Morning Star PPP

Version 1.4.1

User Guide

12 August 1994

Morning Star PPP

Version 1.4.1

User Guide

12 August 1994

Published by
Morning Star Technologies, Inc.
3518 Riverside Drive, suite 101
Columbus OH USA 43221-1754

+1 614 451 1883 (voice)
+1 800 558 7827 (voice)
+1 614 459 5054 (FAX)
Support@MorningStar.Com (technical e-mail)
Marketing@MorningStar.Com (sales e-mail)
ftp.MorningStar.Com (anonymous FTP)
http://www.MorningStar.Com/ (World-Wide Web)

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies, Inc.
All rights reserved

Published by
Morning Star Technologies, Inc.
3518 Riverside Drive, suite 101
Columbus OH USA 43221-1754

+1 614 451 1883 (voice)
+1 800 558 7827 (voice)
+1 614 459 5054 (FAX)
Support@MorningStar.Com (technical e-mail)
Marketing@MorningStar.Com (sales e-mail)
ftp.MorningStar.Com (anonymous FTP)
http://www.MorningStar.Com/ (World-Wide Web)

SnapLink is a registered trademark of Morning Star Technologies, Inc.
UNIX is a registered trademark of UNIX System Laboratories, Inc.
Telebit, NetBlazer, and QBlazer are trademarks of Telebit Corporation
NeXT is a trademark of NeXT Computer, Inc.
Ethernet is a trademark of Xerox Corporation
DOS is a trademark of International Business Machines Corporation
MS-DOS is a registered trademark of Microsoft Corporation
NFS is a trademark of Sun Microsystems, Inc.
MNP is a trademark of Microcom Inc.
PC/TCP and FTP Software are registered trademarks of FTP Software, Inc.
3Com and NETBuilder are trademarks of 3Com Corporation
Macintosh is a trademark of Apple Computer, Inc.
cisco, AGS, and CGS are trademarks of cisco Systems, Inc.
Xylogics and Annex are trademarks of Xylogics, Inc.
LAN WorkPlace for DOS is a trademark of Novell, Inc.
Xyplex is a trademark of Xyplex, Inc.

All other product names mentioned herein are used for identification
purposes only, and may be the trademarks or registered trademarks
of their respective companies.

Contents

Contents

1. Introduction **1**
1.1. Introduction to PPP 1
1.2. Using this Manual 2
1.3. Related Manuals 3

2. Installation **4**
2.1. Installation Checklist 4
2.2. System-Specific Details 5
2.3. Unpacking the distribution 6
2.4. Installing the software and documentation 7
2.5. Building and installing a kernel 8
2.6. Installing an updated version 8
2.7. Arranging for PPP connections 8
2.8. Creating the PPP configuration files 12
2.9. Testing the installation 14

3. Special Link Management Issues **15**
3.1. Active vs. Passive 15
3.2. The Idle Timer 15
3.3. The *exec* option 16
3.4. SLIP framing rather than PPP 17
3.5. Synchronous PPP 18
3.6. Link Quality Monitoring 19
3.7. Dedicated Lines 21
3.8. Constantly-Open Telephone Calls 22
3.9. Compression 22
3.10. Soft Addresses 25
3.11. Dynamic address assignment 25

4. Security Techniques **26**
4.1. Time-To-Call Restrictions 26
4.2. Dial-Back 27
4.3. SecureID 27
4.4. Replacing *getty* With *pppd* 28
4.5. Link Peer Authentication 29
4.6. Packet Filtering 29
4.7. Tunneling 32
4.8. Selective Gateway Encryption 34

5. Observing *pppd*'s actions **35**

5.1. The Argument Vector 35
5.2. The Log File 35
5.3. The Accounting File 36

6. IP Routing Tips 37
6.1. Connecting a Host to a LAN 38
6.2. Connecting two LANs 41
6.3. Connecting a host or LAN to the Internet 42
6.4. A Common Test Setup 42

7. Observations about on-demand dialup IP 43
7.1. Application behavior 43
7.2. Dealing with bandwidth limitations 43

8. Cabling 46
8.1. Asynchronous Modem cables 46
8.2. Asynchronous 'Null-Modem' cables 47

9. Modem parameters 49
9.1. Flow control 49
9.2. General Recommendations 50
9.3. Specific examples 52

10. Interoperability with other PPP implementations 54
10.1. The Telebit NetBlazer 54
10.2. FTP Software Inc's PC/TCP Network Software for DOS 57
10.3. Novell LAN WorkPlace for DOS 58
10.4. Brixton Systems' BrxPPP 58
10.5. SCO UNIX/ODT PPP 58
10.6. Network Application Technology LANB-820 59
10.7. Proteon cnx500 59
10.8. Xylogics Annex-3 59
10.9. Xyplex Terminal Servers 59
10.10. Livingston Portmaster 59
10.11. KA9Q 60
10.12. The Free UNIX-based PPP implementations 60
10.13. HP LanProbe 60

11. Getting Help 60

12. Getting updated software and documentation 61

13. Credits 64

14. Copyright Information 64

tun(4) – IP network tunnel driver 2
ppp.Auth(5) – PPP authentication file format 5
ppp.Devices(5) – PPP physical device description file format 8
ppp.Dialers(5) – PPP dialer description file format 12
ppp.Filter(5) – PPP packet filter specification file format 16
ppp.Keys(5) – PPP encryption keys file format 25
ppp.Systems(5) – PPP neighboring systems description file format 28
pppd(8) – PPP daemon 35
Troubleshooting Guide 49
Glossary 59
Bibliography 65
Release Notes 69
Index 79

iii

iv

Morning Star PPP User Guide

1. Introduction

1.1. Introduction to PPP

Morning Star PPP provides an easy and flexible means of creating wide-area TCP/IP-based networks for transferring data among UNIX systems, and between UNIX systems and others that also implement the Internet standard Point-to-Point Protocol (PPP), or the non-standard but popular Serial Line Internet Protocol (SLIP). Users of Morning Star PPP can connect their isolated UNIX systems to established TCP/IP networks, or can connect geographically separated networks. Morning Star PPP can also run on a hub machine to provide multiple remote systems with transparent dial-in access to the hub and other LAN-connected hosts.

Since users continue to use the UNIX host's native TCP/IP implementation and related utilities, no additional training is needed to make full use of the new link. Because of the transparency of TCP/IP internetwork routing, many may even be unaware that remote facilities are not directly connected to the local network.

By contrast with network routers that require an expensive leased line to provide a constant connection, Morning Star PPP can establish an asynchronous link over standard telephone lines when traffic warrants a call. When the traffic has finished, Morning Star PPP can hang up the connection to save on telephone costs. User applications cannot distinguish between an on-demand dialup link and one that is constantly maintained, except by looking at the clock. Alternatively, where the traffic load requires the increased bandwidth, Morning Star PPP can run over the SnapLink SCSI-attached high speed serial interface to make efficient use of a dedicated line. If the dedicated line is unavailable or fails during use, Morning Star PPP can automatically switch over to a dialup modem to provide backup service.

The UNIX system administrator has complete control over the traffic allowed to traverse the link. Morning Star PPP can turn a UNIX system into a selective-isolation packet filtering 'firewall' gateway, enhancing the security provided to other systems on the local network. Traffic can be encrypted between two LANs that are each connected to an insecure internet by Morning Star PPP, to provide wide-area communication that is secure from intermediate traffic snoopers.

Morning Star PPP User Guide

1. Introduction

1.1. Introduction to PPP

Morning Star PPP provides an easy and flexible means of creating wide-area TCP/IP-based networks for transferring data among UNIX systems, and between UNIX systems and others that also implement the Internet standard Point-to-Point Protocol (PPP), or the non-standard but popular Serial Line Internet Protocol (SLIP). Users of Morning Star PPP can connect their isolated UNIX systems to established TCP/IP networks, or can connect geographically separated networks. Morning Star PPP can also run on a hub machine to provide multiple remote systems with transparent dial-in access to the hub and other LAN-connected hosts.

Since users continue to use the UNIX host's native TCP/IP implementation and related utilities, no additional training is needed to make full use of the new link. Because of the transparency of TCP/IP internetwork routing, many may even be unaware that remote facilities are not directly connected to the local network.

By contrast with network routers that require an expensive leased line to provide a constant connection, Morning Star PPP can establish an asynchronous link over standard telephone lines when traffic warrants a call. When the traffic has finished, Morning Star PPP can hang up the connection to save on telephone costs. User applications cannot distinguish between an on-demand dialup link and one that is constantly maintained, except by looking at the clock. Alternatively, where the traffic load requires the increased bandwidth, Morning Star PPP can run over the SnapLink SCSI-attached high speed serial interface to make efficient use of a dedicated line. If the dedicated line is unavailable or fails during use, Morning Star PPP can automatically switch over to a dialup modem to provide backup service.

The UNIX system administrator has complete control over the traffic allowed to traverse the link. Morning Star PPP can turn a UNIX system into a selective-isolation packet filtering 'firewall' gateway, enhancing the security provided to other systems on the local network. Traffic can be encrypted between two LANs that are each connected to an insecure internet by Morning Star PPP, to provide wide-area communication that is secure from intermediate traffic snoopers.

Morning Star PPP implements HDLC address/control field and protocol field compression, as well as TCP header compression, to reduce transmission overhead to a minimum. This improves both throughput and interactive response on typical modem connections. Its interface to the UNIX host's TCP/IP implements Van Jacobson's TCP 'fast queue' scheme, whereby interactive packets have priority for transmission on a congested link.

1.2. Using this Manual

This User Guide contains sections on

- Unpacking and installing the software
- Configuring your system to both initiate and answer PPP calls
- Link-level authentication and encryption
- Using SLIP framing rather than PPP
- Using synchronous connections and dedicated lines
- Using constantly-open telephone calls
- IP routing tips for various common network topologies
- Taking advantage of the daemon's management and monitoring features
- Tuning your applications to take best advantage of the dialup IP environment
- Asynchronous modem cabling and configuration
- Flow control
- Using Morning Star PPP with other PPP implementations
- Getting help with Morning Star PPP

The portions of this manual following this introductory User Guide have been organized in the style of the standard Berkeley UNIX manual sections. The interface to the host UNIX system's IP implementation is described in section 4. Section 5 describes the format of the configuration files, and the PPP daemon itself is described in section 8.

After the reference manual pages, you'll find

- A troubleshooting guide to help solve common problems
- A brief glossary of networking and modem terminology
- A bibliography of useful networking references

Morning Star PPP version 1.4.1

Morning Star PPP implements HDLC address/control field and protocol field compression, as well as TCP header compression, to reduce transmission overhead to a minimum. This improves both throughput and interactive response on typical modem connections. Its interface to the UNIX host's TCP/IP implements Van Jacobson's TCP 'fast queue' scheme, whereby interactive packets have priority for transmission on a congested link.

1.2. Using this Manual

This User Guide contains sections on

- Unpacking and installing the software
- Configuring your system to both initiate and answer PPP calls
- Link-level authentication and encryption
- Using SLIP framing rather than PPP
- Using synchronous connections and dedicated lines
- Using constantly-open telephone calls
- IP routing tips for various common network topologies
- Taking advantage of the daemon's management and monitoring features
- Tuning your applications to take best advantage of the dialup IP environment
- Asynchronous modem cabling and configuration
- Flow control
- Using Morning Star PPP with other PPP implementations
- Getting help with Morning Star PPP

The portions of this manual following this introductory User Guide have been organized in the style of the standard Berkeley UNIX manual sections. The interface to the host UNIX system's IP implementation is described in section 4. Section 5 describes the format of the configuration files, and the PPP daemon itself is described in section 8.

After the reference manual pages, you'll find

- A troubleshooting guide to help solve common problems
- A brief glossary of networking and modem terminology
- A bibliography of useful networking references

- A description of the changes that have occurred with each release of Morning Star PPP
- An index of important points in the rest of the document

1.3. Related Manuals

The Morning Star PPP daemon is described in detail in the UNIX-style manual page **pppd**(8). Its configuration files are described in **ppp.Auth**(5), **ppp.Devices**(5), **ppp.Dialers**(5), **ppp.Filter**(5), **ppp.Keys**(5), and **ppp.Systems**(5). The IP tunnel driver (*pppd*'s interface to the host's IP network stack) is described in **tun**(4).

Hardware installation, when necessary, is described in the *Hardware Installation Guide* for the specific communications interface hardware. (Not all Morning Star PPP installations require additional hardware, so if you are using a serial port-only product, you won't have received a copy of any *Hardware Installation Guide*.)

Last minute hints and installation instructions pertinent to the architecture of your machine can be found in the file **ppp/README** that's delivered as part of the software distribution.

The authoritative references on TCP/IP and the Point-to-Point Protocol are the Internet Requests for Comments series, particularly RFCs 1548[1] and 1332[2]. These are occasionally updated by the Point-to-Point Protocol Working Group of the Internet Engineering Task Force (IETF), and are available from the Network Information Center. See the file **rfc-index** in the Morning Star PPP distribution directory for instructions on acquiring an up-to-date copy. Along with RFCs 1548 and 1332, Morning Star PPP version 1.4.1 implements the Link Quality Monitoring protocol defined in RFC 1333[3], and with the Challenge Handshake Authentication Protocol (CHAP) and the Password Authentication Protocol (PAP) defined in RFC 1334[4]. Morning Star PPP does not perform 32-bit FCS negotiation.

TCP header compression is described in RFC 1144[5], and reduces the

[1] Simpson, W., 'The Point-to-Point Protocol (PPP)', RFC 1548, Computer Systems Consulting Services, December 1993.

[2] McGregor, G., 'The PPP Internet Protocol Control Protocol (IPCP)', RFC 1332, Merit, May 1992.

[3] Simpson, W., 'PPP Link Quality Monitoring', RFC 1333, Computer Systems Consulting Services, May 1992.

[4] Lloyd, B. and Simpson, W, 'PPP Authentication Protocols', RFC 1334, October 1992.

[5] Jacobson, V., 'Compressing TCP/IP Headers for Low-Speed Serial Links',

User Guide: Organization

- A description of the changes that have occurred with each release of Morning Star PPP
- An index of important points in the rest of the document

1.3. Related Manuals

The Morning Star PPP daemon is described in detail in the UNIX-style manual page **pppd**(8). Its configuration files are described in **ppp.Auth**(5), **ppp.Devices**(5), **ppp.Dialers**(5), **ppp.Filter**(5), **ppp.Keys**(5), and **ppp.Systems**(5). The IP tunnel driver (*pppd*'s interface to the host's IP network stack) is described in **tun**(4).

Hardware installation, when necessary, is described in the *Hardware Installation Guide* for the specific communications interface hardware. (Not all Morning Star PPP installations require additional hardware, so if you are using a serial port-only product, you won't have received a copy of any *Hardware Installation Guide*.)

Last minute hints and installation instructions pertinent to the architecture of your machine can be found in the file **ppp/README** that's delivered as part of the software distribution.

The authoritative references on TCP/IP and the Point-to-Point Protocol are the Internet Requests for Comments series, particularly RFCs 1548[1] and 1332[2]. These are occasionally updated by the Point-to-Point Protocol Working Group of the Internet Engineering Task Force (IETF), and are available from the Network Information Center. See the file **rfc-index** in the Morning Star PPP distribution directory for instructions on acquiring an up-to-date copy. Along with RFCs 1548 and 1332, Morning Star PPP version 1.4.1 implements the Link Quality Monitoring protocol defined in RFC 1333[3], and with the Challenge Handshake Authentication Protocol (CHAP) and the Password Authentication Protocol (PAP) defined in RFC 1334[4]. Morning Star PPP does not perform 32-bit FCS negotiation.

TCP header compression is described in RFC 1144[5], and reduces the

[1] Simpson, W., 'The Point-to-Point Protocol (PPP)', RFC 1548, Computer Systems Consulting Services, December 1993.

[2] McGregor, G., 'The PPP Internet Protocol Control Protocol (IPCP)', RFC 1332, Merit, May 1992.

[3] Simpson, W., 'PPP Link Quality Monitoring', RFC 1333, Computer Systems Consulting Services, May 1992.

[4] Lloyd, B. and Simpson, W, 'PPP Authentication Protocols', RFC 1334, October 1992.

