

Contents

Introduction	xxix
-------------------------------	-------------

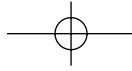
Part I

Chapter 1: What Is OpenSolaris?	3
--	----------

Introduction to OpenSolaris	3
OpenSolaris code	3
OpenSolaris distributions	4
OpenSolaris community	4
OpenSolaris Features	5
The “Open” in OpenSolaris	6
Open source software basics	6
Open source licenses	7
OpenSolaris licenses	8
Open development	9
What open source OpenSolaris means to you	9
The History of OpenSolaris	9
Comparing OpenSolaris to Other Operating Systems	11
OpenSolaris and Solaris	11
OpenSolaris and Linux	11
OpenSolaris and BSD	13
Getting Involved in OpenSolaris	13
Running OpenSolaris	13
Participating in discussion lists	14
Finding OpenSolaris user groups	14
Contributing to OpenSolaris	15
OpenSolaris Development Process	15
Resources	16
Summary	17

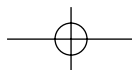
Chapter 2: Installing OpenSolaris	19
--	-----------

Solaris Express Community Edition	20
Schillix	21
BeleniX	22
NexentaCore	23
MartUX	24
MilaX	25



Contents

- OpenSolaris26
 - History of the OpenSolaris distribution26
 - What OpenSolaris includes27
 - Will OpenSolaris run on my hardware?28
 - Downloading OpenSolaris29
 - Booting the OpenSolaris CD30
 - Installing OpenSolaris33
 - Booting OpenSolaris41
 - Installing OpenSolaris in a virtual machine43
- Resources45
- Summary46
- Chapter 3: OpenSolaris Crash Course 47**
 - Discovering the Desktop47
 - Overview48
 - Managing windows49
 - Navigating files and directories49
 - Using the Internet51
 - Office suite52
 - Multimedia52
 - Printers and peripherals53
 - Customizing GNOME53
 - Logging out and shutting down53
 - Using the Command Line54
 - Shells54
 - Executing commands55
 - Shell History57
 - Environment variables58
 - Command paths59
 - Managing files61
 - Redirection64
 - Job control64
 - Customizing Bash65
 - Text editors66
 - Running privileged commands68
 - Switching Languages and Locales71
 - Changing locale in GNOME71
 - Changing locale in a terminal session73
 - Changing the default system locale74
 - Changing keyboard layout and input languages74
 - Installing additional languages75
 - Getting Online75
 - Network AutoMagic75
 - Manual network configuration75
 - Troubleshooting network connections77

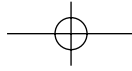


Contents

Adding Software	78
Finding and installing software	78
Alternative repositories	80
Developing on OpenSolaris	82
Connecting Remotely	82
System Administration	83
System information	83
Processes and services	85
Users, groups, and roles	89
Storage and file systems	92
Log files	95
Booting and shutting down	95
Managing boot environments	97
Managing GRUB and the OpenSolaris boot archive	97
Resources	99
Summary	99

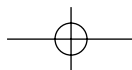
Part II

Chapter 4: The Desktop	103
Desktop Customization	103
Desktop session	103
Locking the session	104
Customizing the panel	105
Customizing your desktop's appearance	106
Other preferences	107
Desktop Sharing	108
Internet Applications	110
Web browsing with Firefox	110
E-mail and calendar	112
Instant messaging	116
Media Applications	119
Audio	119
Video	122
Graphics Applications	122
Screenshots	122
Viewing images	122
Organizing and editing images	123
System Administration	125
Users and groups	125
Keyring Manager	127
Disk Usage Analyzer	127
Log File Viewer	128



Contents

Performance Monitor	129
Power management and statistics	129
Other Applications	130
Troubleshooting	131
X server startup	131
GNOME session startup	132
Resources	132
Summary	133
Chapter 5: Printers and Peripherals	135
Printing	135
Automatic printer configuration with Presto	136
Manual printer configuration	138
PPD management	147
Scanners	148
USB Devices	149
Keyboards and mice	149
MP3 players	150
Webcams	150
Digital cameras	153
Audio	156
Serial Devices and Modems	156
Serial ports	156
USB-to-serial converters	157
Modems	159
Network Interfaces	159
Power Management and UPSs	161
Configuring power management	161
Uninterruptible power supply (UPS)	162
Device Drivers	163
Resources	164
Summary	165
Chapter 6: Software Management	167
Package Management	167
IPS concepts	168
Package names and versions	169
Installing packages with Package Manager	171
Removing packages	172
Viewing, verifying, and searching packages	173
Updating Your Software	177
Boot Environment Management	180
Viewing boot environments	180
Activating and renaming boot environments	182
Creating and destroying boot environments	183



