

Contents

	<i>Page</i>
Preface	xv
UNICOS System Administration Publications	xv
Related publications	xvi
Ordering Cray Research Publications	xviii
Conventions	xviii
Reader Comments	xx
Introduction [1]	1
TCP/IP [2]	3
TCP/IP Basics	4
Internet Structure	5
Internet Addressing	8
Address Classes	8
Subnet and Supernet Addressing	10
Decimal Notation	12
Mapping Internet Addresses to Names	12
Hardware Addressing	13
Using the Address Resolution Protocol (ARP)	13
Using a Configuration File—Model E and Model V Systems Only	13
Using a Configuration File—GigaRing Based Systems Only	14
Using the Internet Address—Model E and Model V Based Systems Only	14
Routing of Information	15
Routing Procedure	17
Routing Algorithm	20

	<i>Page</i>
Routing Tables	21
Configuring TCP/IP	23
Configuration Issues	24
Looking up Host Names and Addresses	24
Selection of Internet Addresses	26
Configuring the TCP/IP Kernel Code	27
Determining the Number of Mbufs Needed	27
Setting the Number of Mbufs	28
Specifying Other Kernel Variables	29
Security Configuration Parameters for Networking	29
Setting up Network-wide Configuration Files	31
The /etc/hosts File	31
The /etc/networks File	33
Setting up Local System Configuration Files	35
The/etc/services File	35
The /etc/shells File	37
The /etc/hosts.equiv File	37
The /etc/protocols File	40
Configuring Network Interfaces—Model E and Model V Systems Only	41
Defining Hardware Devices	41
Naming the Cray Interface	43
Choosing an Internet Address	46
Creating the hycf File	46
Configuring Network Interfaces—GigaRing Based Systems Only	56
Defining I/O Node Configuration	56
Naming the Cray GigaRing Interface	58
Interface Name Prefix	58
Identifying Character Special Devices	58

	<i>Page</i>
Creating HIPPI Character Special Device Nodes	59
Choosing an Internet Address	60
Creating the <code>ghippi#.arp</code> File	60
Creating the <code>atm.pvc</code> File	62
Configuring Daemons	64
The <code>gated</code> Daemon	65
The <code>lpd</code> Daemon	73
The <code>named</code> Daemon	81
The <code>sendmail</code> Daemon	85
The <code>snmpd</code> Daemon	89
The <code>ntpd</code> Daemon	97
The <code>inetd</code> Daemon	102
Performing Startup Procedures	110
Calling the First Local Script	111
Initializing Kernel Networking Variables	112
Updating the Binary Hosts Database	112
Configuring the Host Name	112
Loading the Maps	113
Initializing the Network Interfaces	113
Calling the Midpoint Local Script	119
Setting up Routing	119
Setting up Daemons	121
Calling the Final Local Script	123
Using the <code>telnet</code> Linemode Feature	123
Tab Settings	123
Special Character Processing	124
Command Completion/editing Shells (<code>ksh/tcsh</code>)	125
Simulated Terminal Input	125

	<i>Page</i>
Assisting Users in Setting up Environments	125
The \$HOME/.netrc File	125
The \$HOME/.rhosts File	126
The bftp Facility	127
Network Tuning	128
Data Transmission Units	128
Interface Mtu—Model E and Model V Based Systems Only	129
Using the Interface Mtu—GigaRing Based Systems Only	129
Datagram Size Limitations	129
IP Datagram Size Selection	130
Path Mtu Discovery	130
TCP Segment Size Selection	131
Buffering and Memory Requirements	133
Buffered Memory (Mbufs)	134
A Network Example	146
Network Routing	154
Special Host Routing	157
Load Balancing	159
Controlling Routing by Group IDs	162
Controlling Access	162
Diagnosing and Fixing Routing Problems	163
Labeling Route Entries with IP Type-of-Service (TOS)	173
Preventing the Cray Research System from Becoming a Gateway	174
Troubleshooting	175
Troubleshooting Tools	176
Hardware Diagnostics	176
Network Monitoring	178
Network Testing and Diagnosing	179

	<i>Page</i>
Network Services	180
Basic Problem-solving Strategy	185
TCP/IP in a Cray Research Environment	185
Monitoring and Controlling System Changes	188
Isolating the Failing Component	188
Isolating the Daemon and Client	189
Isolating the Hardware	189
Isolating the Networking Software	190
Examples of Network Problems and Solutions	191
Troubleshooting Guidelines	192
Troubleshooting Examples	193
Trace Facility	214
Collecting Trace Information	215
Formatting Trace Information	217
Obtaining Trace Socket Status	218
Security Administration Basics	218
Network Security Functional Overview	219
Network Access List (NAL)	220
IPSO Mapping Entries	221
IP Security Options	222
Workstation Access List (WAL)	223
Identification and Authentication	223
Login Authentication	224
Network Security Configuration	224
UNICOS Security Configuration Guidelines	224
Network Security Options	225
NFS Configuration Options	226
Restricting Access to Network Interfaces	227

