departments at Cornell.

Richard McDougall (T2), an established engineer in the Performance Application Engineering Group at Sun Microsystems, focuses on large systems performance and architecture. He has over 12 years of experience in UNIX performance tuning, application/kernel development, and capacity planning. Richard is the author of many papers and tools for measurement, monitoring, tracing and sizing UNIX systems, including the memory-sizing methodology for Sun, the MemTool set for Solaris, the recent Priority Paging memory algorithms in Solaris, and many unbundled tools for Solaris, and is co-author of *Solaris Internals: Architecture Tips and Techniques* (Sun Microsystems Press/Prentice Hall, forthcoming).

Evi Nemeth (M6) is a faculty member in computer science at the University of Colorado and has managed UNIX systems for the past 20 years, both from the front lines and from the ivory tower. She is co-author of the *UNIX System Administration Handbook*.

Ian Poynter (M5) is president of Jerboa Inc., a strategic Internet security consultancy he founded in 1994. He has over 14 years in the technology industry, focusing on networking and human/computer interfaces. He has delivered firewall and Internet security training to key IS personnel and has appeared as an expert speaker at professional meetings and industry conferences. Mr. Poynter holds a B.Sc. First Class in computer science from University College, London.

Marcus J. Ranum (M1) is CEO and founder of Network Flight Recorder, Inc. He is the principal author of several major Internet firewall products, including the DEC SEAL, the TIS Gauntlet, and the TIS Internet Firewall Toolkit. Marcus has been managing UNIX systems and network security for over 13 years, including configuring and managing whitehouse.gov. Marcus is a frequent lecturer and conference speaker.

Jon Rochlis (M9) is a senior consultant for System-Experts Corp. He and his colleagues provide high-level advice to businesses large and small in the areas of network security, distributed systems design and management, high availability, and electronic commerce. Before joining SystemExperts, Mr. Rochlis was engineering manager with BBN Planet, a major national Internet service provider.

Greg Rose (M4) graduated from the University of New South Wales with a B.Sc. (honours) in computer science and was awarded the University Medal in 1977. A member of the Board of Directors of the USENIX Association, he served as program chair of the 1996 USENIX Security Symposium. As Principal Engineer at QUALCOMM, he focuses on cryptographic security and authentication for wireless communications, and on setting up the office of QUALCOMM Australia. He has written a number of public tools using cryptography, and he holds generic cryptographic export licenses for two countries.

Char Sample (M5), a senior systems engineer at L-3 Network Security, has over fourteen years of experience in the industry. One of the original five engineers on the Gauntlet project at Trusted Information Systems, Char has installed and integrated over 200 firewalls and has experience deploying e-commerce solutions. She has developed and delivered training for a number of organizations and has been an invited speaker for various industry security conferences.

Eric Schultze (S6) specializes in assessing and securing Microsoft products. He is a contributing author to *Hacking Exposed: Network Security Secrets and Solutions* and is a frequent speaker at security conferences, including Black Hat, CSI, and MIS. Eric is also a faculty instructor for CSI's education resource center, presenting workshops on NT4 and Windows 2000 security.

Gregory Neil Shapiro (T10) began his professional career as a systems administrator for Worcester Polytechnic Institute (WPI). There he became involved with beta-testing the BIND name-server, the sendmail mail-transfer agent, and other UNIX utilities such as emacs and screen. He contributed the secure zones functionality included in BIND 4.9.X. His involvement with sendmail grew into assisting in supporting sendmail by joining the Sendmail Consortium and later increased to include code maintenance and release assistance. As Lead Engineer at Sendmail, Inc., he has continued to support the open source version while working on Sendmail Pro, the commercial version.

Marc Staveley (S3) recently took a position with Sun Microsystems Enterprise Services, where he is applying his 16 years of experience with UNIX development and administration in helping to create new service programs. Previously Marc was an independent consultant, and he has held positions at NCR, Princeton University, and the University of Waterloo. He is a frequent speaker on the topics of standards-based development, multi-threaded programming, systems administration, and performance tuning.

Theodore Ts'o (T3) has been a Linux kernel developer since almost the very beginnings of Linux—he implemented POSIX job control in the 0.10 Linux kernel. He is the maintainer and author for the Linux COM serial port driver and the Comtrol Rocketport driver. He architected and implemented Linux's tty layer. Outside of the kernel, he is the maintainer of the e2fsck filesystem consistency checker. Ted is currently employed by VA Linux Systems.

Stephen C. Tweedie (T3) works on Linux kernel internals and high availability for Red Hat, Inc. Before that, he worked on VMS filesystem internals for Digital's Operating Systems Software Group. He has been contributing to Linux for a number of years, in particular designing some of the high-performance algorithms central to the ext2fs file system and the virtual memory code.

Dusty White (T8) was an early employee of Adobe, where she served in a variety of managerial positions. She now works as a management consultant in Silicon Valley, where she acts as a trainer, coach, and troubleshooter for technical companies.

Refereed Papers	Invited Talks	FREENIX

WEDNESDAY, JUNE 21, 2000

9:00 AM–10:30 AM

Opening Remarks and Keynote

Keynote Address

Bill Joy, *Sun Microsystems Co-Founder and Vice President*

Bill Joy will be talking about his vision of the future of computing.