Mounting boot environments	185
Managing a Package Repository	185
Building Your Own Distribution	187
Resources	188
Summary	188

Part III

Chapter 7: Disks, Local File Systems, and the Volume Manager 191

Disks	192
Disk device names	192
Formatting and labeling	193
Removable media	196
RAM disk	198
lofi	198
SANs	198
iSCSI	199
I/O Multipathing	202
Remote replication	203
Other Disk Utilities	203
File System Management	205
Mounting and unmounting file systems	205
Monitoring file systems	206
File systems and shutting down	207
devfs	207
UFS	207
Creating a UFS File System	208
Logging	209
UFS Mount Options	209
Checking and Repairing a UFS File System	209
Quotas	211
Backup, Snapshots, and Restore	212
Swap Space	214
Other Local File Systems	216
pcfs	216
hsfs	216
tmpfs	216
lofs	217
SAM-QFS	217
FUSE	217
The Volume Manager	217
Creating the metadb	218
Creating a metadevice	218
Other commands and features	220



Contents

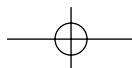
Resources	221
Summary	222

Chapter 8: ZFS 223

ZFS Basics	224
Managing ZFS Pools	226
Mirrors	227
RAID Z	231
Spare devices	232
Data scrubbing	234
Migration	235
Pool properties	237
Pool history	239
Monitoring ZFS performance	240
ZFS Datasets	241
ZFS file systems	241
ZFS volumes	243
ZFS snapshots	245
ZFS clones	248
Dataset replication and backups	249
Dataset properties	251
ZFS encryption	257
ZFS Delegated Administration	258
ZFS Versioning	259
Resources	261
Summary	262

Chapter 9: Networking 263

Network Interfaces	263
Displaying IP interfaces	265
Configuring interfaces automatically with NWAM	267
Configuring interfaces manually	271
Logical interfaces	276
IP multipathing	278
Link aggregation	285
Configuring virtual LAN interfaces	287
Configuring a virtual NIC	288
Configuring IP tunnels	288
PPP and PPP over Ethernet	290
Network Services	290
Domain Name System	290
Multicast DNS	299
Dynamic Host Configuration Protocol	300
File Transfer Protocol	305
Network Time Protocol	306

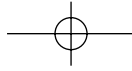


Contents

Mail service	308
HTTP	309
inetd	309
OpenSolaris As a Router or Firewall	313
Routing	313
Configuring a firewall with IP filter	318
TCP Wrappers	322
Troubleshooting	324
netstat	324
ping and traceroute	325
Snoop	326
SNMP	328
Resources	328
Summary	329

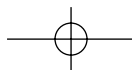
Chapter 10: Network File Systems and Directory Services 331

Introduction to NFS	332
Introduction to CIFS	332
Managing File Sharing	333
Installing sharing packages	334
Share groups and sharemgr	334
Configuring sharing services with sharectl	338
Configuring the CIFS service in workgroup mode	340
Automatic sharing of user home directories with CIFS	341
Advanced CIFS server topics	341
Accessing Files with NFS	342
Manual NFS mounts	343
Mounting NFS shares with the automounter	344
NFS security	346
NFS monitoring and troubleshooting	349
Accessing Files with CIFS	349
OpenSolaris Naming Services	353
The name service switch	353
Name service caching with nscd	354
Troubleshooting name service lookups	355
NIS	355
Configuring a NIS client	356
Configuring a NIS master server	360
Configuring a NIS slave server	362
Managing NIS maps	364
Leaving a NIS domain	365
LDAP	365
OpenSolaris as an LDAP server	366
OpenSolaris as an LDAP client	366



Contents

- Resources367
- Summary368
- Chapter 11: Security 369**
 - Security Overview369
 - Being a global security citizen370
 - Organization of this chapter371
 - Preventing Unauthorized Access371
 - User education and physical security372
 - Pluggable Authentication Modules (PAM)372
 - Password management375
 - Firewalls379
 - Secure by Default (SBD)380
 - Limiting the Damage384
 - Role-based access control384
 - Privileges394
 - Restricted shell398
 - Access control lists399
 - Encrypted files404
 - Message digests405
 - Preventing user stack execution406
 - Zones and resource management406
 - Ensuring Secure Communication406
 - Secure Shell408
 - IP security413
 - Detecting Attacks420
 - Logs420
 - Basic Audit Reporting Tool422
 - Solaris Auditing425
 - Virus scanning430
 - Kerberos431
 - Clock synchronization431
 - Setting up the key distribution center433
 - Setting up the Kerberos clients434
 - Starting Kerberized services435
 - Creating Kerberos accounts436
 - Managing tickets437
 - Using Kerberized services438
 - Kerberized NFS439
 - Configuring PAM for Kerberos441
 - Kerberos logs444
 - Enhancing Kerberos availability445
 - Trusted Extensions445
 - Resources446
 - Summary448