	<i>Page</i>
Labeling Network Interfaces	227
Network Security Configuration Procedures	230
inetd Operation	237
Error Messages	238
Network Access Violations	238
reduce(8) Command	241
Problem Isolation Guidelines	242
Network File System (NFS) [3]	243
Administering UNICOS NFS	244
Activating NFS	244
Choosing a Configuration Method	244
UNICOS ICMS Configuration Method	244
Manual Configuration Method	246
Local Script and File Configuration	246
Setting up a UNICOS NFS Server	246
Setting up a UNICOS NFS Client	249
Mounting a Remote File System	249
Automount Facility	251
Protocol between Cray Research Systems	252
Typical UNICOS NFS Layout	253
ID Mapping	254
Disabling ID Mapping	255
Configuring and Using ID Mapping	256
Network Description Example	257
Setup, Creation, and Maintenance of ID Map Files Example	258
Kernel Map Manipulation Example	264
Other Administrative Considerations	270

	<i>Page</i>
Running <code>pcnfsd</code> with NFS ID Mapping Control	272
Deciding When to Use ID Mapping	273
Special <code>MAP_THRU</code> NFS ID Map	275
Configuring NFS Parameters	276
Changing the <code>config.h</code> File	276
Changing the NFS Parameter File	277
General Security Concerns	277
NFS and UNICOS Security	279
Kerberos Authentication	281
Kerberized NFS	281
UDP Checksum	282
Troubleshooting	283
Isolating the Problem	284
NFS Mounting Problems	284
Problems Accessing NFS Mounted Files	287
Problems with ID Mapping	290
NFS Mount Failure	291
NFS Mount Example	291
NFS Mount Failure Error Messages	292
Hanging Programs	295
No Super-user Access over the Network	295
File Operations Not Supported	297
Remote Device Access Not Supported	297
Confidence Testing	297
Installation	298
Test Execution	299
Test Configurations	301
Executing Individual Tests	301

	<i>Page</i>
Cleaning up	302
Test Contents	302
Performance and Tuning	303
Factors That Affect NFS Performance	303
NFS_MAXDATA Parameter	303
mount Command Arguments	304
NFS Daemons	304
File System Configuration and ldcache(8)	305
Network Speed	306
Network Configuration and Load	306
NFS Server/client Configuration and Load	306
Obtaining NFS Performance Figures	306
Network Information Service (NIS) [4]	309
About NIS	309
NIS Databases	311
NIS Maps	311
NIS Domains	311
Servers and Clients	312
Servers	313
Clients	313
Masters and Slaves	313
Naming	314
Data Storage	314
Supported Databases	315
the /etc/passwd File	315
The /etc/group File	316
Changing NIS Data	316
Using NIS	316
NIS and UNICOS NFS	317

	<i>Page</i>
Configuring NIS	317
UNICOS NIS Domain Configuration Procedure	318
Adding a User to the UNICOS NIS Domain	319
Precautions Concerning Sets of Users	320
Precautions Concerning the Cray Research System As a Master Server	321
Precautions Concerning NIS and UNICOS Security	321
Secure RPC	321
Generating the Database	322
Developing Secure RPC Applications	325
About NIS+	325
NIS+ Licensing	326
Comparing NIS and NIS+	327
Components of NIS+	328
NIS+ Namespace	328
Directory Objects	328
NIS+ Domains	329
NIS+ Servers	329
NIS+ Clients	330
NIS+ Tables	330
Name Service Switch	331
NIS+ Commands	332
NIS+ API	334
Planning Your NIS+ Namespace	335
Setting up Your First NIS+ Domain	336
Calculating Disk Requirements for Your Master Servers	336
How to Set up a Root Domain	337
Initializing an NIS+ Client	339
Setting up an NIS+ Server	340
How to Set up a Nonroot Domain	340

	<i>Page</i>
Administering Your NIS+ Namespace	342
Migrating from NIS to NIS+	344
NIS-compatibility Mode	344
NIS to NIS+ Command Compatibility	345
Appendix A MIB Variables Supported by CRI	347
System Group	347
Interface Group	347
Address Translation Group	348
IP Group	348
ICMP Group	349
TCP Group	350
UDP Group	350
SNMP Group	351
Index	353
Figures	
Figure 1. Two networks interconnected by gateway G	6
Figure 2. Several interconnected networks	7
Figure 3. Internet configuration with obvious paths	16
Figure 4. Internet configuration with alternative paths	17
Figure 5. Routing procedure example	19
Figure 6. Routing table example	22
Figure 7. Sample network configuration	70
Figure 8. Performance chart	139
Figure 9. Double buffering network	143
Figure 10. Sample network configuration	147

	<i>Page</i>
Figure 11. Network routing example configuration	156
Figure 12. Special host routing example configuration	158
Figure 13. Load balancing example configuration	160
Figure 14. Route tracing example configuration	166
Figure 15. TCP/IP component interaction	186
Figure 16. Configuration example	229
Figure 17. System interfaces and ID mapping	255

Tables

Table 1. Characteristics of class A, B, and C addresses	9
Table 2. /etc/inetd.conf file columns	104
Table 3. Configurable NFS parameters	276
Table 4. NFS man pages	283
Table 5. Comparing the features of NIS and NIS+	327
Table 6. NIS+ tables on UNICOS systems	330
Table 7. Sample NIS+ client configuration	332
Table 8. NIS+ administration commands	333
Table 9. NIS+ API functions	334
Table 10. Common NIS+ commands	342
Table 11. Correspondence between information sources on a UNICOS system	345
Table 12. Comparing NIS and NIS+ commands on a UNICOS system	345