10:30 AM–11:00 AM BREAK

11:00 AM–12:30 PM

Instrumentation and Visualization

Session Chair: Christopher Small, *Osprey Partners LLC*

Mapping and Visualizing the Internet
Hal Burch, *Carnegie Mellon University;* Bill Cheswick and Steve Branigan, *Bell Labs Research, Lucent Technologies*

Measuring and Characterizing System Behavior Using Kernel-Level Event Logging
Karim Yaghmour and Michel R. Dagenais, *Ecole Polytechnique de Montréal*

Pandora: A Flexible Network Monitoring Platform
Simon Patarin and Mesaac Makpangou, *INRIA Rocquencourt*

Computer System Security: Is There Really a Threat?

Avi Rubin, *AT&T Research*

I'm often asked, "If we're so vulnerable, how come I don't hear about incidents that often?" While I cannot answer that question, I can try to answer the question of whether or not there is a threat. In this talk, I will look at some historic and some more recent computer security incidents. How did the attacks occur? Why did they succeed? What were the consequences? Could it have been worse? We will look at security issues in existing systems and assess the level of danger. Finally, I'll discuss what the best defenses are, and the steps we can each take to secure our systems and data.

Storage Systems

Session Chair: Marshall Kirk McKusick, *Author & Consultant*

Swarm: A Log-Structured Storage System for Linux
Ian Murdock and John H. Hartman, *University of Arizona*

DMFS—A Data Migration File System for NetBSD
William Studenmund, *Veridian MRJ Technology Solutions*

A 3-Tier RAID Storage System with RAID1, RAID5, and Compressed RAID5 for Linux
K. Gopinath, *IISc*; Nitin Muppalaneni, *VERITAS Software;* N. Suresh Kumar, *Lucent Technologies;* Pankaj Risbood, *IISc*

12:30 PM–2:00 PM LUNCH (ON YOUR OWN)

Refereed Papers

Invited Talks

FREENIX

2:00 PM–3:30 PM

File Systems
Session Chair: Liuba Shrira, *Brandeis University*

A Comparison of File System Workloads
Drew Roselli and Jacob R. Lorch, *University of California at Berkeley;* Thomas E. Anderson, *University of Washington*

FiST: A Language for Stackable File Systems
Erez Zadok and Jason Nieh, *Columbia University*

Logging Versus Soft Updates: Asynchronous Metadata Protection in File Systems
Margo I. Seltzer, *Harvard University;* Gregory R. Ganger, *Carnegie Mellon University;* M. Kirk McKusick, *Author & Consultant;* Keith A. Smith, *Harvard University;* Craig A. N. Soules, *Carnegie Mellon University;* Christopher A. Stein, *Harvard University*

Watching the Waist of IP
Steve Deering, *Cisco Systems*

The Internet protocol architecture has an hourglass shape: a wide variety of applications and end-to-end (upper-layer) protocols are supported by a single, "narrow" protocol called IP, which in turn rests upon a wide variety of network and datalink (lower-layer) protocols. The Internet's enormous flexibility in accommodating new transmission technologies and new applications, and its ability to serve as the convergence platform for data, telephony, TV, and other media, depend on this hourglass design. However, as the Internet has grown, the waist of the hourglass has spread. In this talk, I review the evolution of the IP layer of the Internet, discuss the consequences of the changes, and speculate on the future shape of IP.

Network System Administration
Session Chair: Victor Yodaiken, *FSMLabs and New Mexico Institute of Technology*

Extending Internet Services Via LDAP
James Dutton, *Southern Illinois University at Carbondale*

MOSIX: How Linux Clusters Solve Real-World Problems
Steve McClure and Richard Wheeler, *EMC*

Webmin
Jamie Cameron, *Caldera Systems*

3:30 PM–4:00 PM BREAK

4:00 PM–5:30 PM

Old Dogs, New Tricks
Session Chair: Greg Minshall, *Siara Systems*

Lexical File Names in Plan 9, or, Getting Dot-Dot Right
Rob Pike, *Lucent Technologies—Bell Labs*

Gecko: Tracking a Very Large Billing System
Andrew Hume, *AT&T Labs—Research;* Scott Daniels, *EDS;* Angus MacLellan, *AT&T Labs*

Extended Data Formatting Using Sfio
David G. Korn, Glenn S. Fowler, and Kiem-Phong Vo, *AT&T Labs—Research*

Implementing 3D Workstation Graphics on PC UNIX Hardware
Daryll Strauss, *Precision Insight*

3D hardware for PCs has improved to the point that it is beginning to rival that of traditional 3D graphics workstations. Providing these capabilities on commodity hardware poses a number of difficult problems. For example, 3D hardware has a voracious appetite for data, and commodity hardware is typically not designed for secure multitasking. Precision Insight is working with a number of vendors to provide completely open-source solutions to these problems under X and Linux.