[5] Jacobson, V., 'Compressing TCP/IP Headers for Low-Speed Serial Links',

3

number of protocol overhead bytes required for typical packets in a TCP data connection, to improve interactive responsiveness.

Fast queuing for interactive TCP packets is (so far) best described by its implementation in Van Jacobson's header-compressed SLIP[6].

The Serial Line Internet Protocol is described in RFC 1055[7].

If you do not have access to these documents, please contact Morning Star Technologies as described below to request a copy.

2. Installation

First, we'll overview a general installation checklist, and discuss system-specific details.

Then, we'll go through the steps necessary to configure a simple but illustrative installation. Our system, a SPARCstation named *robin* and running SunOS 4.1.*, has a Telebit T1600 asynchronous dialup modem on its **/dev/ttya**, which it uses for its on-demand connection to *lark*. It is also connected to a similar machine, *sparrow*, via a short null-modem cable on its **/dev/ttyb**, which it uses for a connection that is constantly active.

2.1. Installation Checklist

Here are the general steps in the installation process:

- Unpack the distribution (electronic or physical media) into a directory *other than* $PPPHOME
- Read the enclosed README
- Acquire a license key from Morning Star Tech Support
- Run an installation script
- Copy the example configuration files to create working files
- Edit the working configuration files to customize them to your environment
- Start an instance of the PPP daemon to test outbound connections
- Answer a few incoming calls to test inbound connections

RFC 1144, Lawrence Berkeley Laboratory, February 1990.

[6] Jacobson, V., ftp.ee.lbl.gov:cslip-2.7.tar.Z, if_sl.c, UTSL.

[7] Romkey, J., 'A Nonstandard for Transmission of IP Datagrams Over Serial Lines: SLIP', RFC 1055, The Asylum, June 1988.

Morning Star PPP version 1.4.1

number of protocol overhead bytes required for typical packets in a TCP data connection, to improve interactive responsiveness.

Fast queuing for interactive TCP packets is (so far) best described by its implementation in Van Jacobson's header-compressed SLIP[6].

The Serial Line Internet Protocol is described in RFC 1055[7].

If you do not have access to these documents, please contact Morning Star Technologies as described below to request a copy.

2. Installation

First, we'll overview a general installation checklist, and discuss system-specific details.

Then, we'll go through the steps necessary to configure a simple but illustrative installation. Our system, a SPARCstation named *robin* and running SunOS 4.1.*, has a Telebit T1600 asynchronous dialup modem on its **/dev/ttya**, which it uses for its on-demand connection to *lark*. It is also connected to a similar machine, *sparrow*, via a short null-modem cable on its **/dev/ttyb**, which it uses for a connection that is constantly active.

2.1. Installation Checklist

Here are the general steps in the installation process:

- Unpack the distribution (electronic or physical media) into a directory *other than* $PPPHOME
- Read the enclosed README
- Acquire a license key from Morning Star Tech Support
- Run an installation script
- Copy the example configuration files to create working files
- Edit the working configuration files to customize them to your environment
- Start an instance of the PPP daemon to test outbound connections
- Answer a few incoming calls to test inbound connections

RFC 1144, Lawrence Berkeley Laboratory, February 1990.

[6] Jacobson, V., ftp.ee.lbl.gov:cslip-2.7.tar.Z, if_sl.c, UTSL.

[7] Romkey, J., 'A Nonstandard for Transmission of IP Datagrams Over Serial Lines: SLIP', RFC 1055, The Asylum, June 1988.

4

2.2. System-Specific Details

First, read the file named **README** that came with the software distribution for your system. The configuration files used by Morning Star PPP are identical in name and format, regardless of the underlying operating system. But those configuration files are located in different places on different operating systems, and the debugging log file is written to a different place, too. Also, the license key is constructed from different information on each type of system.

Here's where to find the PPP daemon itself, and the various files that support the operation of the daemon, on each type of system supported by Morning Star PPP. You'll also find a listing of the specific information needed to construct a license key on each type of system.

System-Specific Information

Hardware	OS	pppd	$PPPHOME	pppd.log	key
SPARC	SunOS 4.1.*	/usr/etc	/etc/ppp	/usr/adm	showrev
SPARC	Solaris 2.*	/etc	/usr/lib/ppp	/var/adm	showrev
Sun-3	SunOS 4.1.1	/usr/etc	/etc/ppp	/usr/adm	showrev
DECstation	Ultrix 4.[23]	/usr/etc	/etc/ppp	/usr/adm	hostname
NeXT	NeXTStep 3.2	/usr/etc	/etc/ppp	/usr/adm	hostname hostid
SGI	IRIX 4.0	/usr/etc	/usr/etc/ppp	/usr/adm	hostname sysinfo
RS/6000	AIX 3.2.5	/usr/etc	/etc/ppp	/usr/adm	hostname uname -m
HP 9000/[78]00	HP-UX 9.0	/usr/etc	/etc/ppp	/usr/adm	hostname uname -a
x86	Solaris 2.1	/etc	/usr/lib/ppp	/var/adm	showrev
x86	NeXTStep 3.2	/usr/etc	/etc/ppp	/usr/adm	hostname
x86	SCO UNIX 3.2v2.0	/etc	/usr/lib/ppp	/usr/adm	hostname uname -X
x86	ISC 3.2v3.0	/etc	/usr/lib/ppp	/usr/adm	hostname
x86	BSDI 1.1	/usr/sbin	/etc/ppp	/var/log	hostname
x86	SCO Xenix 2.3.4	/etc	/usr/lib/ppp	/usr/adm	hostname
x86	Univel 1.1	/etc	/usr/lib/ppp	/usr/adm	uname -X

User Guide: Installation

2.2. System-Specific Details

First, read the file named **README** that came with the software distribution for your system. The configuration files used by Morning Star PPP are identical in name and format, regardless of the underlying operating system. But those configuration files are located in different places on different operating systems, and the debugging log file is written to a different place, too. Also, the license key is constructed from different information on each type of system.

Here's where to find the PPP daemon itself, and the various files that support the operation of the daemon, on each type of system supported by Morning Star PPP. You'll also find a listing of the specific information needed to construct a license key on each type of system.

System-Specific Information

Hardware	OS	pppd	$PPPHOME	pppd.log	key
SPARC	SunOS 4.1.*	/usr/etc	/etc/ppp	/usr/adm	showrev
SPARC	Solaris 2.*	/etc	/usr/lib/ppp	/var/adm	showrev
Sun-3	SunOS 4.1.1	/usr/etc	/etc/ppp	/usr/adm	showrev
DECstation	Ultrix 4.[23]	/usr/etc	/etc/ppp	/usr/adm	hostname
NeXT	NeXTStep 3.2	/usr/etc	/etc/ppp	/usr/adm	hostname hostid
SGI	IRIX 4.0	/usr/etc	/usr/etc/ppp	/usr/adm	hostname sysinfo
RS/6000	AIX 3.2.5	/usr/etc	/etc/ppp	/usr/adm	hostname uname -m
HP 9000/[78]00	HP-UX 9.0	/usr/etc	/etc/ppp	/usr/adm	hostname uname -a
x86	Solaris 2.1	/etc	/usr/lib/ppp	/var/adm	showrev
x86	NeXTStep 3.2	/usr/etc	/etc/ppp	/usr/adm	hostname
x86	SCO UNIX 3.2v2.0	/etc	/usr/lib/ppp	/usr/adm	hostname uname -X
x86	ISC 3.2v3.0	/etc	/usr/lib/ppp	/usr/adm	hostname
x86	BSDI 1.1	/usr/sbin	/etc/ppp	/var/log	hostname
x86	SCO Xenix 2.3.4	/etc	/usr/lib/ppp	/usr/adm	hostname
x86	Univel 1.1	/etc	/usr/lib/ppp	/usr/adm	uname -X

To acquire a license key to run MST PPP on your system, send the output of the command indicated in the "key information" column above to the MST Tech Support group, and we'll return a key. If you're using MST PPP on a demonstration basis, the key will allow MST PPP to run on your system for 30 days from the date the key is created. When you send us an order for the software, we'll send a 45 day key. When the invoice is paid, we'll issue a permanent key that will let this major version (v1.4.*) of our software run on your system forever.

Send the key information via electronic mail to

```
Keys@MorningStar.Com
```

or by FAX to +1 614 459 5054.

2.3. Unpacking the distribution

2.3.1. Electronic distribution

If you received the software distribution via FTP or UUCP, it is a *compress*(1)ed *tar*(1) archive. Create a working directory (it doesn't matter where, just be sure it's *not* the place that will eventually become $PPPHOME) and unpack it:

```
% ls mst*
mst-machinetype-ppp.tar.Z
% mkdir /usr/local/src/ppp
% cp mst* /usr/local/src/ppp
% cd /usr/local/src
% zcat ppp/mst-machinetype-ppp.tar.Z | tar xvf -
...lots of output...
% lpr ppp/LICENSE-AGREEMENT ppp/README
%
```

2.3.2. Magnetic media distribution

If you received the software on magnetic media, it is a *tar*(1) archive, and likely compressed. Follow the instructions on the label to unpack it. For example, if you are installing SPARC software from a floppy drive:

```
% cd /usr/local/src
% zcat < /dev/rfd0 | tar xvf -
...lots of output...
% lpr ppp/LICENSE-AGREEMENT ppp/README
%
```


Morning Star PPP version 1.4.1

To acquire a license key to run MST PPP on your system, send the output of the command indicated in the "key information" column above to the MST Tech Support group, and we'll return a key. If you're using MST PPP on a demonstration basis, the key will allow MST PPP to run on your system for 30 days from the date the key is created. When you send us an order for the software, we'll send a 45 day key. When the invoice is paid, we'll issue a permanent key that will let this major version (v1.4.*) of our software run on your system forever.

Send the key information via electronic mail to

```
Keys@MorningStar.Com
```

or by FAX to +1 614 459 5054.

2.3. Unpacking the distribution

2.3.1. Electronic distribution

If you received the software distribution via FTP or UUCP, it is a *compress*(1)ed *tar*(1) archive. Create a working directory (it doesn't matter where, just be sure it's *not* the place that will eventually become $PPPHOME) and unpack it:

```
% ls mst*
mst-machinetype-ppp.tar.Z
% mkdir /usr/local/src/ppp
% cp mst* /usr/local/src/ppp
% cd /usr/local/src
% zcat ppp/mst-machinetype-ppp.tar.Z | tar xvf -
...lots of output...
% lpr ppp/LICENSE-AGREEMENT ppp/README
%
```

2.3.2. Magnetic media distribution

If you received the software on magnetic media, it is a *tar*(1) archive, and likely compressed. Follow the instructions on the label to unpack it. For example, if you are installing SPARC software from a floppy drive:

```
% cd /usr/local/src
% zcat < /dev/rfd0 | tar xvf -
...lots of output...
% lpr ppp/LICENSE-AGREEMENT ppp/README
%
```

2.4. Installing the software and documentation

First, read the file named **README** that came with the software distribution.

If you're on a SPARC system running SunOS 4.1.*, use the shell script examples/Quick-Install.sparc for your first installation. It will ask you for the information necessary to connect a standalone system to a larger network - a single outbound connection. Even if your configuration is more complex than this, the configuration provided by the Quick-Install.sparc script is a very good starting point.

If you're not on a SPARC system running SunOS 4.1.*, or if you prefer to perform the installation tasks by hand, keep reading...

Become the superuser:

```
% su
Password: (enter your root password here)
#
```

Next, create a new group in **/etc/group** or in the *group.byname* map if you use Sun's NIS. Choose a unique ID number for the group, call it *ppp*, and use it later for each dial-in PPP user login added to **/etc/passwd**. The group entry for our example looks like this:

```
ppp:*:42:
```

Run the installation shell script:

```
# cd /usr/local/src/ppp
# ./Install
...lots of output...
#
```

The *Install* script will ask you to confirm that you have read and understood the terms of the License Agreement before it proceeds. If necessary, the *Install* script will ask you questions about your system. It will install the **pppd** daemon in the directory described above (suid root, only executable by group *ppp*) and put the manual pages into the appropriate subdirectories of /usr/man. It will create a shell script named **/etc/ppp.uninstall**, to be used in case you need to remove the software from your system. Upon successful conclusion of the *Install* script you will be able to continue with building and installing a custom kernel (if necessary) to support PPP.

User Guide: Installation

2.4. Installing the software and documentation

First, read the file named **README** that came with the software distribution.

If you're on a SPARC system running SunOS 4.1.*, use the shell script examples/Quick-Install.sparc for your first installation. It will ask you for the information necessary to connect a standalone system to a larger network - a single outbound connection. Even if your configuration is more complex than this, the configuration provided by the Quick-Install.sparc script is a very good starting point.

If you're not on a SPARC system running SunOS 4.1.*, or if you prefer to perform the installation tasks by hand, keep reading...

Become the superuser:

```
% su
Password: (enter your root password here)
#
```

Next, create a new group in **/etc/group** or in the *group.byname* map if you use Sun's NIS. Choose a unique ID number for the group, call it *ppp*, and use it later for each dial-in PPP user login added to **/etc/passwd**. The group entry for our example looks like this:

```
ppp:*:42:
```

Run the installation shell script:

```
# cd /usr/local/src/ppp
# ./Install
...lots of output...
#
```

The *Install* script will ask you to confirm that you have read and understood the terms of the License Agreement before it proceeds. If necessary, the *Install* script will ask you questions about your system. It will install the **pppd** daemon in the directory described above (suid root, only executable by group *ppp*) and put the manual pages into the appropriate subdirectories of /usr/man. It will create a shell script named **/etc/ppp.uninstall**, to be used in case you need to remove the software from your system. Upon successful conclusion of the *Install* script you will be able to continue with building and installing a custom kernel (if necessary) to support PPP.

2.5. Building and installing a kernel

The contents of the file **/usr/local/src/ppp/README** will describe how to configure and build a new kernel, move it into place, and reboot your system to ensure that it runs correctly. If your system supports dynamically loadable device drivers, you may or may not need to reboot for those drivers to become available.

The **README** file also describes how to configure the asynchronous terminal interfaces on your machine, if any special arrangements are necessary, and how to configure PPP to use the *SnapLink* interface.

2.6. Installing an updated version

New versions of Morning Star PPP will usually work with the same configuration files as were used by earlier versions, though perhaps their names and locations have been changed. Prior to version 1.2, the configuration files had names like /etc/ppp.systems; since version 1.2 they have had names like $PPPHOME/Systems where the PPPHOME environment variable tells *pppd* where to look for its configuration files. **/etc/ppp.uninstall** will not remove any old configuration files, so any passwords or other information they contained will not be lost. You should examine the new example configuration files, because they may contain useful information. In particular, many new modems have been added to Dialers, and the previously-supported modems' descriptions have been improved.

A new version of *pppd* may require a new version of the tunnel driver, which is placed into the correct location by the normal installation process. In particular, the tunnel driver distributed with version 1.1 will not work with the PPP daemon from version 1.2 or later. On SPARC systems, you'll probably want to begin using the dynamically loadable version of the tunnel driver. NeXT systems only support loadable device drivers, so the kernel never needs to be rebuilt. If you were running version 1.1, you must either (a) remove the 'tun' lines from /sys/sun/conf.c and /sys/conf.common/files.cmn, build a new kernel without the tunnel driver installed, and use the loadable driver instead (only available on SPARC), or (b) build a new kernel containing the new version of the tunnel driver.

2.7. Arranging for PPP connections

The tunnel driver must be installed in the kernel of every host that will use PPP, and minor devices (subdevices) configured for each simultaneous link that will be in operation. To make configuration easier, 'pseudo-device tun'

Morning Star PPP version 1.4.1

2.5. Building and installing a kernel

The contents of the file /usr/local/src/ppp/README will describe how to configure and build a new kernel, move it into place, and reboot your system to ensure that it runs correctly. If your system supports dynamically loadable device drivers, you may or may not need to reboot for those drivers to become available.

The README file also describes how to configure the asynchronous terminal interfaces on your machine, if any special arrangements are necessary, and how to configure PPP to use the SnapLink interface.