Part IV

Chapter 12: Fault Management 451

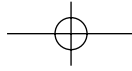
- Predictive Self-Healing 451
 - Fault managed resource identifiers 452
 - Fault management versus service management 453
- Fault Management Overview 453
 - FMD pluggable modules 454
 - Knowledge articles 454
 - Fault management hardware support 455
- Fault Management Commands 455
 - fmadm 455
 - fmstat 456
 - fmdump 457
 - Other fault management commands 459
- Using Fault Management 461
- Resources 464
- Summary 464

Chapter 13: Service Management 465

- Processes and Services 465
- SMF By Example 468
 - The service manifest 472
 - Service method script 479
 - Service management commands 481
- SMF Machinery 490
 - Restarters 490
 - SMF repository 493
 - The manifest-import service 495
 - Milestones and init compatibility 496
 - Profiles 499
- Customizing SMF Services 500
- Resources 501
- Summary 501

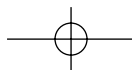
Chapter 14: Monitoring and Observability 503

- Getting System Configuration Information 504
- Primary Utilities 509
 - uptime 509
 - ps 509
 - prstat 510
 - vmstat 512
 - mpstat 514
 - iostat 515
- /proc 516



Contents

Kstats	518
Other Utilities	519
cpustat	519
truss	520
intrstat	521
lockstat	522
sar	523
Logs	524
syslog	524
Log management	525
User activity	525
SNMP	526
Resources	527
Summary	527
Chapter 15: DTrace	529
Getting Started	530
Tracing Syntax	535
Program structure	535
Probes	536
Predicates	539
Actions	541
The dtrace Command	559
Advanced Tracing	560
Tracing during boot	560
Buffering	560
Speculative tracing	562
Postmortem tracing	563
Standalone programs	564
User-Level and High-Level Language Tracing	564
The pid provider	564
The sdt provider	565
User-level data	568
Tracing Java programs	569
Tracing programs in other languages	572
Resources	573
Summary	574
Chapter 16: Clustering OpenSolaris for High Availability	575
Introduction to High-Availability Clusters	575
Overview of Open High Availability Cluster	576
Cluster infrastructure	577
Cluster agents	578
Setting Up a Cluster	579
Hardware requirements and configuration	579



Contents

Installing the cluster software	583
Configuring the cluster	584
Using the Cluster	589
Managing services	589
Making Apache highly available	590
Making Apache scalable	600
Advanced Cluster Administration	606
Shutting down the cluster	606
Service management	606
Volume management	622
Zones As Logical Nodes	622
Network load balancing	627
Other cluster commands	628
Making Custom Services Highly Available	631
SMF Proxy	631
Generic data service	633
Disaster Recovery with Open High Availability Cluster	634
Terminology	635
Open HA Cluster Geographic Edition	635
Setting up a Geographic Edition configuration	636
Topology and architecture	637
Installing and configuring Geographic Edition	638
Geographic Edition operations	642
Resources	643
Summary	645

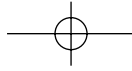
Part V

Chapter 17: Virtualization Overview 649

Benefits of Virtualization	650
Types of Virtualization	651
Resource management	651
Operating-system-level virtualization	651
Full virtualization	652
Comparison of virtualization layers	654
Other virtualization solutions	655
Comparing Virtualization Solutions	655
Virtualization and a Graphical Display	657
Virtualization Administration	658
Summary	658

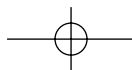
Chapter 18: Resource Management 659

Introduction to Resource Management	659
Projects and Tasks	660



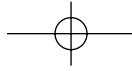
Contents

The project database	661
Determining the default project	662
Changing tasks	663
Configuring projects	663
Managing by project and task	665
Resource Controls	665
Using rctl	666
rctl Syntax	667
rctl list	668
Project rctl	668
Resource Caps	671
Resource Pools	672
Configuring a pool	672
Binding a pool to a project	675
Dynamically binding to a pool	675
Monitoring pools	676
Advanced pool configuration	676
The dynamic pool daemon	680
Processor Sets	682
Scheduling	682
The Fair Share Scheduler	684
Managing scheduling classes	686
CPU caps	687
Accounting	687
Legacy accounting	687
Extended accounting	688
Resources	691
Summary	692
Chapter 19: Zones	693
Introduction to Zones	693
Uses of Zones	694
Getting Started with Zones	694
Configuring a zone	694
Installing a zone	696
Booting a zone	697
Logging in to a zone	698
Halting a zone	699
Advanced Zone Configuration	699
Resource management	699
Networking	705
Sparse root versus whole root	708
Other zonecfg features	710
Advanced zoneadm Features	719
Moving a zone on the same machine	719