File Systems
Session Chair: Ted Ts'o, *VA Linux Systems*

Porting the SGI XFS File System to Linux
Jim Mostek, Steven Levine, Steve Lord, Bill Earl, Brian Gaffey, and Russell Cattelan, *SGI*

LinLogFS—A Log-Structured File System for Linux
Christian Czezatke and M. Anton Ertl, *TU Wien*

UNIX Filesystem Extensions in the GNOME Environment
Ettore Perazzoli, *Helix Code, Inc.*

THURSDAY, JUNE 22, 2000

9:00 AM–10:30 AM

Refereed Papers

DISTRIBUTION AND SCALABILITY: PROBLEMS AND SOLUTIONS
Session Chair: Ken Arnold, *Sun Microsystems*

Virtual Services: A New Abstraction for Server Consolidation
John Reumann, *University of Michigan;* Ashish Mehra, *IBM TJ Watson Research*; Kang Shin, *University of Michigan;* Dilip Kandlur, *IBM TJ Watson Research*

Location-Aware Scheduling with Minimal Infrastructure
John Heidemann and Dhaval Shah, *USC/ISI*

Distributed Computing: Moving from CGI to CORBA
James FitzGibbon and Tim Strike, *Targetnet.com Inc.*

Invited Talks

THE MICROSOFT ANTITRUST CASE: A VIEW FROM AN EXPERT WITNESS
Edward Felten, *Princeton University*

Edward Felten recently served as an expert witness in the Microsoft antitrust case, and as a consultant to the Department of Justice. He will talk about his experiences in working on this high-profile case, and what he learned about the law, economics, computer science, and connections among them.

FREENIX

SOCKETS
Session Chair: David Greenman, *The FreeBSD Project*

Protocol Independence Using the Sockets API
Craig Metz, *University of Virginia*

Scalable Network I/O in Linux
Niels Provos, *University of Michigan;* Chuck Lever, *Netscape Communications Corp.*

"Thundering Herd" Issues in Linux accept(2)
Stephen Molloy and Peter Honeyman, *CITI, University of Michigan;* Chuck Lever, *Sun-Netscape Alliance*

10:30 AM–11:00 AM BREAK

11:00 AM–12:30 PM

Refereed Papers

TOOLS
Session Chair: Eran Gabber, *Lucent Technologies—Bell Labs*

Outwit: UNIX Tool-Based Programming Meets the Windows World
Diomidis Spinellis, *University of the Aegean*

Plumbing and Other Utilities
Rob Pike, *Lucent Technologies—Bell Labs*

Integrating a Command Shell into a Web Browser
Robert C. Miller and Brad A. Myers, *Carnegie Mellon University*

Invited Talks

CHALLENGES IN INTEGRATING THE MAC OS AND BSD ENVIRONMENTS
Wilfredo Sanchez, *Apple Computer*

Apple's next-generation operating system, Mac OS X, is a drastic departure from previous versions of the Mac OS. Mac OS X's core operating system is a derivative of BSD UNIX, topped by a suite of application toolkits. The user-friendly GUI of the original Mac OS has been widely emulated in the personal computer industry. BSD's robust core, advanced networking, and scalability are highly valued in engineering and server applications. The combination offers a great deal of promise, but it has required many changes in the architecture of system components. Additionally, users use the systems in very different ways and expect different sorts of behavior.

FREENIX

NETWORK PUBLISHING
Session Chair: Chris Demetriou, *AT&T Labs*

Making Web Publishing Irreversible
David S. H. Rosenthal and Victoria A. Reich, *Stanford Libraries*

Globe and the Globe Distribution Network
Arno Bakker, Egon Amade, Gerco Ballintijn, Ihor Kuz, Patrick Verkaik, Ivo van der Wijk, Maarten van Steen, and Andrew Tanenbaum, *VU Amsterdam*

Open Information Pools
Johan Pouwelse, *Delft University of Technology*

Refereed Papers	Invited Talks	FREENIX
12:30 PM–2:00 PM LUNCH (ON YOUR OWN)		
2:00 PM–3:30 PM		
KERNEL STRUCTURES Session Chair: Keith A. Smith, *Harvard University* **Operating System Support for Multi-User, Remote, Graphical Interaction** Alexander Ya-li Wong and Margo Seltzer, *Harvard University* **Java Operating Systems: Design and Implementation** Godmar Back, Patrick Tullmann, Wilson C. Hsieh, and Jay Lepreau, *University of Utah* **Signaled Receiver Processing** José Brustoloni, Eran Gabber, Abraham Silberschatz, and Amit Singh, *Lucent Technologies—Bell Labs*	**THE CONVERGENCE OF NETWORKING AND STORAGE: WILL IT BE SAN OR NAS?** Rod Van Meter, *Network Alchemy* What we think of as storage generally follows one of two models—either named files or undifferentiated, numbered blocks. Both models can be presented on a network. The former is often called network-attached storage (NAS); the latter, storage-area networks (SAN). This talk will explore the differences and similarities between the two and will examine where both are likely to go in the near future. Emphasis will be on scalability, naming, security, and network media.	**X11 AND USER INTERFACES** Session Chair: Miguel de Icaza, *Helix Code, Inc.* **The GNOME Canvas: A Generic Engine for Structured Graphics** Federico Mena-Quintero, *Helix Code, Inc.*; Raph Levien, *Code Art Studio* **Efficiently Scheduling X Clients** Keith Packard, *SuSE, Inc.* **Developing Drivers and Extensions for XFree86-4.x** Dirk Hohndel, *SuSE Linux AG*
3:30 PM–4:00 PM BREAK		
4:00 PM–5:30 PM		
WORKS IN PROGRESS REPORTS (WIPS) Session Chair: Aaron Brown, *University of California at Berkeley* Pithy and fun, Works in Progress Reports introduce interesting new or ongoing work, and the USENIX audience provides valuable discussion and feedback. Slots are limited. If you have interesting work you'd like to share, or a hot idea that's not yet ready for publication, send a paragraph or two of description to Aaron Brown at *usenix2000-wips@usenix.org*. Student work is particularly welcome.	**LESSONS LEARNED ABOUT OPEN SOURCE** Jim Gettys, *Compaq* The X Window System was developed open-source using the Internet from nearly its inception, but has taken a number of (partial) turns along the way. These were partly forced by commercial pressure, but primarily because the Internet was not able to support the kind and scale of development seen in free software today. Now we see large-scale open-source software engineering with hundreds of contributors to a given project. Amazingly, X is alive and moving forward again. What can we learn from these experiences? What traps can be avoided? What opportunities are offered by the new desktops and new window managers? Where is further work needed? How should we further exploit the Web? What is possible now that we have more developers for open source than sit behind the walls of any corporation on the planet?	