2.6. Installing an updated version

New versions of Morning Star PPP will usually work with the same configuration files as were used by earlier versions, though perhaps their names and locations have been changed. Prior to version 1.2, the configuration files had names like /etc/ppp.systems; since version 1.2 they have had names like $PPPHOME/Systems where the PPPHOME environment variable tells pppd where to look for its configuration files. /etc/ppp.uninstall will not remove any old configuration files, so any passwords or other information they contained will not be lost. You should examine the new example configuration files, because they may contain useful information. In particular, many new modems have been added to Dialers, and the previously-supported modems' descriptions have been improved.

A new version of pppd may require a new version of the tunnel driver, which is placed into the correct location by the normal installation process. In particular, the tunnel driver distributed with version 1.1 will not work with the PPP daemon from version 1.2 or later. On SPARC systems, you'll probably want to begin using the dynamically loadable version of the tunnel driver. NeXT systems only support loadable device drivers, so the kernel never needs to be rebuilt. If you were running version 1.1, you must either (a) remove the 'tun' lines from /sys/sun/conf.c and /sys/conf.common/files.cmn, build a new kernel without the tunnel driver installed, and use the loadable driver instead (only available on SPARC), or (b) build a new kernel containing the new version of the tunnel driver.

2.7. Arranging for PPP connections

The tunnel driver must be installed in the kernel of every host that will use PPP, and minor devices (subdevices) configured for each simultaneous link that will be in operation. To make configuration easier, 'pseudo-device tun'

8

in Berkeley-style kernel configuration files is the same as saying 'pseudo-device tun16'. This will allow your configuration to expand to as many as sixteen neighbors before having to rebuild the kernel with a larger specification like 'pseudo-device tun17'. (The static kernel memory allocated per minor device is under 200 bytes.)

The number of PPP neighbors a system can have is independent of the number of serial ports from which it's accessible, though it is constrained to that many *simultaneous* connections. Outbound PPP links (initiated by this system) are configured independently of inbound PPP links (initiated by a neighbor system). If a link might be initiated upon demand in either direction, then each system must arrange for both an outbound and an inbound connection, as described in the following sections. Inbound connections may come via the system's native serial ports, bus-based expansion ports, SnapLink ports, or a terminal server.

2.7.1. Arranging for outbound PPP connections

Whenever *robin* is booted, one PPP daemon must be started for each outbound link it will establish. In this case, since *robin* will call *lark* on demand, we add the following lines to the appropriate spot in *robin*'s boot-time shell script (**/etc/rc.local** on the example machine):[8]

```
if [ -f /etc/ppp/Startup ]; then
     /etc/ppp/Startup
fi
```

You should start the outbound PPP and SLIP daemons at about the same place in **/etc/rc.local** where other IP interfaces are or would be configured, before any routes are added that would pass over the PPP or SLIP link, and before any other daemons (e.g. **in.named**) are started that require access to hosts across the PPP or SLIP link.

We then make the **$PPPHOME/Startup** script look like this:[9]

```
#!/bin/sh

PATH=/usr/etc:/etc:/usr/bin:/bin

if [ -f /usr/adm/pppd.log ]; then
        mv /usr/adm/pppd.log /usr/adm/OLDpppd.log
fi

echo -n "Starting PPP daemons:"       >/dev/console
```

[8] These lines can be copied from $PPPHOME/rc.local.ex.

[9] An example can be found in $PPPHOME/Startup.ex.

User Guide: Installation

in Berkeley-style kernel configuration files is the same as saying 'pseudo-device tun16'. This will allow your configuration to expand to as many as sixteen neighbors before having to rebuild the kernel with a larger specification like 'pseudo-device tun17'. (The static kernel memory allocated per minor device is under 200 bytes.)

The number of PPP neighbors a system can have is independent of the number of serial ports from which it's accessible, though it is constrained to that many *simultaneous* connections. Outbound PPP links (initiated by this system) are configured independently of inbound PPP links (initiated by a neighbor system). If a link might be initiated upon demand in either direction, then each system must arrange for both an outbound and an inbound connection, as described in the following sections. Inbound connections may come via the system's native serial ports, bus-based expansion ports, SnapLink ports, or a terminal server.

2.7.1. Arranging for outbound PPP connections

Whenever *robin* is booted, one PPP daemon must be started for each outbound link it will establish. In this case, since *robin* will call *lark* on demand, we add the following lines to the appropriate spot in *robin*'s boot-time shell script (**/etc/rc.local** on the example machine):[8]

```
if [ -f /etc/ppp/Startup ]; then
     /etc/ppp/Startup
fi
```

You should start the outbound PPP and SLIP daemons at about the same place in **/etc/rc.local** where other IP interfaces are or would be configured, before any routes are added that would pass over the PPP or SLIP link, and before any other daemons (e.g. **in.named**) are started that require access to hosts across the PPP or SLIP link.

We then make the **$PPPHOME/Startup** script look like this:[9]

```
#!/bin/sh

PATH=/usr/etc:/etc:/usr/bin:/bin

if [ -f /usr/adm/pppd.log ]; then
        mv /usr/adm/pppd.log /usr/adm/OLDpppd.log
fi

echo -n "Starting PPP daemons:"       >/dev/console
```

[8] These lines can be copied from $PPPHOME/rc.local.ex.

[9] An example can be found in $PPPHOME/Startup.ex.

```
pppd robin:sparrow auto dedicated
        (echo -n ' sparrow')          >/dev/console
pppd robin:lark auto idle 150 passive
        (echo -n ' lark')             >/dev/console

echo '.'                              >/dev/console
```

The daemons started here will search the first entry of each line in the **Systems** file to find entries for their destinations (the IP address or hostname to the right of the colon). The *device* field in the selected **Systems** line provides an index to an entry in **Devices**. The *dialer* field on the selected line in **Devices** provides an index into **Dialers**. (The configuration file names and functional divisions were chosen to closely mimic their counterparts used for establishing UUCP connections.)

See **Creating the PPP configuration files** below for more discussion and examples.

Notice the use of the *passive* option on the above *pppd* command lines. This tells *pppd* to not start speaking PPP until the other side speaks first. This allows for shorter PPP negotiation times, and is sometimes used on outbound daemons (when *pppd* runs in *auto* mode). At least one end has to speak first, so don't run both ends of the circuit in *passive* mode. Everything will work correctly if you run both ends of the circuit in *active* mode, which is the default behavior if you don't specify *passive*.

2.7.2. Arranging for inbound PPP connections

On machines which will accept only incoming calls no *pppd*s need to be started at boot time, since those *pppd*s will be started when the PPP logins occur. Machines that both initiate and receive calls must start *pppd* at boot time, and must also prepare accounts for incoming connections. In our example, user accounts must be created on both *lark* and *sparrow* for *robin* to be able to login and initiate PPP connections to them. In this case, since we expect *robin* to dial them on demand, we add an entry (using vipw or our favorite editor) to both *lark*'s and *sparrow*'s **/etc/passwd** files:

```
Probin::105:42:Robin's PPP login:/etc/ppp:/etc/ppp/Login

# passwd Probin
New password: some password
Retype new password: some password
#
```

The '105' in the password entry is a unique uid for this PPP login, and the '42' is the gid corresponding to the 'ppp' group in **/etc/group**. The login

Morning Star PPP version 1.4.1

pppd robin:sparrow auto dedicated
        (echo -n ' sparrow')   >/dev/console
pppd robin:lark auto idle 150 passive
        (echo -n ' lark')   >/dev/console

echo '.'   >/dev/console

The daemons started here will search the first entry of each line in the **Systems** file to find entries for their destinations (the IP address or hostname to the right of the colon). The *device* field in the selected **Systems** line provides an index to an entry in **Devices**. The *dialer* field on the selected line in **Devices** provides an index into **Dialers**. (The configuration file names and functional divisions were chosen to closely mimic their counterparts used for establishing UUCP connections.)

See **Creating the PPP configuration files** below for more discussion and examples.

Notice the use of the *passive* option on the above *pppd* command lines. This tells *pppd* to not start speaking PPP until the other side speaks first. This allows for shorter PPP negotiation times, and is sometimes used on outbound daemons (when *pppd* runs in *auto* mode). At least one end has to speak first, so don't run both ends of the circuit in *passive* mode. Everything will work correctly if you run both ends of the circuit in *active* mode, which is the default behavior if you don't specify *passive*.

2.7.2. Arranging for inbound PPP connections

On machines which will accept only incoming calls no *pppd*s need to be started at boot time, since those *pppd*s will be started when the PPP logins occur. Machines that both initiate and receive calls must start *pppd* at boot time, and must also prepare accounts for incoming connections. In our example, user accounts must be created on both *lark* and *sparrow* for *robin* to be able to login and initiate PPP connections to them. In this case, since we expect *robin* to dial them on demand, we add an entry (using vipw or our favorite editor) to both *lark*'s and *sparrow*'s **/etc/passwd** files:

```
Probin::105:42:Robin's PPP login:/etc/ppp:/etc/ppp/Login

# passwd Probin
New password: some password
Retype new password: some password
#
```

The '105' in the password entry is a unique uid for this PPP login, and the '42' is the gid corresponding to the 'ppp' group in **/etc/group**. The login

shell, **$PPPHOME/Login**, is a shell script that looks like this:[10]

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
exec pppd `hostname`: idle 130 rtscts
```

Make sure it is executable:

```
# chmod 755 /etc/ppp/Login
#
```

The PPP user's login shell script can, of course, be located anywhere and can be named almost anything; we just use the above for purposes of illustration. On a NeXT workstation, the name of the user's login shell script may not contain the letter 'r', because of an undocumented feature that would cause **/bin/sh** to consider itself to be a security-restricted shell. Also, the 'rtscts' option is unavailable for *pppd* running on NeXT systems; enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. The 'rtscts' option is unavailable on Silicon Graphics systems for similar reasons; use **/dev/ttyf2** for a modem with hardware flow control instead.

The PPP daemon should be mode 4750 (suid root and executable by members of its group but not by general users), and its group ownership should match that of the inbound PPP logins. In this example,

```
# chgrp ppp /usr/etc/pppd
# ls -lg /usr/etc/pppd
-rwsr-x---  1 root   ppp   338527 Oct 2 07:37 /usr/etc/pppd
#
```

In most cases, all (inbound) PPP logins can use the same generic Login script. If you want some specific host to start *pppd* with a special option (e.g. require authentication) then have that login account use a private login shell, for example, a **$PPPHOME/Login-***host* that looks something like this:

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
exec pppd `hostname`:robin idle 130 rtscts requireauth
```

And then:

[10] You can copy it from $PPPHOME/Login.ex.

User Guide: Installation

shell, **$PPPHOME/Login**, is a shell script that looks like this:[10]

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
exec pppd `hostname`: idle 130 rtscts
```

Make sure it is executable:

```
# chmod 755 /etc/ppp/Login
#
```

The PPP user's login shell script can, of course, be located anywhere and can be named almost anything; we just use the above for purposes of illustration. On a NeXT workstation, the name of the user's login shell script may not contain the letter 'r', because of an undocumented feature that would cause **/bin/sh** to consider itself to be a security-restricted shell. Also, the 'rtscts' option is unavailable for *pppd* running on NeXT systems; enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. The 'rtscts' option is unavailable on Silicon Graphics systems for similar reasons; use **/dev/ttyf2** for a modem with hardware flow control instead.

The PPP daemon should be mode 4750 (suid root and executable by members of its group but not by general users), and its group ownership should match that of the inbound PPP logins. In this example,

```
# chgrp ppp /usr/etc/pppd
# ls -lg /usr/etc/pppd
-rwsr-x---  1 root   ppp   338527 Oct 2 07:37 /usr/etc/pppd
#
```

In most cases, all (inbound) PPP logins can use the same generic Login script. If you want some specific host to start *pppd* with a special option (e.g. require authentication) then have that login account use a private login shell, for example, a **$PPPHOME/Login-***host* that looks something like this:

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
exec pppd `hostname`:robin idle 130 rtscts requireauth
```

And then:

[10] You can copy it from $PPPHOME/Login.ex.

11

```
# chmod 755 /etc/ppp/Login-robin
#
```

2.8. Creating the PPP configuration files

Now we can start building our configuration files. See **ppp.Auth**(5), **ppp.Devices**(5), **ppp.Dialers**(5), **ppp.Filter**(5), **ppp.Keys**(5), **ppp.Systems**(5), and **pppd**(8) for descriptions of all the configuration options, and see the **Examples/** subdirectory in the software distribution for some example configurations. (Each complete entry in **Dialers**, **Devices**, and **Systems** must be typed on a single line, except for the chat script fields, which can be continued on the next physical line by ending lines to be continued with a backslash '\' character.)

The **Systems**, **Devices**, and **Dialers** files are only used for placing on-demand calls (calls placed by a *pppd* started with the 'auto' option in response to a packet sent to its interface). The **Systems** file is scanned for entries matching the destination address supplied on *pppd*'s command line. If the matching entry's *device* field contains 'ACU'[11], the **Dialers** file is searched for an entry whose *speed* field matches the *speed* field of the selected entry in the **Systems** file. The **Dialers** file is then searched for an entry whose *dialer* name field matches the *dialer* name field of the selected entry in the **Devices** file. If the **Systems** file's *device* field is *not* 'ACU', then the **Devices** file is instead searched for an entry with 'Direct' in the *dialer* name field, and the **Dialers** file is not consulted.

The **Systems** file looks like this:

```
lark Any;50 ACU 38400 5551212 in:--in: Probin word: mypasswd
sparrow Any;50 cub 38400 0 "" \r ogin: Probin word: mypasswd
```

The **Devices** file (in **/etc/ppp**, or in **/usr/lib/ppp** on SCO systems) looks like this:

```
T1600    cua      38400     rtscts
Direct   cub      38400     rtscts
```

(The 'rtscts' option is unavailable on NeXT systems; use the device name cufa for outbound connections instead.) The **Dialers** file looks like this:[12]

```
T1600   ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
        ABORT RRING\r\n\r\nRRING\r\n\r\nRRING ABORT ERROR \
        TIMEOUT 5 "" AT OK-AT-OK ATS111=0DT\T TIMEOUT 30 CONNECT
```

[11] ACU is an acronym for Auto-Call Unit. Its use is retained for the comfort of nostalgic traditionalists.

[12] It is available, along with many others, in $PPPHOME/Dialers.ex.

Morning Star PPP version 1.4.1

chmod 755 /etc/ppp/Login-robin
#

2.8. Creating the PPP configuration files

Now we can start building our configuration files. See **ppp.Auth**(5), **ppp.Devices**(5), **ppp.Dialers**(5), **ppp.Filter**(5), **ppp.Keys**(5), **ppp.Systems**(5), and **pppd**(8) for descriptions of all the configuration options, and see the **Examples/** subdirectory in the software distribution for some example configurations. (Each complete entry in **Dialers**, **Devices**, and **Systems** must be typed on a single line, except for the chat script fields, which can be continued on the next physical line by ending lines to be continued with a backslash '\' character.)

The **Systems**, **Devices**, and **Dialers** files are only used for placing on-demand calls (calls placed by a *pppd* started with the 'auto' option in response to a packet sent to its interface). The **Systems** file is scanned for entries matching the destination address supplied on *pppd*'s command line. If the matching entry's *device* field contains 'ACU'[11], the **Dialers** file is searched for an entry whose *speed* field matches the *speed* field of the selected entry in the **Systems** file. The **Dialers** file is then searched for an entry whose *dialer* name field matches the *dialer* name field of the selected entry in the **Devices** file. If the **Systems** file's *device* field is *not* 'ACU', then the **Devices** file is instead searched for an entry with 'Direct' in the *dialer* name field, and the **Dialers** file is not consulted.

The **Systems** file looks like this:

lark Any;50 ACU 38400 5551212 in:--in: Probin word: mypasswd
sparrow Any;50 cub 38400 0 "" \r ogin: Probin word: mypasswd

The **Devices** file (in **/etc/ppp**, or in **/usr/lib/ppp** on SCO systems) looks like this:

T1600   cua   38400   rtscts
Direct   cub   38400   rtscts

(The 'rtscts' option is unavailable on NeXT systems; use the device name cufa for outbound connections instead.) The **Dialers** file looks like this:[12]

T1600   ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
        ABORT RRING\r\n\r\nRRING\r\n\r\nRRING ABORT ERROR \
        TIMEOUT 5 "" AT OK-AT-OK ATS111=0DT\T TIMEOUT 30 CONNECT

[11] ACU is an acronym for Auto-Call Unit. Its use is retained for the comfort of nostalgic traditionalists.