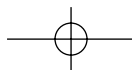
Contents

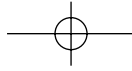
Moving a zone from one machine to another	719
Cloning a zone	723
Uninstalling a zone	724
Ongoing Zones Administration	724
Preconfiguring system identity	724
Zones-related processes	725
Accessing a zone	725
Monitoring	726
Dynamically reconfiguring a zone	729
SMF	731
Backup and restore	731
Software management	732
Other tools	733
Limitations to Zones	733
Branded Zones	734
The ipkg brand	735
The lx brand	735
Experimental Linux 2.6 support	738
Other brands	738
Implementation	739
Resources	739
Summary	740
Chapter 20: xVM Hypervisor	741
xVM Concepts	742
Getting Started with xVM	744
Installing the xVM software and booting under the hypervisor	744
Configuring and installing a guest domain	746
Logging in to a guest domain	748
Basic management of a guest domain	748
Advanced xVM Administration	751
Command line interfaces	751
Installation	751
Monitoring	757
Ongoing management	761
Domain console	767
SMF services	768
Live Migration	769
Enabling live migration	770
Migrating a domain	771
Virtual Devices	772
CPUs	772
Memory	776
Virtual disks	778
Networking	780



Contents

Other devices	782
Devices in HVM domains	782
Troubleshooting	782
Logs	782
DomU core dumps	783
Dom0 core dump	784
DTrace	784
Resources	785
Summary	785
Chapter 21: Logical Domains (LDoms)	787
Introduction to LDoms	787
LDom Concepts	788
Types of domains	788
Types of services and devices	789
Getting Started with LDoms	791
Checking the firmware	791
Installing the management software	792
Administrative privileges	792
Configuring the control domain	792
Configuring a guest domain	795
Logging in to a guest domain	798
Booting and installing a guest domain	798
Advanced LDom Administration	800
Monitoring	800
ldmd daemon	803
Delayed reconfiguration	803
Virtual I/O services	804
Physical I/O	808
Creating services in a different domain	810
CPU, memory, and MAU	810
Virtual Disks	812
Networking	813
Console	814
Variables	816
Other administrative subcommands	817
Managing configurations on the system controller	818
Migrating a domain from one machine to another	818
Hardening the control domain	820
Resources	820
Summary	821
Chapter 22: VirtualBox	823
Getting Started	824
Configuring and installing a virtual machine	824





Contents

Booting and installing the guest OS	826
Managing VirtualBox	828
The running VM window	829
The VirtualBox management GUI	830
Advanced Features	833
Guest additions	833
The management CLI	835
Networking	836
Storage	837
Remote access	840
Programmatic interfaces	841
Running within a zone	841
Resources	842
Summary	842

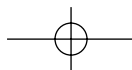
Part VI

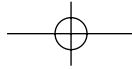
Chapter 23: Deploying a Web Stack on OpenSolaris 845

The Web Stack on OpenSolaris	845
The AMP Stack	847
Installing the AMP stack	847
Configuring Apache	848
Configuring PHP	850
Configuring MySQL	851
Web applications	853
Alternatives to Apache, MySQL, and PHP	854
Java-based Web Services	859
Apache Tomcat	859
GlassFish Application Server	864
Resources	866
Summary	866

Chapter 24: Developing on OpenSolaris 869

Java Development	869
Compilers and tools	870
Debugging with JDB	871
C and C++ Development	875
Compilers and tools	875
OpenSolaris C APIs	878
Debugging	879
Other Languages	891
Perl	891
Python	891
Ruby on Rails	892





Contents

- PHP893
- Shell scripting893
- Build Automation894
- NetBeans894
 - NetBeans overview895
 - NetBeans for Java897
 - NetBeans C and C++ development903
 - NetBeans plug-ins906
 - NetBeans web application development907
- Source Code Management912
 - CVS913
 - Subversion918
 - Mercurial922
- Building IPS Packages926
 - IPS actions927
 - IPS package example927
- Crash Dumps and Kernel Debugging929
 - Core files and crash dumps929
 - Kernel debugging931
- Resources934
- Summary936

Index 937