Refereed Papers	Invited Talks	FREENIX

FRIDAY, JUNE 23, 2000

9:00 AM–10:30 AM

RUN-TIME TOOLS AND TRICKS
Session Chair: Christopher Small, *Osprey Partners LLC*

DITools: Application-Level Support for Dynamic Extension and Flexible Composition
Albert Serra, Nacho Navarro, and Toni Cortes, *Universitat Politècnica de Catalunya*

Portable Multithreading—The Signal Stack Trick for User-Space Thread Creation
Ralf S. Engelschall, *TUM*

Transparent Run-Time Defense Against Stack-Smashing Attacks
Arash Baratloo, Timothy Tsai, and Navjot Singh, *Bell Labs Research, Lucent Technologies*

AN INTRODUCTION TO QUANTUM COMPUTATION AND COMMUNICATION
Rob Pike, *Lucent Technologies—Bell Labs*

Quantum computation is more than just the use of very small things to compute. It exploits the fundamentally odd properties of quantum-mechanical interaction to achieve profound parallelism, zero-energy calculations, and other technological marvels. I will discuss how the quantum world makes these things possible, the design of quantum hardware and software, proposals for practical quantum devices, and the prospects for quantum computation and communication in our lifetimes.

SECURITY
Session Chair: Niels Provos, *University of Michigan*

Implementing Internet Key Exchange, IKE
Angelos D. Keromytis, *University of Pennsylvania;* Niklas Hallqvist, *Applitron Datasystem AB*

Transparent Network Security Policy Enforcement
Angelos D. Keromytis, *University of Pennsylvania;* Jason Wright, *University of North Carolina at Greensboro*

Safety Checking of Kernel Extensions
Craig Metz, *University of Virginia*

10:30 AM–11:00 AM BREAK

11:00 AM–12:30 PM

MEASUREMENT AND STABILITY
Session Chair: Fred Douglis, AT&T Labs—Research

Towards Availability Benchmarks: A Case Study of Software RAID Systems
Aaron Brown and David A. Patterson, *University of California at Berkeley*

Performing Replacement in Modem Pools
Yannis Smaragdakis, *Georgia Tech;* Paul Wilson, *University of Texas at Austin*

Auto-Diagnosis of Field Problems in an Appliance Operating System
Gaurav Banga, *Network Appliance*

PROVIDING FUTURE WEB SERVICES
Andy Poggio, *Sun Labs*

This presentation will begin by describing the day when desktop PCs will no longer dominate as networked devices. In this new era, network appliances will be the most common devices. It will discuss Web services for commerce, education, and entertainment: how they'll change, and what new Web services will proliferate. Finally, it will describe in detail the computer system architecture and network infrastructure that will be needed to provide these services, including the roles that InfiniBand, IPv6, and other new technologies will play.

COOL STUFF
Session Chair: Clem Cole, *Compaq*

An Operating System in Java for the Lego Mindstorms RCX Microcontroller
Pekka Nikander, *Helsinki University of Technology*

LAP: A Little Language for OS Emulation
Donn Seeley, *Berkeley Software Design, Inc.*

Traffic Data Repository at the WIDE Project
Kenjiro Cho, *Sony Computer Science Laboratories, Inc.;* Koushirou Mitsuya, *Keio University;* Akira Kato, *The University of Tokyo*

Refereed Papers	Invited Talks	FREENIX
12:30 PM–2:00 PM LUNCH (ON YOUR OWN)		
2:00 PM–3:30 PM		
SERVERS: LOAD BALANCING AND SCHEDULING Session Chair: Yoonho Park, *IBM Research* **Dynamic Function Placement for Data-Intensive Cluster Computing** Khalil Amiri, David Petrou, and Greg Ganger, *ECE, Carnegie Mellon University*; Garth Gibson, *CS, Carnegie Mellon University* **Scalable Content-Aware Request Distribution in Cluster-Based Network Servers** Mohit Aron, Darren Sanders, Peter Druschel, and Willy Zwaenepoel, *Rice University* **Isolation with Flexibility: A Resource Management Framework for Central Servers** David G. Sullivan and Margo I. Seltzer, *Harvard University*	**THE GNOME PROJECT** Miguel de Icaza The GNU Network Object Model Environment (GNOME) project aims at providing a framework for UNIX application development. Lack of infrastructure has made UNIX systems lag in some areas. GNOME provides a component model that encourages code reuse and tool replacement by making applications adhere to a set of GNOME-standardized CORBA interfaces. A name server and an object-launching facility are used to make GNOME tools integrate in the desktop. GNOME graphical applications are written using the GTK+ toolkit, and they use the GNOME foundation libraries to simplify programming and encourage a standardized graphical user environment. The GNOME printing subsystem provides programmers with a portable and powerful printing subsystem.	**SHORT TOPICS** Session Chair: Stephen C. Tweedie, *Red Hat, Inc.* **JEmacs—The Java/Scheme-Based Emacs** Per Bothner, *Consultant* **A New Rendering Model for X** Keith Packard, *SuSE, Inc.* **UBC: An Efficient Unified I/O and Memory Caching Subsystem for BSD** Chuck Silvers, *VERITAS Software* **Mbuf Issues in 4.4BSD IPv6 Support—Experiences from the KAME Project** Jun-ichiro Hagino, *Research Laboratory, IIJ* **Malloc() Performance in a Multithreaded Linux Environment** Chuck Lever and David Boreham, *Netscape Communications Corp.* **The AT&T OpenSource Software Collection** Glenn Fowler, David Korn, Stephen North, and Kiem-Phong Vo, *AT&T Labs—Research*
3:30 PM–4:00 PM BREAK		
4:00 PM–5:30 PM		