[12] It is available, along with many others, in $PPPHOME/Dialers.ex.

12

This elaborate dialer string will cause *pppd* to abort the connection attempt if any of several things go wrong with the telephone call, then will disable UUCP protocol spoofing in the modem before dialing the destination telephone number. Here is the **Filter** file:[13]

```
default bringup !ntp !3/icmp !who
        keepup  !send !ntp !3/icmp !who
        pass    !route
        log     !nntp tcp/syn/recv
```

This filter says to bring the connection up for any traffic except for Network Time Protocol packets, ICMP Network Unreachable messages, and packets from the *in.rwhod* daemon. After the link is up, the same packets will keep it alive, except for those we send. All packets will be passed except for RIP routing messages between *in.routed* daemons, and a message will be printed to the log file whenever an inbound TCP session is established, except for NNTP connections.

Last, set their file protections appropriately:

```
# chmod 644 Devices Dialers Filter
# chmod 600 Systems
# chown root Systems
#
```

In both **Systems** and **Devices**, *pppd* selects the first line that matches its search criteria. If the connection attempt fails while using the method described by that line, *pppd* will search for the next matching line. *Pppd* will report a failure only when all the criteria-matching lines have been tried and exhausted.

For example, suppose two lines in **Systems** differed only by their telephone number field:

```
lark Any;50 ACU 38400 5551212 in:--in: Probin word: mypasswd
lark Any;50 ACU 38400 5551213 in:--in: Probin word: mypasswd
```

Pppd would first try to connect by dialing the first number, then (if it receives a 'BUSY' from the modem) the second number. Or suppose that a host has two modems attached, of different brands, each of which can be used for outbound calls. They would be described in **Devices** like this:

```
T3000       cua      38400     rtscts
USRv32bis   cub      38400     rtscts
```

Pppd would try to call out through **/dev/cua**, but if it's busy (e.g. there's already an incoming UUCP connection on **/dev/ttya**), *pppd* will try **/dev/cub**

[13] Another example is available in $PPPHOME/Filter.ex.

User Guide: Installation

This elaborate dialer string will cause *pppd* to abort the connection attempt if any of several things go wrong with the telephone call, then will disable UUCP protocol spoofing in the modem before dialing the destination telephone number. Here is the **Filter** file:[13]

```
default bringup !ntp !3/icmp !who
        keepup  !send !ntp !3/icmp !who
        pass    !route
        log     !nntp tcp/syn/recv
```

This filter says to bring the connection up for any traffic except for Network Time Protocol packets, ICMP Network Unreachable messages, and packets from the *in.rwhod* daemon. After the link is up, the same packets will keep it alive, except for those we send. All packets will be passed except for RIP routing messages between *in.routed* daemons, and a message will be printed to the log file whenever an inbound TCP session is established, except for NNTP connections.

Last, set their file protections appropriately:

```
# chmod 644 Devices Dialers Filter
# chmod 600 Systems
# chown root Systems
#
```

In both **Systems** and **Devices**, *pppd* selects the first line that matches its search criteria. If the connection attempt fails while using the method described by that line, *pppd* will search for the next matching line. *Pppd* will report a failure only when all the criteria-matching lines have been tried and exhausted.

For example, suppose two lines in **Systems** differed only by their telephone number field:

```
lark Any;50 ACU 38400 5551212 in:--in: Probin word: mypasswd
lark Any;50 ACU 38400 5551213 in:--in: Probin word: mypasswd
```

Pppd would first try to connect by dialing the first number, then (if it receives a 'BUSY' from the modem) the second number. Or suppose that a host has two modems attached, of different brands, each of which can be used for outbound calls. They would be described in **Devices** like this:

```
T3000       cua      38400     rtscts
USRv32bis   cub      38400     rtscts
```

Pppd would try to call out through **/dev/cua**, but if it's busy (e.g. there's already an incoming UUCP connection on **/dev/ttya**), *pppd* will try **/dev/cub**

[13] Another example is available in $PPPHOME/Filter.ex.

instead.

2.9. Testing the installation

Our PPP configuration is now complete, so we can go ahead and start it up for testing:

```
# pppd robin:lark auto passive
#
```

then make sure it got started:

```
# tail -f /usr/adm/pppd.log &
8/4-14:14:43-14902 Morning Star Technologies PPP
8/4-14:14:43-14902 Version 1.4 Beta [1-Aug-1992 21:59:58 sparc]
8/4-14:14:43-14902 du0: pppd robin:lark auto passive
```

then use *telnet* to bring up the link, but then type ^D to exit the login:

```
# telnet lark
Trying lark ...   (26-second pause while robin dials the phone,
                   the modems establish a carrier, the Systems chat script
                   completes, and an answering pppd is started on lark)
Connected to lark.
Escape character is '^]'.

SunOS 4.1 UNIX (lark) (ttyp3)

lark login: ^DConnection closed by foreign host.
#
```

Notice how the log shows the link was initiated:

```
8/4-14:14:53-14902 tcp 137.175.2.11/1204 -> 131.187.1.131/telnet
                                                        40 syn bringup
8/4-14:14:54-14902 Dialing lark (cua/38400/5551212/T1600)
8/4-14:15:22-14902 PPP connected to 131.187.1.131
8/4-14:15:25-14902 tcp 137.175.2.2/smtp <- 129.221.8.2/947 40 syn
```

This log file snippet shows that our *telnet* session to *lark* was the cause for the link being initiated. It also shows that the 'log' line in **Filter** is operating as expected, and that the first incoming TCP connection delivered mail (by SMTP).

Morning Star PPP is installed, configured, running and connected on both ends of one of our links. When the link is up, users should be able to access *robin* from a remote machine via *rlogin*. You should also be able to *telnet*, *ftp*, etc. between the two. If either machine is connected to a local area network, you can set up IP routing on the two networks so that hosts on either can communicate with hosts on the other, using the machines on the ends of the PPP link as routers.

Morning Star PPP version 1.4.1

instead.

2.9. Testing the installation

Our PPP configuration is now complete, so we can go ahead and start it up for testing:

```
# pppd robin:lark auto passive
#
```

then make sure it got started:

```
# tail -f /usr/adm/pppd.log &
8/4-14:14:43-14902 Morning Star Technologies PPP
8/4-14:14:43-14902 Version 1.4 Beta [1-Aug-1992 21:59:58 sparc]
8/4-14:14:43-14902 du0: pppd robin:lark auto passive
```

then use *telnet* to bring up the link, but then type ^D to exit the login:

```
# telnet lark
Trying lark ...   (26-second pause while robin dials the phone,
                   the modems establish a carrier, the Systems chat script
                   completes, and an answering pppd is started on lark)
Connected to lark.
Escape character is '^]'.

SunOS 4.1 UNIX (lark) (ttyp3)

lark login: ^DConnection closed by foreign host.
#
```

Notice how the log shows the link was initiated:

```
8/4-14:14:53-14902 tcp 137.175.2.11/1204 -> 131.187.1.131/telnet
                                                        40 syn bringup
8/4-14:14:54-14902 Dialing lark (cua/38400/5551212/T1600)
8/4-14:15:22-14902 PPP connected to 131.187.1.131
8/4-14:15:25-14902 tcp 137.175.2.2/smtp <- 129.221.8.2/947 40 syn
```

This log file snippet shows that our *telnet* session to *lark* was the cause for the link being initiated. It also shows that the 'log' line in **Filter** is operating as expected, and that the first incoming TCP connection delivered mail (by SMTP).

Morning Star PPP is installed, configured, running and connected on both ends of one of our links. When the link is up, users should be able to access *robin* from a remote machine via *rlogin*. You should also be able to *telnet*, *ftp*, etc. between the two. If either machine is connected to a local area network, you can set up IP routing on the two networks so that hosts on either can communicate with hosts on the other, using the machines on the ends of the PPP link as routers.

14

3. Special Link Management Issues

This section addresses how to manage *pppd*'s connections in situations other than on-demand dialups using the PPP protocol. We'll also discuss the finer points of configuring and using PPP to achieve the network results you need.

3.1. Active vs. Passive

Morning Star PPP can be used on either end of a connection, either as the calling system or as the answering system. *Pppd*'s default behavior is to immediately begin sending PPP messages as soon as the line is connected, anticipating that another PPP implementation will be waiting there, ready to start negotiating. When in *auto* mode, this will happen as soon as the **Systems** chat script completes. When not in *auto* mode, messages are sent immediately when the daemon starts.

This default behavior will work correctly in almost all situations. When calling another system with a dialup modem, however, it is sometimes better to let the answering end speak first, and there exist PPP implementations that get confused if they hear their peer speak first. In these situations, give *pppd* the *passive* option, and it will not try to start communicating until the other end does.

Most implementations (including Morning Star PPP) expect to actively initiate the negotiation process, but the negotiation may progress more slowly if both ends are active. If a system running such a PPP dials into a system running Morning Star PPP, the answering *pppd*'s default active behavior may result in a slight connection delay. In this case, it may be desirable for the Login script to invoke *pppd* with the *passive* option, although it would be preferable to configure the caller to be passive if possible.

3.2. The Idle Timer

The *idle* option may be used for both the calling and the answering invocation of *pppd*. Whichever end specifies the shorter interval will shut down the line first. But how should idle timer values be selected, and should they ever not be used?

When *pppd* is talking to a system running PPP software that does not implement on-demand auto-dialing, it should not take the link down and expect the sessions to stay intact, as they would if the other end were running Morning Star PPP. These systems include those running most free PPP implementations, plus MS-DOS PCs running FTP Software's PC/TCP (see below for configuration hints).

User Guide: Installation

3. Special Link Management Issues

This section addresses how to manage *pppd*'s connections in situations other than on-demand dialups using the PPP protocol. We'll also discuss the finer points of configuring and using PPP to achieve the network results you need.

3.1. Active vs. Passive

Morning Star PPP can be used on either end of a connection, either as the calling system or as the answering system. *Pppd*'s default behavior is to immediately begin sending PPP messages as soon as the line is connected, anticipating that another PPP implementation will be waiting there, ready to start negotiating. When in *auto* mode, this will happen as soon as the **Systems** chat script completes. When not in *auto* mode, messages are sent immediately when the daemon starts.

This default behavior will work correctly in almost all situations. When calling another system with a dialup modem, however, it is sometimes better to let the answering end speak first, and there exist PPP implementations that get confused if they hear their peer speak first. In these situations, give *pppd* the *passive* option, and it will not try to start communicating until the other end does.

Most implementations (including Morning Star PPP) expect to actively initiate the negotiation process, but the negotiation may progress more slowly if both ends are active. If a system running such a PPP dials into a system running Morning Star PPP, the answering *pppd*'s default active behavior may result in a slight connection delay. In this case, it may be desirable for the Login script to invoke *pppd* with the *passive* option, although it would be preferable to configure the caller to be passive if possible.

3.2. The Idle Timer

The *idle* option may be used for both the calling and the answering invocation of *pppd*. Whichever end specifies the shorter interval will shut down the line first. But how should idle timer values be selected, and should they ever not be used?

When *pppd* is talking to a system running PPP software that does not implement on-demand auto-dialing, it should not take the link down and expect the sessions to stay intact, as they would if the other end were running Morning Star PPP. These systems include those running most free PPP implementations, plus MS-DOS PCs running FTP Software's PC/TCP (see below for configuration hints).

Idle timer values should be selected based on the scarcity of resources and the cost of maintaining a connection. The calling system should set a relatively brief idle timeout if the connection carries a monetary cost per minute – e.g., a long-distance telephone call. On the other hand, if the telephone billing scheme is based on the number of calls rather than their duration, the calling system would probably prefer to use a longer idle timer, or none at all.

The answering system should set a relatively brief timeout if it can accommodate a limited number of incoming connections because of e.g. too few modems to service all the incoming requests. The answering system might also use a shorter idle-timeout value if it were acting as a hub and providing its services via a toll-free WATS (800) number. On the other hand, if it were providing its services via a 976 or 900 number scheme, it may not want to specify any timeout interval at all, since each unit of the calling system's connect time would put funds in the answering system's pocket.

3.3. The *exec* option

The *exec* option provides a way to trigger an action when a link is established, and a different action when the link is taken down. It can be used on either the calling or answering end of the link, and the specified command is executed immediately after the link is either established or hung up. The command or shell script specified as the argument to *exec* is invoked with either 'up' or 'down' as its first argument, depending upon whether the link has just been established or just been hung up, respectively. The second argument is the IP address of the peer, and the arguments with which *pppd* was invoked are provided to the *exec*ed command as its third and subsequent arguments.

Suppose your Login shell script looks like

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin
# default config file location for BSD-like UNIXen (SunOS, etc.)
PPPHOME=/etc/ppp
# default config file location for SysV-386-style UNIXen (SCO, ISC, etc.)
#PPPHOME=/usr/lib/ppp
export PPPHOME

mesg n
stty -tostop
exec pppd `hostname`: idle 130 rtscts exec $PPPHOME/Exec
```

$PPPHOME/Exec could be an executable shell script that looks like

```
#!/bin/sh
```


Morning Star PPP version 1.4.1

Idle timer values should be selected based on the scarcity of resources and the cost of maintaining a connection. The calling system should set a relatively brief idle timeout if the connection carries a monetary cost per minute – e.g., a long-distance telephone call. On the other hand, if the telephone billing scheme is based on the number of calls rather than their duration, the calling system would probably prefer to use a longer idle timer, or none at all.

The answering system should set a relatively brief timeout if it can accommodate a limited number of incoming connections because of e.g. too few modems to service all the incoming requests. The answering system might also use a shorter idle-timeout value if it were acting as a hub and providing its services via a toll-free WATS (800) number. On the other hand, if it were providing its services via a 976 or 900 number scheme, it may not want to specify any timeout interval at all, since each unit of the calling system's connect time would put funds in the answering system's pocket.

3.3. The *exec* option

The *exec* option provides a way to trigger an action when a link is established, and a different action when the link is taken down. It can be used on either the calling or answering end of the link, and the specified command is executed immediately after the link is either established or hung up. The command or shell script specified as the argument to *exec* is invoked with either 'up' or 'down' as its first argument, depending upon whether the link has just been established or just been hung up, respectively. The second argument is the IP address of the peer, and the arguments with which *pppd* was invoked are provided to the *exec*ed command as its third and subsequent arguments.

Suppose your Login shell script looks like

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin
# default config file location for BSD-like UNIXen (SunOS, etc.)
PPPHOME=/etc/ppp
# default config file location for SysV-386-style UNIXen (SCO, ISC, etc.)
#PPPHOME=/usr/lib/ppp
export PPPHOME

mesg n
stty -tostop
exec pppd `hostname`: idle 130 rtscts exec $PPPHOME/Exec
```

$PPPHOME/Exec could be an executable shell script that looks like

```
#!/bin/sh
```

16

```
case "$1" in
    up) echo link is up at `date` > /dev/console ;
        /usr/lib/sendmail -q < /dev/null ;;
  down) echo link is down at `date` > /dev/console ;;
esac
```

This will cause *sendmail* to run its queue whenever a remote system establishes a connection, possibly triggering a delivery to that system.

Since *pppd* runs **suid root**, anything specified in the Exec script will be run as root, and therefore presents a potential risk if mismanaged. Take appropriate security precautions with the Exec script, to ensure that it cannot be modified by non-**root** users.

3.4. SLIP framing rather than PPP

If you must establish a link with a peer host that is unable to use the Point-to-Point Protocol, Morning Star PPP is able to optionally use the non-standard but popular Serial Line Internet Protocol (SLIP). SLIP is really only a framing convention for arranging IP packets on a link, and it provides few of PPP's advanced facilities. By default, *pppd* running with the *slip* option does not use RFC 1144 'VJ' TCP header compression, although it will start sending VJ-compressed packets if it first receives VJ-compressed messages from its peer. Specifying *vjcomp* will cause *pppd* to always use header compression with the default 16 slots (useful for talking to 'CSLIP'), or header compression can be completely disabled with the *novjcomp* option. SLIP's default MRU and MTU (maximum receive unit and maximum transmission unit) are 1006. Automatic dialing, idle line hangup, packet filtering, the *exec* option, and most other management facilities are all available for use with SLIP.

When *pppd* is invoked with the *slip* option on its command line, it performs no LCP, PAP, CHAP, or IPCP negotiation. *Pppd* can provide no Link Quality Monitoring services when running with SLIP framing. SLIP does not support the Asynchronous Control Character Map feature or the *escape* option, and therefore can only be used over connections that are completely transparent to all 8-bit character values. You must either use hardware flow control (specify *rtscts* on most systems, or use **cufa** and **ttydfa** on NeXT systems) or no flow control at all. SLIP can be used only on asynchronous links that provide a clear 8-bit data path and don't interpret the passing data as flow control, and cannot be used with the HDLC[14] device driver or the SnapLink synchronous interface.

[14] available only for MC68040 NeXTstations, and SPARCstations running SunOS 4.1.* and Solaris 2.3

User Guide: Link Management


```
case "$1" in
    up) echo link is up at `date` > /dev/console ;
        /usr/lib/sendmail -q < /dev/null ;;
  down) echo link is down at `date` > /dev/console ;;
esac
```

This will cause *sendmail* to run its queue whenever a remote system establishes a connection, possibly triggering a delivery to that system.

Since *pppd* runs **suid root**, anything specified in the Exec script will be run as root, and therefore presents a potential risk if mismanaged. Take appropriate security precautions with the Exec script, to ensure that it cannot be modified by non-**root** users.

3.4. SLIP framing rather than PPP

If you must establish a link with a peer host that is unable to use the Point-to-Point Protocol, Morning Star PPP is able to optionally use the non-standard but popular Serial Line Internet Protocol (SLIP). SLIP is really only a framing convention for arranging IP packets on a link, and it provides few of PPP's advanced facilities. By default, *pppd* running with the *slip* option does not use RFC 1144 'VJ' TCP header compression, although it will start sending VJ-compressed packets if it first receives VJ-compressed messages from its peer. Specifying *vjcomp* will cause *pppd* to always use header compression with the default 16 slots (useful for talking to 'CSLIP'), or header compression can be completely disabled with the *novjcomp* option. SLIP's default MRU and MTU (maximum receive unit and maximum transmission unit) are 1006. Automatic dialing, idle line hangup, packet filtering, the *exec* option, and most other management facilities are all available for use with SLIP.

When *pppd* is invoked with the *slip* option on its command line, it performs no LCP, PAP, CHAP, or IPCP negotiation. *Pppd* can provide no Link Quality Monitoring services when running with SLIP framing. SLIP does not support the Asynchronous Control Character Map feature or the *escape* option, and therefore can only be used over connections that are completely transparent to all 8-bit character values. You must either use hardware flow control (specify *rtscts* on most systems, or use **cufa** and **ttydfa** on NeXT systems) or no flow control at all. SLIP can be used only on asynchronous links that provide a clear 8-bit data path and don't interpret the passing data as flow control, and cannot be used with the HDLC[14] device driver or the SnapLink synchronous interface.

[14] available only for MC68040 NeXTstations, and SPARCstations running SunOS 4.1.* and Solaris 2.3

You can use Morning Star PPP in its SLIP framing mode to dial into a terminal server made by cisco Systems. Since the SLIP protocol supports no option negotiations, cisco terminal servers print the incoming system's IP address in text on the serial line, before beginning the SLIP protocol. *Pppd* can parse this text by use of the '\A' token in the 'expect' phase of the Systems file chat script. The daemon will then assign the assigned address to the UNIX end of the point-to-point networking interface. See Systems.ex for an example use of this facility.

3.5. Synchronous PPP

Morning Star PPP can run in synchronous mode using the Morning Star SnapLink SCSI-attached high speed serial interface at line speeds up to T1 (1.544Mb/s). On Sun SPARCstations running SunOS 4.1.* or Solaris 2.3, it can run at up to 64Kb/s on the system's native serial ports, though speeds above 38400 are unpleasant without the SnapLink hardware because of the extreme I/O interrupt load. On 68040 NeXTstations running NeXTStep 2.1 or 2.2, it can run at up to 19200 bits per second; higher speeds will cause frequent framing errors. TCP user data will arrive undamaged, but line efficiency will decline as the line speed increases.

To prepare your UNIX system to use the SnapLink interface, follow the instructions in the SnapLink Hardware Installation Guide. If it's supported on your system, installation of the HDLC[15] device driver is discussed in the file **README** included with Morning Star PPP.

For Morning Star PPP to connect in synchronous mode at T1 speeds to another host or router using port 0 on a SnapLink that emulates SCSI disk device 2, use a **Systems** entry like this:

```
hostname Any;5 rsd2a/0 1536000
```

The **Devices** entry looks like this:

```
Direct  rsd2a/0 1536000
```

For Morning Star PPP to connect in synchronous mode at lower speeds to another host or router using port **ttya** on a SPARCstation running SunOS 4.1.*, use a **Systems** entry like this:

```
hostname Any;5 hdlc0 64000
```

The **Devices** entry looks like this:

[15] available only for MC68040 NeXTstations, and SPARCstations running SunOS 4.1.* and Solaris 2.3

Morning Star PPP version 1.4.1

You can use Morning Star PPP in its SLIP framing mode to dial into a terminal server made by cisco Systems. Since the SLIP protocol supports no option negotiations, cisco terminal servers print the incoming system's IP address in text on the serial line, before beginning the SLIP protocol. *Pppd* can parse this text by use of the '\A' token in the 'expect' phase of the Systems file chat script. The daemon will then assign the assigned address to the UNIX end of the point-to-point networking interface. See Systems.ex for an example use of this facility.

3.5. Synchronous PPP

Morning Star PPP can run in synchronous mode using the Morning Star SnapLink SCSI-attached high speed serial interface at line speeds up to T1 (1.544Mb/s). On Sun SPARCstations running SunOS 4.1.* or Solaris 2.3, it can run at up to 64Kb/s on the system's native serial ports, though speeds above 38400 are unpleasant without the SnapLink hardware because of the extreme I/O interrupt load. On 68040 NeXTstations running NeXTStep 2.1 or 2.2, it can run at up to 19200 bits per second; higher speeds will cause frequent framing errors. TCP user data will arrive undamaged, but line efficiency will decline as the line speed increases.

To prepare your UNIX system to use the SnapLink interface, follow the instructions in the SnapLink Hardware Installation Guide. If it's supported on your system, installation of the HDLC[15] device driver is discussed in the file **README** included with Morning Star PPP.

For Morning Star PPP to connect in synchronous mode at T1 speeds to another host or router using port 0 on a SnapLink that emulates SCSI disk device 2, use a **Systems** entry like this:

```
hostname Any;5 rsd2a/0 1536000
```

The **Devices** entry looks like this:

```
Direct  rsd2a/0 1536000
```

For Morning Star PPP to connect in synchronous mode at lower speeds to another host or router using port **ttya** on a SPARCstation running SunOS 4.1.*, use a **Systems** entry like this:

```
hostname Any;5 hdlc0 64000
```

The **Devices** entry looks like this:

[15] available only for MC68040 NeXTstations, and SPARCstations running SunOS 4.1.* and Solaris 2.3

18

```
Direct hdlc0 64000
```

You may want to provide automatic failover (to dialup facilities) for your synchronous or dedicated asynchronous connection, so that user services will continue even if the dedicated line becomes unavailable. Put a second entry in **Systems** referencing a dialup modem ('Any ACU 38400'), after the entry for the dedicated link. *Pppd* will by default ask the peer to send LCP Link-Quality-Report messages. If the dedicated line fails, *pppd* will stop receiving the reports, and will terminate the connection when enough reports have been lost to drive the measured link quality below the configured threshold (see the next section for an explanation of how to set the threshold and message interval). After unsuccessfully attempting to reestablish the connection on the same line, *pppd* will automatically fail over to the second entry, using the modem to dial up and reestablish IP traffic. Users will notice that the link is slower, but it will at least still be available. When the dedicated connection is restored, manually cause the dialup modem to hangup the line, and *pppd* will attempt to reconnect using the next entry in **Systems**, or wrap around to the first entry in the file, which describes the dedicated connection.

3.6. Link Quality Monitoring

Link Quality Monitoring is an optional facility defined within the PPP protocol specification, and provided by some PPP implementations, which allows PPP to make policy decisions based the observed quality of the link between peers.

LQM is particularly useful in the detection and appropriate response to total link failures, providing users with failover protection, as described in the section above. Most such total failures (e.g. a backhoe digging through the telephone company's cable) result in the communications equipment (CSU/DSU or modem) deasserting the Carrier Detect signal, which *pppd* observes as a hangup event. But some failure modes (e.g. misconfigured flow control, or over-reliance on in-band XON/XOFF flow control) can leave the modems connected while the PPP peers are unable to communicate. In this situation, the peers will observe a LQM failure and take appropriate action, usually a disconnection and redial.

Another use for LQM might be if an intercontinental telephone call is using a circuit of such poor quality that significant numbers of packets are being damaged in transit. The PPP implementations on each end can decide, based on LQM measurements, to hang up and redial in hopes of getting a better connection. This is a very rare occurrence if your modems provide

User Guide: Link Management

Direct hdlc0 64000

You may want to provide automatic failover (to dialup facilities) for your synchronous or dedicated asynchronous connection, so that user services will continue even if the dedicated line becomes unavailable. Put a second entry in **Systems** referencing a dialup modem ('Any ACU 38400'), after the entry for the dedicated link. *Pppd* will by default ask the peer to send LCP Link-Quality-Report messages. If the dedicated line fails, *pppd* will stop receiving the reports, and will terminate the connection when enough reports have been lost to drive the measured link quality below the configured threshold (see the next section for an explanation of how to set the threshold and message interval). After unsuccessfully attempting to reestablish the connection on the same line, *pppd* will automatically fail over to the second entry, using the modem to dial up and reestablish IP traffic. Users will notice that the link is slower, but it will at least still be available. When the dedicated connection is restored, manually cause the dialup modem to hangup the line, and *pppd* will attempt to reconnect using the next entry in **Systems**, or wrap around to the first entry in the file, which describes the dedicated connection.

3.6. Link Quality Monitoring

Link Quality Monitoring is an optional facility defined within the PPP protocol specification, and provided by some PPP implementations, which allows PPP to make policy decisions based the observed quality of the link between peers.

LQM is particularly useful in the detection and appropriate response to total link failures, providing users with failover protection, as described in the section above. Most such total failures (e.g. a backhoe digging through the telephone company's cable) result in the communications equipment (CSU/DSU or modem) deasserting the Carrier Detect signal, which *pppd* observes as a hangup event. But some failure modes (e.g. misconfigured flow control, or over-reliance on in-band XON/XOFF flow control) can leave the modems connected while the PPP peers are unable to communicate. In this situation, the peers will observe a LQM failure and take appropriate action, usually a disconnection and redial.

Another use for LQM might be if an intercontinental telephone call is using a circuit of such poor quality that significant numbers of packets are being damaged in transit. The PPP implementations on each end can decide, based on LQM measurements, to hang up and redial in hopes of getting a better connection. This is a very rare occurrence if your modems provide

V.42 or MNP4 error correction, but it does occasionally happen.

Whatever the cause, the disconnection and redial operation can happen without user intervention or application awareness, because even if PPP frames are damaged or lost, the upper protocol layers will arrange for retransmission as needed to provide the user with a complete data stream. The user will simply experience a pause while the modems reestablish the connection.

LQM works by asking the peer to send periodic status packets. *Pppd* will request that the peer send Link-Quality-Report packets as frequently as specified in the *lqrinterval* command line argument, or every ten seconds if *lqrinterval* is not specified. If the link goes down or is degraded, many or all LQR packets (along with user data packets) will be lost. *Pppd* counts the arriving LQRs, and if too many have been lost, *pppd* will close the connection. The *lqthreshold* argument specifies the minimum acceptable link quality, which defaults to requiring at least one LQR out of every five to successfully make it through. So (with the default value 1/5) unless at least one LQR has arrived from the peer in the past minute (counting timing slop), *pppd* will shut down the link.

The default LQM behavior is fairly permissive. If you want *pppd* to be more demanding about line quality, specify a higher value for *lqthreshold*. For example, to demand that no more than one LQR be dropped per minute, use 'lqthreshold 5/6'. This way, if two LQRs in a row are dropped, the line will be shut down. *Pppd* will discover line failures more quickly (at the expense of greater monitoring traffic) by decreasing the *lqrinterval*, but remember to also consider the *lqthreshold*. For example, you can demand that at least one LQR arrive per minute by specifying 'lqrinterval 5 lqthreshold 1/12', and you can demand that no more than one LQR be lost each minute by specifying 'lqrinterval 5 lqthreshold 11/12'.

If, during LCP option negotiation, the peer refuses to send Link-Quality-Reports, *pppd* will instead begin sending LCP Echo-Request messages at the requested *lqrinterval* and use the arriving LCP Echo-Response messages to make the link quality decision. If the peer doesn't correctly use a LCP Configure-Reject message to tell Morning Star PPP to switch to LCP Echo-Requests, MST PPP can be given either the *echolqm* argument, to dispense with the negotiation phase and begin directly with Echo-Requests, or the *nolqm* argument, to disable link quality monitoring completely.

At *pppd*'s debugging verbosity level 4, the log file will receive summary messages like this:

```
5/7-13:45:27-1514 LQM: Pkt: 1/1 Oct: 53/53 LQRs: 5/5
```


Morning Star PPP version 1.4.1

V.42 or MNP4 error correction, but it does occasionally happen.

Whatever the cause, the disconnection and redial operation can happen without user intervention or application awareness, because even if PPP frames are damaged or lost, the upper protocol layers will arrange for retransmission as needed to provide the user with a complete data stream. The user will simply experience a pause while the modems reestablish the connection.

LQM works by asking the peer to send periodic status packets. *Pppd* will request that the peer send Link-Quality-Report packets as frequently as specified in the *lqrinterval* command line argument, or every ten seconds if *lqrinterval* is not specified. If the link goes down or is degraded, many or all LQR packets (along with user data packets) will be lost. *Pppd* counts the arriving LQRs, and if too many have been lost, *pppd* will close the connection. The *lqthreshold* argument specifies the minimum acceptable link quality, which defaults to requiring at least one LQR out of every five to successfully make it through. So (with the default value 1/5) unless at least one LQR has arrived from the peer in the past minute (counting timing slop), *pppd* will shut down the link.

The default LQM behavior is fairly permissive. If you want *pppd* to be more demanding about line quality, specify a higher value for *lqthreshold*. For example, to demand that no more than one LQR be dropped per minute, use 'lqthreshold 5/6'. This way, if two LQRs in a row are dropped, the line will be shut down. *Pppd* will discover line failures more quickly (at the expense of greater monitoring traffic) by decreasing the *lqrinterval*, but remember to also consider the *lqthreshold*. For example, you can demand that at least one LQR arrive per minute by specifying 'lqrinterval 5 lqthreshold 1/12', and you can demand that no more than one LQR be lost each minute by specifying 'lqrinterval 5 lqthreshold 11/12'.

If, during LCP option negotiation, the peer refuses to send Link-Quality-Reports, *pppd* will instead begin sending LCP Echo-Request messages at the requested *lqrinterval* and use the arriving LCP Echo-Response messages to make the link quality decision. If the peer doesn't correctly use a LCP Configure-Reject message to tell Morning Star PPP to switch to LCP Echo-Requests, MST PPP can be given either the *echolqm* argument, to dispense with the negotiation phase and begin directly with Echo-Requests, or the *nolqm* argument, to disable link quality monitoring completely.

At *pppd*'s debugging verbosity level 4, the log file will receive summary messages like this:

```
5/7-13:45:27-1514 LQM: Pkt: 1/1 Oct: 53/53 LQRs: 5/5
```

20

This means that, during the last testing interval, this system transmitted one packet and received one packet. 53 octets crossed the link in each direction. And this system has received responses to all five of the most recent five Link Quality Reports it sent.