CLOSING SESSION

New Horizons for Music on the Internet
Thomas Dolby Robertson, *Beatnik, Inc.*

The dynamics of creating and experiencing Web content are continually evolving. The integration of music and interactive audio into the fabric of computer and Internet technologies have enhanced the overall Web experience, moving it from a silent environment to a multi-sensory one. Come see what Thomas Dolby Robertson and his company, Beatnik, Inc., have contributed to the world of the Internet using sound and audio technologies. Mr. Robertson will show that everyone, from composers and musicians to Web homesteaders and professional Web designers, can benefit from these evolving technologies. Case studies presented will also illustrate how the emergence of new applications is making the Web a stage for true musical interaction.

USENIX 2000 Vendor Exhibition

WEDNESDAY, JUNE 21, 12 NOON–7:00 PM
THURSDAY, JUNE 22, 10:00 AM–4:00 PM

- Preview in operation innovative products and services
- Get the details from well-informed vendor representatives
- Compare solutions quickly on the floor, saving hours of research

EXHIBITORS (AS OF 1/24/00):

ActiveState Tool Corp. *http://www.ActiveState.com/*
Addison Wesley Longman/New Riders *http://www.aw.com/cseng*
Advanced Computer and Network Corp. *http://www.acnc.com/*
Alta Technology *http://www.altatech.com /*
Alteon Web Systems *http://www.alteonwebsystems.com/*
Astart Technologies *http://www.astart.com/*
Attachmate Corporation *http://www.attachmate.com/*
Aurora Software, Inc. *http://www.phobos.com/*
Auspex Systems, Inc. *http://www.auspex.com/*
Baydel North America *http://www.baydel.com/*
Binary Evolution *http://www.binevolve.com/*
Compaq Computer Corp. *http://www.compaq.com/*
Covalent Technologies, Inc. *http://www.Covalent.com/*
Coyote Point Systems Inc. *http://www.coyotepoint.com/*
Eagle Software Inc. *http://www.eaglesoft.com/*
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GNAC, Inc. *http://www.gnac.com/*
Hummingbird Communications Ltd *http://www.hummingbird.com/*
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Lund Performance Solutions *http://www.lund.com/*
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UniTree Software Inc. *http://www.unitree.com/*
VA Linux Systems Inc. *http://www.valinux.com/*
Walnut Creek CDROM *http://www.cdrom.com/*
Western Scientific, Inc. *http://www.wsm.com/*
Zzyzx Peripherals, Inc. *http://www.zzyzx.com/*

FREE EXHIBIT ADMISSION

Open: Wednesday, June 21, 12 noon–7 pm
Thursday, June 22, 10 am–4 pm

Location: San Diego Marriott Hotel & Marina
333 West Harbor Drive, San Diego, California 92101-7700

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How did you *first* hear about this exhibition (check one):
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4. ❑ WWW 5. ❑ from a colleague 6. ❑ magazine 7. ❑ from an exhibitor

USENIX & SAGE Membership Information and Events

About USENIX

http://www.usenix.org/

USENIX is the Advanced Computing Systems Association. Since 1975, USENIX has brought together the community of system administrators, engineers, scientists, and technicians working on the cutting edge of the computing world. USENIX and its members are engaged in problem-solving, in innovation, and in research that works.

About SAGE

http://www.usenix.org/sage/

SAGE, the System Administrators Guild, is a special technical group within USENIX. SAGE is dedicated to the recognition and advancement of the system administration profession.

UPCOMING USENIX EVENTS

3RD LARGE INSTALLATION SYSTEM ADMINISTRATION OF WINDOWS NT/2000 CONFERENCE (LISA-NT 2000)
July 30 - August 2, 2000 — Madison Renaissance Hotel, Seattle, Washington, USA
http://www.usenix.org/events/lisa-nt2000

4TH USENIX WINDOWS SYSTEMS SYMPOSIUM
August 3–4, 2000 — Madison Renaissance Hotel, Seattle, Washington, USA
http://www.usenix.org/events/usenix-win2000

9TH USENIX SECURITY SYMPOSIUM
Sponsored by USENIX in cooperation with the CERT Coordination Center
August 14–17, 2000 — Denver Marriott City Center, Denver, Colorado, USA
http://www.usenix.org/events/sec2000

4TH ANNUAL LINUX SHOWCASE AND CONFERENCE, ATLANTA
Co-sponsored by USENIX and Atlanta Linux Showcase, in cooperation with Linux International
October 10-14, 2000 — Cobb Galleria, Atlanta, Georgia, USA
http://www.linuxshowcase.org