The LQR packet is 36 octets long, and the default *lqrinterval* of ten seconds will cause the additional traffic to be unnoticed on most connections. However, if the application is very sensitive to speed and requires absolutely every bit of available line bandwidth, Link Quality Monitoring can be disabled with the *nolqm* argument.

Link Quality Monitoring packets, since they are part of the Point-to-Point Protocol rather than user data, do not count against the idle line disconnection timer.

3.7. Dedicated Lines

Some PPP installations use asynchronous serial connections that are always available, often using high-speed asynchronous short-haul modems over a building or campus wiring plant. In this situation, it makes sense to keep the PPP connection up at all times, and reestablish connectivity as soon as possible if one end goes down. For this purpose, use the *dedicated* argument on the *pppd* command line. *Dedicated* instructs *pppd* to never give up on the connection; that is, if the peer tells *pppd* to disconnect, it will continuously attempt to reconnect. Fatal disconnects, though (LQM failures, loss of Carrier Detect), will still cause *pppd* to close the device, go back to the **Systems** file looking for another matching entry, and then go through the call retry delay if none are available.

Normally, on a dedicated line, no *getty* or *login* process is run on the device and both ends of the circuit actively try to connect to their peer. Each machine's **Startup** script should contain a line like

```
pppd local:remote auto dedicated
```

The **Systems** file should specify the device name (such as **cua**) in the *device* field (rather than **ACU**), and the **Devices** file should contain a line like

```
Direct cua 38400 rtscts
```

The Dialers file is ignored when **Direct** is found in the *dialer* field.

See the discussion above regarding line failovers and using an auto-dial modem as a backup link.

User Guide: Link Management

This means that, during the last testing interval, this system transmitted one packet and received one packet. 53 octets crossed the link in each direction. And this system has received responses to all five of the most recent five Link Quality Reports it sent.

The LQR packet is 36 octets long, and the default *lqrinterval* of ten seconds will cause the additional traffic to be unnoticed on most connections. However, if the application is very sensitive to speed and requires absolutely every bit of available line bandwidth, Link Quality Monitoring can be disabled with the *nolqm* argument.

Link Quality Monitoring packets, since they are part of the Point-to-Point Protocol rather than user data, do not count against the idle line disconnection timer.

3.7. Dedicated Lines

Some PPP installations use asynchronous serial connections that are always available, often using high-speed asynchronous short-haul modems over a building or campus wiring plant. In this situation, it makes sense to keep the PPP connection up at all times, and reestablish connectivity as soon as possible if one end goes down. For this purpose, use the *dedicated* argument on the *pppd* command line. *Dedicated* instructs *pppd* to never give up on the connection; that is, if the peer tells *pppd* to disconnect, it will continuously attempt to reconnect. Fatal disconnects, though (LQM failures, loss of Carrier Detect), will still cause *pppd* to close the device, go back to the **Systems** file looking for another matching entry, and then go through the call retry delay if none are available.

Normally, on a dedicated line, no *getty* or *login* process is run on the device and both ends of the circuit actively try to connect to their peer. Each machine's **Startup** script should contain a line like

```
pppd local:remote auto dedicated
```

The **Systems** file should specify the device name (such as **cua**) in the *device* field (rather than **ACU**), and the **Devices** file should contain a line like

```
Direct cua 38400 rtscts
```

The Dialers file is ignored when **Direct** is found in the *dialer* field.

See the discussion above regarding line failovers and using an auto-dial modem as a backup link.

3.8. Constantly-Open Telephone Calls

Some PPP installations choose to have their connections up at all times, rather than depending upon *pppd*'s on-demand dialing capability to reestablish a formerly-idle link when traffic warrants. This is different from a *dedicated* line because a modem must be dialed or a login negotiated before PPP frames can be exchanged. In this situation, use the *up* argument on *pppd*'s command line. *Up* instructs *pppd* to make every effort to keep the connection up. For example, when the connection goes down, *pppd* will immediately redial the modem, rather than waiting for traffic demand. (It would not be sensible to use the *up* argument along with the *idle* argument.)

3.9. Compression

Morning Star PPP supports several different sorts of compression, at several different layers of the communications stack.

3.9.1. In-Modem Compression

If your modem or CSU/DSU supports V.42bis compression, you should probably enable it (see the discussion of Modem Parameters below). Data compression in the modem allows the telephone line to carry more bits than the modem's basic carrier speed. File transfers will accelerate by a factor of 1.5:1 to 3.0:1, depending upon the compressibility of the data. Text files are typically more compressible, and binary data files (e.g. executable programs) are less compressible. Files thare are already compressed will experience very little additional compression in the modem. To gain maximum benefit from in-modem data compression, you must run the serial port at its maximum possible speed, usually 38400.

Some modems' data compression software adds significant latency to the data passing through, adversely affecting interactive responsiveness. Experiment with your own modem and your own data mix to be sure what's best for you.

In-modem compression is transparent to PPP. *Pppd* can't tell whether or not your modem has compression enabled.

3.9.2. HDLC Frame Compression

The PPP frame format is based on the established HDLC[16] format. Synchronous PPP links almost always run with the full PPP/HDLC frame, because it's supported in the hardware (e.g. Z8530, MC68302) used for such

[16] Simpson, W.,ed., 'PPP in HDLC Framing', RFC 1549.

Morning Star PPP version 1.4.1

3.8. Constantly-Open Telephone Calls

Some PPP installations choose to have their connections up at all times, rather than depending upon *pppd*'s on-demand dialing capability to reestablish a formerly-idle link when traffic warrants. This is different from a *dedicated* line because a modem must be dialed or a login negotiated before PPP frames can be exchanged. In this situation, use the *up* argument on *pppd*'s command line. *Up* instructs *pppd* to make every effort to keep the connection up. For example, when the connection goes down, *pppd* will immediately redial the modem, rather than waiting for traffic demand. (It would not be sensible to use the *up* argument along with the *idle* argument.)

3.9. Compression

Morning Star PPP supports several different sorts of compression, at several different layers of the communications stack.

3.9.1. In-Modem Compression

If your modem or CSU/DSU supports V.42bis compression, you should probably enable it (see the discussion of Modem Parameters below). Data compression in the modem allows the telephone line to carry more bits than the modem's basic carrier speed. File transfers will accelerate by a factor of 1.5:1 to 3.0:1, depending upon the compressibility of the data. Text files are typically more compressible, and binary data files (e.g. executable programs) are less compressible. Files thare are already compressed will experience very little additional compression in the modem. To gain maximum benefit from in-modem data compression, you must run the serial port at its maximum possible speed, usually 38400.

Some modems' data compression software adds significant latency to the data passing through, adversely affecting interactive responsiveness. Experiment with your own modem and your own data mix to be sure what's best for you.

In-modem compression is transparent to PPP. *Pppd* can't tell whether or not your modem has compression enabled.

3.9.2. HDLC Frame Compression

The PPP frame format is based on the established HDLC[16] format. Synchronous PPP links almost always run with the full PPP/HDLC frame, because it's supported in the hardware (e.g. Z8530, MC68302) used for such

[16] Simpson, W.,ed., 'PPP in HDLC Framing', RFC 1549.

22

links. But over lower-speed asynchronous links, it makes sense to amend the full HDLC frame format because the framing is typically handled in software, and because several of the fields carry the same contents in each message.

3.9.2.1. Address and Control Field Compression

After the optional initial Flag octet (0x7E), a full PPP frame contains the HDLC ALLSTATIONS value (0xFF) in the the Address field, and the HDLC Un-numbered Information value (0x03) in the Control field.

Since these fields always carry the same information and are therefore unnecessary, and since they only contribute to increasing the latency of a low-speed link, asynchronous PPP links usually negotiate both fields away during the LCP phase of the connection establishment process. Once the LCP layer is Opened, PPP frames are transmitted without that pair of octets.

3.9.2.2. Protocol Field Compression

After the optional initial Flag octet (0x7E) and the Address and Control fields (0xFF03) which are usually negotiated away on async PPP links, the next field is the two-octet PPP Protocol field. This field allows the receiving PPP implementation to discern whether the incoming frame carries an IP network datagram, a Link Quality Report, an authentication (re)challenge or response, various link option (re)negotiations, or any of several other sorts of data that flow on a PPP link.

Though link-level traffic like option negotiations always requires two octets, most of the traffic flowing across an established link consists of network-layer (e.g. IP) datagrams. PPP's protocol field values are arranged so that network-layer protocol values always begin with a null octet (0x00) before the octet that distinguishes (e.g.) IP (0x21) from Appletalk (0x29) datagrams. Since that octet almost always contains the same value (0x00), asynchronous PPP links usually negotiate it away to reduce latency.

3.9.3. Van Jacobson TCP Header Compression

TCP/IP network traffic consists of a stream of datagrams that each contain headers added by the various layers the user data has passed through. For example, each packet contains the source and destination IP address, and a tag to identify which stream (of potentially many between the same pair of hosts) this datagram belongs to. But those headers are very large, and a comparison between successive packets reveals strong similarities.

User Guide: Link Management

links. But over lower-speed asynchronous links, it makes sense to amend the full HDLC frame format because the framing is typically handled in software, and because several of the fields carry the same contents in each message.

3.9.2.1. Address and Control Field Compression

After the optional initial Flag octet (0x7E), a full PPP frame contains the HDLC ALLSTATIONS value (0xFF) in the the Address field, and the HDLC Un-numbered Information value (0x03) in the Control field.

Since these fields always carry the same information and are therefore unnecessary, and since they only contribute to increasing the latency of a low-speed link, asynchronous PPP links usually negotiate both fields away during the LCP phase of the connection establishment process. Once the LCP layer is Opened, PPP frames are transmitted without that pair of octets.

3.9.2.2. Protocol Field Compression

After the optional initial Flag octet (0x7E) and the Address and Control fields (0xFF03) which are usually negotiated away on async PPP links, the next field is the two-octet PPP Protocol field. This field allows the receiving PPP implementation to discern whether the incoming frame carries an IP network datagram, a Link Quality Report, an authentication (re)challenge or response, various link option (re)negotiations, or any of several other sorts of data that flow on a PPP link.

Though link-level traffic like option negotiations always requires two octets, most of the traffic flowing across an established link consists of network-layer (e.g. IP) datagrams. PPP's protocol field values are arranged so that network-layer protocol values always begin with a null octet (0x00) before the octet that distinguishes (e.g.) IP (0x21) from Appletalk (0x29) datagrams. Since that octet almost always contains the same value (0x00), asynchronous PPP links usually negotiate it away to reduce latency.

3.9.3. Van Jacobson TCP Header Compression

TCP/IP network traffic consists of a stream of datagrams that each contain headers added by the various layers the user data has passed through. For example, each packet contains the source and destination IP address, and a tag to identify which stream (of potentially many between the same pair of hosts) this datagram belongs to. But those headers are very large, and a comparison between successive packets reveals strong similarities.

RFC 1144 "VJ" TCP header compression reduces the packet header overhead by exploiting those similarities, transmitting only the header segments that changed from one packet to the next. The TCP and IP header overhead is reduced from over 40 octets to as few as 4.

TCP header compression has a dramatic effect on interactive responsiveness over low-speed links, because it reduces a typical single-character Telnet or rlogin packet from over 40 octets to 5 or 6 octets. It has a much smaller effect on batch data throughput, like X bitmap displays, or FTP or rcp file transfers, because that sort of data flows in much larger packets. A frame size reduction from 1500 to 1460 octets is a much smaller percentage improvement than a reduction from 45 to 5 octets.

TCP header compression is enabled by default on async PPP and SLIP links, and disabled by default on synchronous PPP links.

3.9.4. PPP Link Compression

Like in-modem data compression (see above), PPP link compression reduces the amount of data that must flow across a low-bandwidth telephone line, thus increasing its effective bandwidth. Since PPP link compression is performed in *pppd*, on the UNIX system, less data flows across the serial interface. This offers advantages when used on hosts with serial interfaces that are incapable of high asynchronous data rates, or for hosts on which the serial I/O subsystem is inefficient and causes an onerous interrupt load on the host processor. It is also useful for direct connections between computers, where there are no modems to compress the data, or with communication devices (modems or CSU/DSUs) that lack support for data compression.

You may not see any performance advantage when using PPP link compression over modems that support V.42bis compression, except in cases where the link's bandwidth was limited by slow serial interfaces.

3.9.4.1. Predictor-1

Predictor type 1 compression yields about 1.5:1 reduction in the size of typical binary data crossing the link, absorbs relatively little of the host's CPU, and adds very little latency to interactive traffic. It's well suited to wringing even better performance from higher-speed synchronous PPP connections.

Morning Star PPP version 1.4.1

RFC 1144 "VJ" TCP header compression reduces the packet header overhead by exploiting those similarities, transmitting only the header segments that changed from one packet to the next. The TCP and IP header overhead is reduced from over 40 octets to as few as 4.

TCP header compression has a dramatic effect on interactive responsiveness over low-speed links, because it reduces a typical single-character Telnet or rlogin packet from over 40 octets to 5 or 6 octets. It has a much smaller effect on batch data throughput, like X bitmap displays, or FTP or rcp file transfers, because that sort of data flows in much larger packets. A frame size reduction from 1500 to 1460 octets is a much smaller percentage improvement than a reduction from 45 to 5 octets.

TCP header compression is enabled by default on async PPP and SLIP links, and disabled by default on synchronous PPP links.

3.9.4. PPP Link Compression

Like in-modem data compression (see above), PPP link compression reduces the amount of data that must flow across a low-bandwidth telephone line, thus increasing its effective bandwidth. Since PPP link compression is performed in *pppd*, on the UNIX system, less data flows across the serial interface. This offers advantages when used on hosts with serial interfaces that are incapable of high asynchronous data rates, or for hosts on which the serial I/O subsystem is inefficient and causes an onerous interrupt load on the host processor. It is also useful for direct connections between computers, where there are no modems to compress the data, or with communication devices (modems or CSU/DSUs) that lack support for data compression.

You may not see any performance advantage when using PPP link compression over modems that support V.42bis compression, except in cases where the link's bandwidth was limited by slow serial interfaces.

3.9.4.1. Predictor-1

Predictor type 1 compression yields about 1.5:1 reduction in the size of typical binary data crossing the link, absorbs relatively little of the host's CPU, and adds very little latency to interactive traffic. It's well suited to wringing even better performance from higher-speed synchronous PPP connections.

24

3.10. Soft Addresses

If *pppd* is told an IP address on the command line, the address is offered during IPCP negotiations. But some peers (e.g. terminal servers) wish to assign an address at connection time for the host running MST PPP to use for the duration of the connection. To instruct MST PPP to allow itself to be assigned an address that's different from the one it was given on the command line, say something like

```
pppd `hostname`~:192.0.2.5 auto idle 300
```

Because SLIP does not perform any IPCP negotiations, the tilde option will not function. To obtain a similar "feature" the remote side must provide the IP address during the connection process, and a new local address must be obtained using the **Systems** file '\A' chat script feature.

3.11. Dynamic address assignment

When an answering *pppd* is invoked in **Login**, it is told a pair of IP addresses on the command line. The **Login** script can use any means it likes to decide what IP addresses to put on that command line. It could look them up in a file or a database, or calculate them algorithmically based on the username or any other distinguishing feature of the incoming connection, or even invoke a program to ask a BOOTP server. The *pppd* command line arguments provide the mechanism; your **Login** script provides the policy.

3.11.1. Address Selected From a Small List

Here's an example **Login** script that uses the tty name to guarantee uniqueness of the addresses it assigns. This would work fine for a small installation with few modem server serial ports and a fairly static configuration.

```
#!/bin/sh
TTY=`tty`
case $TTY in
/dev/tty1)
      IP=192.0.2.1
      ;;
/dev/tty2)
      IP=192.0.2.2
      ;;
esac
exec pppd `hostname`:$IP idle 300 rtscts
```


User Guide: Link Management

3.10. Soft Addresses

If *pppd* is told an IP address on the command line, the address is offered during IPCP negotiations. But some peers (e.g. terminal servers) wish to assign an address at connection time for the host running MST PPP to use for the duration of the connection. To instruct MST PPP to allow itself to be assigned an address that's different from the one it was given on the command line, say something like

```
pppd `hostname`~:192.0.2.5 auto idle 300
```

Because SLIP does not perform any IPCP negotiations, the tilde option will not function. To obtain a similar "feature" the remote side must provide the IP address during the connection process, and a new local address must be obtained using the **Systems** file '\A' chat script feature.

3.11. Dynamic address assignment

When an answering *pppd* is invoked in **Login**, it is told a pair of IP addresses on the command line. The **Login** script can use any means it likes to decide what IP addresses to put on that command line. It could look them up in a file or a database, or calculate them algorithmically based on the username or any other distinguishing feature of the incoming connection, or even invoke a program to ask a BOOTP server. The *pppd* command line arguments provide the mechanism; your **Login** script provides the policy.

3.11.1. Address Selected From a Small List

Here's an example **Login** script that uses the tty name to guarantee uniqueness of the addresses it assigns. This would work fine for a small installation with few modem server serial ports and a fairly static configuration.

```
#!/bin/sh
TTY=`tty`
case $TTY in
/dev/tty1)
      IP=192.0.2.1
      ;;
/dev/tty2)
      IP=192.0.2.2
      ;;
esac
exec pppd `hostname`:$IP idle 300 rtscts
```

3.11.2. Address Calculated From tty Name

This script also uses the tty name to guarantee uniqueness of the addresses it assigns. You must define ttyN in your **/etc/hosts** file or NIS **hosts** map or NetInfo **hosts** map or DNS database, whichever your system uses. This works better in a larger installation with more ports and a configuration that tends to change more often.

```
#!/bin/sh
TTY=`/bin/basename \`/bin/tty\``
exec pppd `hostname`:$TTY idle 300 rtscts
```

3.11.3. SLIP

If *pppd* is running in its default PPP mode, it will use IPCP to tell the incoming peer what we think its address should be. But SLIP lacks any such facility. The **Login** script can tell the peer its address textually, just before invoking *pppd*, something like this:

```
#!/bin/sh
localaddr=`calculate`
peeraddr=`calculate`
echo my address is $localaddr and your address is $peeraddr
exec pppd $localaddr:$peeraddr slip idle 120 rtscts ...
```

The incoming peer is responsible for parsing the "my address is" line, and doing something sensible with the addresses it finds there.

4. Security Techniques

In this section, we will discuss facilities and techniques that can lead to greater security within networks that are connected via Morning Star PPP. When external network connectivity is desired, but it's impractical to impose thorough security practices on each internal host, these techniques can offer some peace of mind.

In most cases, multiple security techniques can be used to manage a single connection. For example, a host might dial its peer only during certain hours, the peer's modem might dial back to the originator, the peer might also employ SecureID to restrict logins, the PPPs might authenticate each other using CHAP, and their packet filters might still only allow certain types of traffic to cross the link.

4.1. Time-To-Call Restrictions

The second field on each line in the **Systems** file specifies what times of day *pppd* is allowed to attempt to establish a connection. This can be used to

Morning Star PPP version 1.4.1

3.11.2. Address Calculated From tty Name

This script also uses the tty name to guarantee uniqueness of the addresses it assigns. You must define ttyN in your **/etc/hosts** file or NIS **hosts** map or NetInfo **hosts** map or DNS database, whichever your system uses. This works better in a larger installation with more ports and a configuration that tends to change more often.

```
#!/bin/sh
TTY=`/bin/basename \`/bin/tty\``
exec pppd `hostname`:$TTY idle 300 rtscts
```

3.11.3. SLIP

If *pppd* is running in its default PPP mode, it will use IPCP to tell the incoming peer what we think its address should be. But SLIP lacks any such facility. The **Login** script can tell the peer its address textually, just before invoking *pppd*, something like this:

```
#!/bin/sh
localaddr=`calculate`
peeraddr=`calculate`
echo my address is $localaddr and your address is $peeraddr
exec pppd $localaddr:$peeraddr slip idle 120 rtscts ...
```

The incoming peer is responsible for parsing the "my address is" line, and doing something sensible with the addresses it finds there.

4. Security Techniques

In this section, we will discuss facilities and techniques that can lead to greater security within networks that are connected via Morning Star PPP. When external network connectivity is desired, but it's impractical to impose thorough security practices on each internal host, these techniques can offer some peace of mind.

In most cases, multiple security techniques can be used to manage a single connection. For example, a host might dial its peer only during certain hours, the peer's modem might dial back to the originator, the peer might also employ SecureID to restrict logins, the PPPs might authenticate each other using CHAP, and their packet filters might still only allow certain types of traffic to cross the link.

4.1. Time-To-Call Restrictions

The second field on each line in the **Systems** file specifies what times of day *pppd* is allowed to attempt to establish a connection. This can be used to

26

control telephone charges, or to ensure that connections are attempted only when personnel are present on each end to monitor the link. See **ppp.Systems**(5) for details.

4.2. Dial-Back

An answering modem set up for dial-back applications will typically challenge incoming callers with a prompt string, accept the input which probably identifies the caller, then hangup the call. It will then call some preconfigured number, usually associated with the caller's identification, and reestablish a carrier. The original answering modem might then issue another prompt and demand the same identification before allowing data to flow to the system connected to its serial interface.

The originating system's *pppd* must be prepared for the brief period of disconnection, and the temporary lack of a Carrier Detect signal from its modem. To avoid receiving a SIGHUP, *pppd* must instruct the UNIX system's serial drivers not to deliver the signal - to temporarily treat the serial interface as if it were connected to a local device like a terminal or printer, instead of a modem. *Pppd* does this by specifying **\M** in the 'send' phase of a **Systems** chat script. After the disconnection period, *pppd* must instruct the system's serial drivers to respect the modem's full variety of control signals, by specifying **\m** in the 'send' phase of a **Systems** chat script.

For example, to dial into a system protected by a dial-back modem, the **Systems** chat script might look like

```
#
# This connects to a system that's protected by a callback modem (in
# this case, a Telebit T3000 with S46=2).
#
server Any ACU 38400 19071234567 TIMEOUT 60 \
      ENTER\sPASSWORD: my_modem_password\M \
      ENTER\SPASSWORD: my_modem_password\m \
      ogin: my_login_name ssword: my_login_password
```

See **ppp.Systems**(5) for details.

4.3. SecureID

Sometimes an answering system is protected by a SecureID system, which incoming calls must penetrate before they're offered a prompt to login on the answering system itself. Suppose it prompts incoming calls with the string 'Identify Yourself!' and expects the incoming user to type a secret string, to be read from a credit card-sized device carried by the user. The calling system's **Systems** entry would look like

User Guide: Security

control telephone charges, or to ensure that connections are attempted only when personnel are present on each end to monitor the link. See **ppp.Systems**(5) for details.

4.2. Dial-Back

An answering modem set up for dial-back applications will typically challenge incoming callers with a prompt string, accept the input which probably identifies the caller, then hangup the call. It will then call some preconfigured number, usually associated with the caller's identification, and reestablish a carrier. The original answering modem might then issue another prompt and demand the same identification before allowing data to flow to the system connected to its serial interface.

The originating system's *pppd* must be prepared for the brief period of disconnection, and the temporary lack of a Carrier Detect signal from its modem. To avoid receiving a SIGHUP, *pppd* must instruct the UNIX system's serial drivers not to deliver the signal - to temporarily treat the serial interface as if it were connected to a local device like a terminal or printer, instead of a modem. *Pppd* does this by specifying **\M** in the 'send' phase of a **Systems** chat script. After the disconnection period, *pppd* must instruct the system's serial drivers to respect the modem's full variety of control signals, by specifying **\m** in the 'send' phase of a **Systems** chat script.

For example, to dial into a system protected by a dial-back modem, the **Systems** chat script might look like

```
#
# This connects to a system that's protected by a callback modem (in
# this case, a Telebit T3000 with S46=2).
#
server Any ACU 38400 19071234567 TIMEOUT 60 \
      ENTER\sPASSWORD: my_modem_password\M \
      ENTER\SPASSWORD: my_modem_password\m \
      ogin: my_login_name ssword: my_login_password
```

See **ppp.Systems**(5) for details.

4.3. SecureID

Sometimes an answering system is protected by a SecureID system, which incoming calls must penetrate before they're offered a prompt to login on the answering system itself. Suppose it prompts incoming calls with the string 'Identify Yourself!' and expects the incoming user to type a secret string, to be read from a credit card-sized device carried by the user. The calling system's **Systems** entry would look like

27

```
peer Any ACU 38400 5551212 self! `XPrompt` in: Pfoo word: bar
```

In the calling *pppd*'s search path (as set in the **Startup** script), you would install an executable shell script **Xprompt** which would look something like this, if your **xprompt** program is like the one distributed with X11R4:

```
#!/bin/sh
DISPLAY=:0.0
export DISPLAY
prompt="`tr -d "\015" | tail -1`"
/usr/local/bin/X11R4/xprompt -p "$prompt" -rlen 20
```

When pppd brings up the link on demand, the **Systems** chat script progresses until it sees "self!". It then invokes **XPrompt**, which invokes **xprompt**, which puts a window on the workstation's screen. The user types the secret string into the **xprompt** window and hits a carriage return. **xprompt** exits, putting that secret string on its standard output (stdout). **XPrompt** exits, putting that secret string on its stdout. When the command between the backquotes (**XPrompt** in this case) exits, *pppd* sends its stdout across the modem to the SecureID barrier, just as if it had been typed directly by the user. The expect/send couplets then continue as in a normal connection.

4.4. Replacing *getty* With *pppd*

Some UNIX systems' serial drivers and configuration methods allow the administrator to specify any arbitrary program to be invoked in response to an incoming call, not just **getty**. For example, on a system running SunOS 4.1.*, **/etc/ttytab** could contain a line like

```
ttya "/usr/etc/pppd my-hostname: idle 120 rtscts requirechap \
     netmask 0xffffff00 38400 acct /var/adm/pppd.acct" unknown on
```

(This would all be one line in /etc/ttytab - it's only broken here to fit on the page.)

When the modem answers an incoming call and raises the Carrier Detect signal, the caller sees a burst of what looks like line noise, but is actually the beginning of LCP option negotiations. Most callers find this much more difficult to crack into than if they see a simple 'login:' prompt, but CHAP is still strongly recommended for security.

This option only works on systems which provide different tty devices for incoming and outgoing modem connections. *Pppd* does not implement the device locking techniques necessary to replace *getty* on systems without the dual-device trick.

Morning Star PPP version 1.4.1

peer Any ACU 38400 5551212 self! `XPrompt` in: Pfoo word: bar

In the calling *pppd*'s search path (as set in the **Startup** script), you would install an executable shell script **Xprompt** which would look something like this, if your **xprompt** program is like the one distributed with X11R4:

#!/bin/sh
DISPLAY=:0.0
export DISPLAY
prompt="`tr -d "\015" | tail -1`"
/usr/local/bin/X11R4/xprompt -p "$prompt" -rlen 20

When pppd brings up the link on demand, the **Systems** chat script progresses until it sees "self!". It then invokes **XPrompt**, which invokes **xprompt**, which puts a window on the workstation's screen. The user types the secret string into the **xprompt** window and hits a carriage return. **xprompt** exits, putting that secret string on its standard output (stdout). **XPrompt** exits, putting that secret string on its stdout. When the command between the backquotes (**XPrompt** in this case) exits, *pppd* sends its stdout across the modem to the SecureID barrier, just as if it had been typed directly by the user. The expect/send couplets then continue as in a normal connection.

4.4. Replacing *getty* With *pppd*

Some UNIX systems' serial drivers and configuration methods allow the administrator to specify any arbitrary program to be invoked in response to an incoming call, not just **getty**. For example, on a system running SunOS 4.1.*, **/etc/ttytab** could contain a line like

ttya "/usr/etc/pppd my-hostname: idle 120 rtscts requirechap \
netmask 0xffffff00 38400 acct /var/adm/pppd.acct" unknown on

(This would all be one line in /etc/ttytab - it's only broken here to fit on the page.)

When the modem answers an incoming call and raises the Carrier Detect signal, the caller sees a burst of what looks like line noise, but is actually the beginning of LCP option negotiations. Most callers find this much more difficult to crack into than if they see a simple 'login:' prompt, but CHAP is still strongly recommended for security.

This option only works on systems which provide different tty devices for incoming and outgoing modem connections. *Pppd* does not implement the device locking techniques necessary to replace *getty* on systems without the dual-device trick.

4.5. Link Peer Authentication

Morning Star PPP implements both the Password Authentication Protocol (PAP) and the Challenge Handshake Authentication Protocol (CHAP). If *pppd* is invoked with either of the *requireauth* or *requirechap* options, it will demand that the peer (either calling or called) authenticate itself.

The **Auth** file contains pairs of either *names* and *secrets* for CHAP negotiation, or *usernames* and *passwords* for PAP negotiation. If a peer provides a name or username, its secret or password must match that found in **Auth** or the authentication phase fails and the connection is terminated.

Each *name/secret* pair in **Auth** may be followed by address patterns restricting the peer's negotiated IP address. If an address restriction is specified for a particular *name* and the peer's negotiated IP address does not match the restriction address patterns, *pppd* will terminate the connection.

The *rechap interval* option instructs *pppd* to periodically (every *interval* seconds) challenge the peer to authenticate itself. If the peer fails the new challenge, the link is terminated.

4.6. Packet Filtering

Morning Star PPP can selectively pass or block any packet based on a wide variety of criteria:

- Source or Destination host or network, by name or address
- Session originated locally or remotely
- Inbound or outbound packet
- Protocol (e-mail, interactive terminal, file transfer, etc.)

The administrator may record the passage of any packet, but it's particularly easy and helpful to log those that attempted to breach the firewall.

Here's an example complex Filter configuration, appropriate for a system used as a router between a private network (192.0.2.0) and the Internet, interspersed with commentary about its functions:

```
default
```

The 'default' filter's specs will be applied to any packet crossing the point-to-point link connecting this host to the peer.

```
bringup    !ntp !3/icmp !5/icmp !11/icmp !who !route !nntp
```

If the link is configured for dialup connections on demand, the 'bringup' clause describes those packets that will cause a call to be placed and a

User Guide: Security

4.5. Link Peer Authentication

Morning Star PPP implements both the Password Authentication Protocol (PAP) and the Challenge Handshake Authentication Protocol (CHAP). If *pppd* is invoked with either of the *requireauth* or *requirechap* options, it will demand that the peer (either calling or called) authenticate itself.

The **Auth** file contains pairs of either *names* and *secrets* for CHAP negotiation, or *usernames* and *passwords* for PAP negotiation. If a peer provides a name or username, its secret or password must match that found in **Auth** or the authentication phase fails and the connection is terminated.

Each *name/secret* pair in **Auth** may be followed by address patterns restricting the peer's negotiated IP address. If an address restriction is specified for a particular *name* and the peer's negotiated IP address does not match the restriction address patterns, *pppd* will terminate the connection.

The *rechap interval* option instructs *pppd* to periodically (every *interval* seconds) challenge the peer to authenticate itself. If the peer fails the new challenge, the link is terminated.

4.6. Packet Filtering

Morning Star PPP can selectively pass or block any packet based on a wide variety of criteria:

- Source or Destination host or network, by name or address
- Session originated locally or remotely
- Inbound or outbound packet
- Protocol (e-mail, interactive terminal, file transfer, etc.)

The administrator may record the passage of any packet, but it's particularly easy and helpful to log those that attempted to breach the firewall.