FIRST WORKSHOP ON INDUSTRIAL EXPERIENCES WITH SYSTEMS SOFTWARE (WIESS 2000)
Co-sponsored by IEEE TCOS and ACM SIGOPS (pending)
October 22, 2000 — Paradise Point Resort, San Diego, California, USA
http://www.usenix.org/events/osdi2000/wiess2000

4TH SYMPOSIUM ON OPERATING SYSTEMS DESIGN & IMPLEMENTATION (OSDI 2000)
Co-sponsored by IEEE TCOS and ACM SIGOPS
October 23–25, 2000 — Paradise Point Resort, San Diego, California, USA
http://www.usenix.org/events/osdi2000

14TH SYSTEMS ADMINISTRATION CONFERENCE (LISA 2000)
Sponsored by USENIX and SAGE
December 3–8, 2000 — New Orleans, Louisiana, USA
http://www.usenix.org/events/lisa2000

6TH USENIX CONFERENCE ON OBJECT-ORIENTED TECHNOLOGIES AND SYSTEMS
January 29–February 2, 2001 — San Antonio, Texas, USA
http://www.usenix.org/events/coots01

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Thank you

Conference Activities and Services

Conference Activities

Birds-of-a-Feather Sessions (BoFs)

Tuesday, Wednesday, and Thursday evenings, June 20–22

Lead or attend a BoF! Meet with your peers! Present new work! Don't miss these special activities designed to maximize the value of your time at the conference. The always-popular evening Birds-of-a-Feather sessions are very informal gatherings of persons interested in a particular topic. BoFs may be scheduled during the conference at the registration desk or in advance by contacting the USENIX Conference Office, either by phone (1.949.588.8649) or by email (conference@usenix.org). BoFs are open to all attendees. Topics are announced at the conference.

Work in Progress Reports (WiPs)

Thursday, June 22, 4:00 pm–5:30 pm

Short, pithy, and fun, Work in Progress reports introduce interesting new or ongoing work. If you have work you would like to share or a cool idea that's not quite ready for publication, send a one- or two-paragraph summary to usenix2000-wips@usenix.org. We are particularly interested in presenting students' work. A schedule of presentations will be posted at the conference, and the speakers will be notified in advance. Work in Progress reports are five-minute presentations; the time limit will be strictly enforced.

Social Activities

Meet the conference speakers and connect with your peers in the community.

Sunday, June 18	
Welcome Reception	6:00 pm–7:00 pm
Conference Orientation	7:00 pm–8:00 pm
Tuesday, June 20	
Birds-of-a-Feather Sessions	6:00 pm–10:00 pm
Wednesday, June 21	
Happy Hour at the Exhibition	5:30 pm–7:00 pm
Birds-of-a-Feather Sessions	9:00 pm–11:00 pm
Thursday, June 22	
25th Anniversary Reception	7:00 pm–9:00 pm
Birds-of-a-Feather Sessions	9:00 pm–11:00 pm

Dr. Dobb's Technetcast

Dr. Dobbs will be videotaping conference sessions for presentation on their Web site. Visit them at *http://www.technetcast.com/*.

Conference Services

Internet Connectivity

New to the conference will be a wireless network for your use. Bring your laptop and your 802.11-compliant wireless card, and you will have a larger range of connectivity. A limited number of cards will be available for checkout.

The terminal room itself will have Internet connectivity via PCs running OpenBSD, as well as drops for you to connect your laptop to our switches. The terminal room will offer dial-in to our network from your hotel room. Our hours of operation will be 7 am to 2 am Monday through Thursday, and 7 am to 2 pm on Friday (N.B. We may close during special conference activities.) Want to be a terminal room volunteer? Send email to mcginley@usenix.org.

Attendee Message Service

Stay in touch with your home and office!

An email message service will be available Sunday, June 18, through Friday, June 23. Email to conference attendees should be addressed: first_lastname@conference.usenix.org.

Telephone messages may be left at the USENIX Message Center Desk, 1.619.234.1500. The Message Center will be open Sunday, June 18, through Thursday, June 22, from 7:30 am until 5:00 pm, and Friday, June 23, until 3:00 pm.

Conference Proceedings and CD-ROMs

One copy of the Proceedings is included with your technical sessions registration fee. Additional copies may be purchased at the conference. To order additional copies after the conference, see *http://www.usenix.org/publications/ordering/*, telephone the Executive Office at 1.510.528.8649, or send email to *office@usenix.org*.

What to Do in San Diego

Enjoy the San Diego sunshine, scenery, seven miles of shoreline, fine dining, and lively night life!

In Balboa Park you'll find the famous Zoo, as well as 14 museums, art galleries, and theaters. Museum displays include art, cars, aerospace, model trains, local history, science, and much more.

Sea World presents a variety of marine life in Mission Bay. It features 5 shows and more than 20 exhibits and attractions, including Shamu!

Over 2,200 animals roam free in the San Diego Wild Animal Park, an 1,800-acre exotic animal and botanical reserve dedicated to the preservation and protection of endangered species. Approximately 45 minutes from the hotel, it's well worth the journey.

The Gaslamp Quarter, a 16-block historical district, houses a variety of restaurants and shops within walking distance of the hotel.

Old Town is characterized by adobe haciendas and beautiful restored Victorian homes. Enjoy the margaritas, mariachis, and hand-crafted treasures from around the world.

Mexico is only twenty miles away. U.S. and Canadian citizens need only a valid identification to recross the border, and you can bring back $400 in purchases. The San Diego Trolley will take you to Tijuana. You must have special insurance in order to drive to Mexico.

Registration, Hotel, and Travel Information

Registration Information

Early registration deadline: Friday, May 12, 2000

TUTORIAL FEES (JUNE 18–20)

Tutorial registration fees include:

- Admission to the tutorials you select
- Lunch
- Tutorial CD-ROM
- Printed tutorial materials for your courses
- Admission to the Vendor Exhibition

Select only one full-day tutorial per day.

Members/Nonmembers	
One day	$455
Two days	$760
Three days	$1065
CEU credit (optional)	$15/day
Students	
One day	$70
Two days	$140
Three days	$210
CEU credit (optional)	$15/day

After May 12, add $50 to the tutorial fee.

TECHNICAL SESSIONS FEES (JUNE 21–23)

Technical sessions registration fees include:

- Admission to all technical sessions
- Copy of Conference Proceedings
- Admission to the Conference Receptions
- Admission to the Vendor Exhibition

Early Registration Fees (before May 12)	
Member*	$465
Nonmember**	$560
Student	$75

After May 12, members and nonmembers add $50 to the technical sessions fee.

** The member fee applies to current members of USENIX, EurOpen national groups, JUS, AUUG.*

***Join or renew your USENIX membership at no additional charge. Just check the box on the registration form and pay the nonmember technical sessions fee.*

Payment by check or credit card must accompany the registration form. Purchase orders, vouchers, or telephone or email registrations cannot be accepted.

REFUND / CANCELLATION POLICY
If you must cancel, all refund requests must be in writing with your signature, postmarked no later than June 9, 2000. Telephone and email cancellations cannot be accepted. You may fax your cancellation or substitute another in your place. Contact the Conference Office for details.
Telephone: 1.949.588.8649; Fax: 1.949.588.9706.

Student Discounts & Stipends

TUTORIALS

A limited number of tutorial seats are reserved for full-time students at the very special rate of $70.00 for a full-day tutorial. You must telephone the Conference Office to confirm availability and make a reservation. You will be given a code number, which you must use when you register. The Conference Office must receive your registration form, with the code number, full payment, and a photocopy of your current student I.D. card, within 14 days from the date you make your reservation, or your reservation will be canceled. This special fee is nontransferable.

TECHNICAL SESSIONS

USENIX offers full-time students a special discount rate of $75 for its technical sessions. You must include a copy of your current student I.D. card with your registration. This special fee is not transferable.

STUDENT STIPENDS

The USENIX student stipend program covers travel, living expenses, and registration fees to enable full-time students to attend USENIX meetings. We'll post application information on comp.org.usenix 6–8 weeks before the conference. Apply for a stipend at *http://www.usenix.org/students/*.

STUDENT MEMBERSHIP

USENIX offers full-time students a special membership rate of $25 a year. Students must provide a copy of current student ID. To join SAGE, the System Administrators Guild, you must be a member of USENIX. SAGE membership is an additional $15. Students receive the same member benefits as individual members.

Join when you register by filling out the appropriate line on the print or on-line registration form.

Questions?
USENIX Conference Office:
22672 Lambert Street, Suite 613, Lake Forest, CA 92630
Phone: 1.949.588.8649. **Fax:** 1.949.588.9706.
Email: *conference@usenix.org.*
URL: *http://www.usenix.org*
Office hours: 8:30 am – 5:00 pm P.D.T.

Hotel and Travel Information

Hotel discount reservation deadline: Friday, May 26, 2000

USENIX has negotiated special rates for conference attendees at the San Diego Marriott Hotel & Marina. Contact the hotel directly to make your reservation. You must mention USENIX to get the special rate. A one-night room deposit must be guaranteed to a major credit card. To cancel your reservation, you must notify the hotel at least 24 hours prior to your planned arrival date.

San Diego Marriott Hotel & Marina
333 West Harbor Drive
San Diego, CA 92101-7700
Toll-free: 1.800.876.5030 (U.S.A.)
Local telephone: 1.619.234.1500
Reservation fax: 1.619.234.8678

Room Rates (single/double occupancy)

City view	$166
Bay view	$190

(plus local and state taxes, currently at 10.5%)

Note: All requests for hotel reservations made after the May 26 deadline will be handled on a space-available basis at the hotel's standard rate.

Need a Roommate?

Usenet facilitates room-sharing. If you wish to share a room, post to and check *comp.org.usenix.roomshare*.

DISCOUNT AIRFARES

Special airline discounts will be available for USENIX attendees. Please call for details:
JNR, Inc.
Toll Free: 1.800.343.4546 (U.S.A. and Canada)
Local telephone: 1.949.476.2788

TRANSPORTATION

The San Diego International Airport is approximately 10 minutes from the hotel. Cloud 9 Shuttle is available 24 hours a day. Catch the shuttle at the shuttle island outside the baggage claim area. Cost is $5 one way. Taxi service is approximately $10. Amtrak is less than two miles from the hotel, with taxi service available.

PARKING

Parking at the Marriott costs $18/day for valet parking and $12/day if you park your car yourself.

Other Nearby Parking

The Convention Center parking lot next door to the Marriott, offers parking only until midnight, at $4/day. Allright Parking, across the street from the Marriott, offers $5/day overnight parking.

Registration Form *USENIX 2000 June 18-23, 2000*

Copy this form as needed. Type or print clearly.

This address will be used for all USENIX mailings unless you notify us in writing.

Name First Last

First Name for Badge Member Number

Company / Institution

Mail Stop Mail Address

City State Zip Country

( ) ( )
Telephone No. Fax

Email Address (one only, please) WWW

Attendee Profile

Please help us meet your needs by answering the following questions. All information is confidential.

❑ I do not want to be on the Attendee list.
❑ I do not want my address made available except for USENIX mailings.
❑ I do not want USENIX to email me notices of Association activities.

What is your affiliation (check one):
❑ academic ❑ commercial ❑ gov't ❑ R&D

What is your role in the purchase decision (check one):
1. ❑ final 2. ❑ specify 3. ❑ recommend 4. ❑ influence 5. ❑ no role

What is your primary job function (check one):
1. ❑ system/network administrator 2. ❑ consultant
3. ❑ academic/researcher 4. ❑ developer/programmer/architect
5. ❑ system engineer 6. ❑ technical manager 7. ❑ student
8. ❑ security 9. ❑ Webmaster

How did you *first* hear about this meeting (check one):
1. ❑ USENIX brochure 2. ❑ newsgroup/bulletin board 3. ❑ *;login:*
4. ❑ WWW 5. ❑ from a colleague 6. ❑ magazine

What publications or newsgroups do you read related to the topics of this conference? _____

Payment Must Accompany This Form

Payment (U.S. dollars only) must accompany this form. Purchase orders, vouchers, email, or telephone registrations cannot be accepted.

❑ **Payment enclosed.** Make check payable to USENIX Conference.

Charge to my: ❑ VISA ❑ MasterCard ❑ American Express ❑ Discover

Account No. / Exp. Date

Print Cardholder's Name

Cardholder's Signature

You may fax your registration form to 1.949.588.9706 if paying by credit card. To avoid duplicate billing, please do not mail an additional copy.

Tutorial Program *(Sunday–Tuesday, June 18-20)*

Select only one full-day tutorial per day (9:00 am - 5:00 pm)

Sunday, June 18

❑ S1 UNIX Security Tools
❑ S2 Sendmail Config. and Operation
❑ S3 Sys. and Network Perf. Tuning
❑ S4 Adv. Topics in Perl Prog.
❑ S5 Windows NT Internals
❑ S6 Hacking Exposed: LIVE!
❑ S7 Intro. to UNIX Administration
❑ S8 Crypto. Algorithms Revealed

Monday, June 19

❑ M1 ID and Network Forensics
❑ M2 Adv. Solaris Sys. Admin. Topics
❑ M3 Linux Systems Administration
❑ M4 Win NT and UNIX Integration
❑ M5 Security from the Inside Out
❑ M6 Topics in Systems Admin. I
❑ M7 Administering Windows 2000
❑ M8 Adv. CGI Techniques Using Perl
❑ M9 Modern Sec. Sys. for Intranets, Extranets, and the Internet
❑ M10 Secure Networking

Tuesday, June 20

❑ T1 Designing Resilient Distrib. Sys.
❑ T2 Solaris Internals
❑ T3 Inside the Linux Kernel
❑ T4 Config. and Adm. Samba Servers
❑ T5 Computer Attacks: Trends and Countermeasures
❑ T6 Network Administration
❑ T7 Practical Web Site Dev. and Maintenance with Perl
❑ T8 Managing and Being Managed
❑ T9 Network Security Profiles
❑ T10 Special Topics in Sendmail

One-day tutorial fee	$455.00	$_____
One-day CEU fee (optional)	$15.00	$_____
Two-day tutorial fee	$760.00	$_____
Two-day CEU fee (optional)	$30.00	$_____
Three-day tutorial fee	$1065.00	$_____
Three-day CEU fee (optional)	$45.00	$_____
Tutorial late fee *applies if postmarked after Friday, May 12, 2000*	Add $50.00	$_____

Full-time student (attach photocopy of current student I.D.)

CODE NO	$70.00	$_____
CODE NO	$70.00	$_____
CODE NO	$70.00	$_____

Technical Program *(Wednesday–Friday, June 21-23)*

Current member fee *(applies to individual members of USENIX, EurOpen national groups, JUS, or AUUG)*	$465.00	$_____
Non-member or renewing member fee*	$560.00	$_____

***Join or renew your USENIX membership, for no additional fee, AND attend the conference.** **Check here:** ❑

Join or renew your SAGE membership *(You must be a current member of USENIX)*	Add $30.00	$_____
Technical sessions late fee *applies if postmarked after Friday, May 12, 2000*	Add $50.00	$_____
Full-time student** fee, pre-registered or on-site	$75.00	$_____
Full-time student** fee including USENIX membership fee	$100.00	$_____
Join or renew your student SAGE membership... *(You must be a current member of USENIX)*	Add $15.00	$_____

***Students: Attach a photocopy of current student I.D.*

TOTAL DUE $_____

REFUND/CANCELLATION POLICY: If you must cancel, all refund requests must be in writing with your signature, and postmarked no later than Friday, June 9, 2000. Telephone or email cancellations cannot be accepted. You may fax your cancellation or substitute another in your place. Call the Conference Office for details: 1.949.588.8649.

PLEASE COMPLETE THIS FORM AND RETURN IT, ALONG WITH FULL PAYMENT, TO:

USENIX Conference Office
22672 Lambert St., Suite 613
Lake Forest, CA USA 92630
Phone: 1.949.588.8649 Fax: 1.949.588.9706