Here's an example complex Filter configuration, appropriate for a system used as a router between a private network (192.0.2.0) and the Internet, interspersed with commentary about its functions:

```
default
```

The 'default' filter's specs will be applied to any packet crossing the point-to-point link connecting this host to the peer.

```
bringup    !ntp !3/icmp !5/icmp !11/icmp !who !route !nntp
```

If the link is configured for dialup connections on demand, the 'bringup' clause describes those packets that will cause a call to be placed and a

connection initiated. In this case, it's simpler to name the types of 'nuisance' packets that should not be allowed to bring up the link. The Network Time Protocol, the Network News Transport Protocol, broadcasts from **rwhod** and **routed**, and various ICMP messages (pings and error codes) are put in the list of traffic types that aren't interesting enough to dial the modem. Any other sort of traffic not named here will initiate a dial connection.

```
pass !recv/ip-opt=srcrt/unreach=srcfail
```

Don't allow any incoming packets with the Source Route option set in the IP header. Respond with an ICMP Destination Unreachable message with the Source Route Failed code value.

```
!192.0.2.0/recv/src/unreach=net
!192.0.2.0/send/dst/unreach=net
```

Block any incoming packets that claim to be from our net, and block any outgoing packets that claim to be destined for our net. Respond with an ICMP Destination Unreachable message with the Bad Net code value.

```
nntp/128.146.110.50 nntp/128.146.8.50 nntp/150.252.1.1
nntp/131.236.20.19 nntp/129.22.8.64 nntp/128.146.111.36
!nntp/unreach=host
```

Allow Network News (Usenet) exchanges with only our known news neighbors. Block any other NNTP traffic, and respond with an ICMP Destination Unreachable message with the Bad Host code value.

```
domain/tcp/syn/recv/dst domain/tcp/syn/send/dst
```

Allow DNS secondary dumps in both directions, but only if our end of the stream is really being handled by our domain name server.

```
smtp/syn/recv/dst smtp/syn/send/dst
```

Allow SMTP (electronic mail) in both directions, but only if our end of the stream is really being handled by our mail server.

```
ftp/syn/recv/dst/192.0.2.7 !ftp/syn/recv/unreach=host
```

Allow incoming FTP (file transfer) traffic that uses our anonymous-FTP server system, but block any other incoming FTP requests. Respond with an ICMP Destination Unreachable message with the Bad Host code value.

```
!6000/tcp/syn/send/unreach=host
```

Allow no X11 clients running on hosts within our network to display on X11 servers elsewhere. Respond with an ICMP Destination Unreachable message with the Bad Host code value.

Morning Star PPP version 1.4.1

connection initiated. In this case, it's simpler to name the types of 'nuisance' packets that should not be allowed to bring up the link. The Network Time Protocol, the Network News Transport Protocol, broadcasts from **rwhod** and **routed**, and various ICMP messages (pings and error codes) are put in the list of traffic types that aren't interesting enough to dial the modem. Any other sort of traffic not named here will initiate a dial connection.

```
pass !recv/ip-opt=srcrt/unreach=srcfail
```

Don't allow any incoming packets with the Source Route option set in the IP header. Respond with an ICMP Destination Unreachable message with the Source Route Failed code value.

```
!192.0.2.0/recv/src/unreach=net
!192.0.2.0/send/dst/unreach=net
```

Block any incoming packets that claim to be from our net, and block any outgoing packets that claim to be destined for our net. Respond with an ICMP Destination Unreachable message with the Bad Net code value.

```
nntp/128.146.110.50 nntp/128.146.8.50 nntp/150.252.1.1
nntp/131.236.20.19 nntp/129.22.8.64 nntp/128.146.111.36
!nntp/unreach=host
```

Allow Network News (Usenet) exchanges with only our known news neighbors. Block any other NNTP traffic, and respond with an ICMP Destination Unreachable message with the Bad Host code value.

```
domain/tcp/syn/recv/dst domain/tcp/syn/send/dst
```

Allow DNS secondary dumps in both directions, but only if our end of the stream is really being handled by our domain name server.

```
smtp/syn/recv/dst smtp/syn/send/dst
```

Allow SMTP (electronic mail) in both directions, but only if our end of the stream is really being handled by our mail server.

```
ftp/syn/recv/dst/192.0.2.7 !ftp/syn/recv/unreach=host
```

Allow incoming FTP (file transfer) traffic that uses our anonymous-FTP server system, but block any other incoming FTP requests. Respond with an ICMP Destination Unreachable message with the Bad Host code value.

```
!6000/tcp/syn/send/unreach=host
```

Allow no X11 clients running on hosts within our network to display on X11 servers elsewhere. Respond with an ICMP Destination Unreachable message with the Bad Host code value.

30

```
1024-65535/tcp/dst/recv
!0-1023/tcp/src/syn/recv/unreach=host
```

Incoming TCP connections to ports numbered above 1023 are OK, because those are "non-privileged" ports. Above this line, we should list only services where a daemon sends traffic from a privileged port.

```
!domain/tcp/syn domain
```

Allow no DNS zone transfer traffic except that named above (connecting with our own domain name server), and allow any other DNS traffic to pass.

```
!smtp/syn smtp
```

Allow no SMTP traffic except that handled by our mail server.

```
!ident/dst/recv/unreach=host
!ident/src/send/unreach=host
```

We don't use the RFC 1413 identification services here, so we might as well bounce the queries at the gateway instead of having inetd refuse the connection.

```
ftp ftp-data
```

After blocking the traffic specified above, allow both FTP command streams and FTP data streams to cross the link, both inbound and outbound.

```
www/syn/recv/192.0.2.11/dst
!www/syn/recv/unreach=host www
```

Allow incoming World Wide Web traffic to reach our WWW server, allow no other incoming WWW traffic, and allow ourselves unlimited outbound WWW access.

```
!login/syn/recv/unreach=host
!shell/syn/recv/unreach=host
!supdup/unreach=host
!exec/unreach=host
!uucp/unreach=host
!chargen/unreach=host
```

Block incoming rlogin, rsh, and supdup connections. Block access to our system's rexecd. Since we do no UUCP over TCP, block any attempts to appear to be UUCP traffic. Block access to our "character generator" port because that's only a testing facility and could be used by someone outside to swamp our link's bandwidth with unwanted but otherwise harmless traffic.

User Guide: Security

1024-65535/tcp/dst/recv
!0-1023/tcp/src/syn/recv/unreach=host

Incoming TCP connections to ports numbered above 1023 are OK, because those are "non-privileged" ports. Above this line, we should list only services where a daemon sends traffic from a privileged port.

!domain/tcp/syn domain

Allow no DNS zone transfer traffic except that named above (connecting with our own domain name server), and allow any other DNS traffic to pass.

!smtp/syn smtp

Allow no SMTP traffic except that handled by our mail server.

!ident/dst/recv/unreach=host
!ident/src/send/unreach=host

We don't use the RFC 1413 identification services here, so we might as well bounce the queries at the gateway instead of having inetd refuse the connection.

ftp ftp-data

After blocking the traffic specified above, allow both FTP command streams and FTP data streams to cross the link, both inbound and outbound.

www/syn/recv/192.0.2.11/dst
!www/syn/recv/unreach=host www

Allow incoming World Wide Web traffic to reach our WWW server, allow no other incoming WWW traffic, and allow ourselves unlimited outbound WWW access.

!login/syn/recv/unreach=host
!shell/syn/recv/unreach=host
!supdup/unreach=host
!exec/unreach=host
!uucp/unreach=host
!chargen/unreach=host

Block incoming rlogin, rsh, and supdup connections. Block access to our system's rexecd. Since we do no UUCP over TCP, block any attempts to appear to be UUCP traffic. Block access to our "character generator" port because that's only a testing facility and could be used by someone outside to swamp our link's bandwidth with unwanted but otherwise harmless traffic.

```
!finger/syn/recv/unreach=host finger
whois login shell gopher daytime
```

Block incoming finger probes until we install a safe finger daemon. Allow several other sorts of traffic that we know to be safe, within the constraints of the previous filters.

```
33410-33515/udp talk ntalk ntp
!1-65535/udp/unreach=port
```

The **traceroute** tool probes high-numbered UDP ports, and that's so useful that we should let it through. We allow both old and new versions of the **talk** command, and we use the Network Time Protocol to keep our clocks in sync.

```
!icmp/192.0.2.198 icmp
```

Don't allow anyone to ping a particular testing host here, but allow other ICMP messages to pass freely.

```
telnet/syn/recv/128.146.8.0/255.255.255.0
!telnet/syn/recv/unreach=host telnet
```

Allow incoming telnet connections from hosts on a subnet we know to be secure, allow no other inbound telnet connections, and allow outbound telnet connections from our network to anywhere else.

```
!all/unreach=host
```

Allow no other traffic besides that which we've explicitly specified as allowed through the firewall, and respond with an ICMP Destination Unreachable (Bad Host) message.

```
keepup     !send !ntp !3/icmp !5/icmp !11/icmp !who !route
```

The link will be considered active (non-idle) if any packet passes that's not specified on this line as being blocked. Since there are certain link failure modes that will allow our system to continue sending even though the peer is unresponsive, no outbound traffic counts against the idle timer.

```
log  !3/icmp rejected
```

Log any packet blocked by the 'pass' filter above, except ICMP Destination Unreachable messages.

4.7. Tunneling

Morning Star PPP can run the PPP protocol over async serial terminal ports, over the SnapLink's high-speed synchronous serial ports, or over TCP streams between two systems that are already connected by an

Morning Star PPP version 1.4.1

!finger/syn/recv/unreach=host finger
whois login shell gopher daytime

Block incoming finger probes until we install a safe finger daemon. Allow several other sorts of traffic that we know to be safe, within the constraints of the previous filters.

33410-33515/udp talk ntalk ntp
!1-65535/udp/unreach=port

The **traceroute** tool probes high-numbered UDP ports, and that's so useful that we should let it through. We allow both old and new versions of the **talk** command, and we use the Network Time Protocol to keep our clocks in sync.

!icmp/192.0.2.198 icmp

Don't allow anyone to ping a particular testing host here, but allow other ICMP messages to pass freely.

telnet/syn/recv/128.146.8.0/255.255.255.0
!telnet/syn/recv/unreach=host telnet

Allow incoming telnet connections from hosts on a subnet we know to be secure, allow no other inbound telnet connections, and allow outbound telnet connections from our network to anywhere else.

!all/unreach=host

Allow no other traffic besides that which we've explicitly specified as allowed through the firewall, and respond with an ICMP Destination Unreachable (Bad Host) message.

keepup   !send !ntp !3/icmp !5/icmp !11/icmp !who !route

The link will be considered active (non-idle) if any packet passes that's not specified on this line as being blocked. Since there are certain link failure modes that will allow our system to continue sending even though the peer is unresponsive, no outbound traffic counts against the idle timer.

log !3/icmp rejected

Log any packet blocked by the 'pass' filter above, except ICMP Destination Unreachable messages.

4.7. Tunneling

Morning Star PPP can run the PPP protocol over async serial terminal ports, over the SnapLink's high-speed synchronous serial ports, or over TCP streams between two systems that are already connected by an

32

existing IP network. The advantage of using PPP to tunnel a virtual network through an existing network lies in the ability to maintain the inaccessibility of hosts on that virtual network: if the virtual network uses IP addresses that are not known to the rest of the real Internet, hosts on that network are inaccessible except from other hosts on the virtual network.

4.7.1. Tunneling PPP Over Telnet

Suppose a host named frobozz has lines in **/etc/services** like

```
ppp        57/tcp
ppptelnet  59/tcp
```

and lines in **/etc/inetd.conf** like

```
ppp   stream tcp nowait root /usr/etc/pppd pppd nogob:
ppptelnet  stream tcp nowait root /usr/etc/pppd pppd bogon: telnet
```

Then some other host (with similar lines in **/etc/services**) could invoke *pppd* as

```
pppd blat:bogon auto
```

with a **Systems** line like

```
bogon Any telnet/frobozz/ppptelnet
```

This would connect the two UNIX systems via a PPP connection running over a TCP stream through an existing IP network, and the TCP stream would use telnet-style option negotiations for 8-bit transparency and telnet escape processing.

Alternatively, suppose some remote system dials into a terminal server that can only connect with frobozz via a telnet session, but it has the option of connecting to a port other than the usual 23. By invoking the 'answering' *pppd* from **inetd.conf**, rather than via the normal telnetd/login/passwd/Login/pppd mechanism, the overhead of **telnetd** and its pty processing can be avoided. The presence of **telnet** on the answering *pppd*'s command line causes that *pppd* to negotiate the telnet binary option, and understand telnet escape processing - the stuff that's normally done for you by telnetd.

4.7.2. Tunneling PPP over TCP

As a more general example of tunneling PPP over TCP through an existing IP network, some other host (with similar lines in /etc/services) could invoke *pppd* as

```
pppd snorf:nogob auto
```


User Guide: Security

existing IP network. The advantage of using PPP to tunnel a virtual network through an existing network lies in the ability to maintain the inaccessibility of hosts on that virtual network: if the virtual network uses IP addresses that are not known to the rest of the real Internet, hosts on that network are inaccessible except from other hosts on the virtual network.

4.7.1. Tunneling PPP Over Telnet

Suppose a host named frobozz has lines in **/etc/services** like

```
ppp        57/tcp
ppptelnet  59/tcp
```

and lines in **/etc/inetd.conf** like

```
ppp   stream tcp nowait root /usr/etc/pppd pppd nogob:
ppptelnet  stream tcp nowait root /usr/etc/pppd pppd bogon: telnet
```

Then some other host (with similar lines in **/etc/services**) could invoke *pppd* as

```
pppd blat:bogon auto
```

with a **Systems** line like

```
bogon Any telnet/frobozz/ppptelnet
```

This would connect the two UNIX systems via a PPP connection running over a TCP stream through an existing IP network, and the TCP stream would use telnet-style option negotiations for 8-bit transparency and telnet escape processing.

Alternatively, suppose some remote system dials into a terminal server that can only connect with frobozz via a telnet session, but it has the option of connecting to a port other than the usual 23. By invoking the 'answering' *pppd* from **inetd.conf**, rather than via the normal telnetd/login/passwd/Login/pppd mechanism, the overhead of **telnetd** and its pty processing can be avoided. The presence of **telnet** on the answering *pppd*'s command line causes that *pppd* to negotiate the telnet binary option, and understand telnet escape processing - the stuff that's normally done for you by telnetd.

4.7.2. Tunneling PPP over TCP

As a more general example of tunneling PPP over TCP through an existing IP network, some other host (with similar lines in /etc/services) could invoke *pppd* as

```
pppd snorf:nogob auto
```

with a **Systems** line like

```
nogob Any tcp/frobozz/ppp
```

All these *pppd* invocations can be seasoned to taste with appropriate options, like **asyncmap 0x0 nolqm netmask 0xffffff00 requirechap**, or whatever else is needed. If you're invoking *pppd* from **inetd.conf**, **requirechap** is a very good idea.

For more discussion of the idea of tunneling and virtual networks, please see RFC 1241[17] and research.att.com:dist/smb/pnet.ext.ps.Z or ftp.morningstar.com:pub/papers/pnet.ext.ps.Z.

4.8. Selective Gateway Encryption

Encryption is not available in software exported from the USA.

If *pppd* is invoked with the *gw-crypt* option, the next word on the command line will be interpreted as the name of a file containing keys to be used for DES encryption and decryption. When *pppd* is about to transmit a packet, it compares the packet's source and destination addresses with the endpoint values specified on each line of the key file. If the packet's addresses match the endpoints in a line in the key file, the packet's contents are passed through a DES encrypter, using the key specified on the key file line. When *pppd* receives a packet with IP addresses matching an entry in the key file, the associated key is used to decrypt the packet.

In the key file, the endpoint addresses may be specified as either names or literal addresses. The addresses may correspond to individual hosts, or to entire networks, or to subnets with network masks specified after a separator slash ('/'). This way, all traffic between particular LANs can be encrypted during its traversal of an intervening insecure internet, but traffic between hosts on those LANs and hosts on any other connected LAN will be transmitted in the clear.

Morning Star PPP's packet encryption leaves the packet's IP headers unchanged, so the packet will pass through an intervening IP internet just as it would without encryption. The operation encrypts the TCP, UDP, or ICMP header, along with the user data segment of the packet. Snoopers will be able to count packets passing between the gateway encrypter endpoints, but will be unable to observe their content type, since that information is contained in the encrypted TCP header.

[17] Woodburn, R. and Mills, D, 'Scheme for an internet encapsulation protocol: Version 1', RFC 1241, SAIC and University of Delaware, July 1991.

Morning Star PPP version 1.4.1

with a **Systems** line like

```
nogob Any tcp/frobozz/ppp
```

All these *pppd* invocations can be seasoned to taste with appropriate options, like **asyncmap 0x0 nolqm netmask 0xffffff00 requirechap**, or whatever else is needed. If you're invoking *pppd* from **inetd.conf**, **requirechap** is a very good idea.

For more discussion of the idea of tunneling and virtual networks, please see RFC 1241[17] and research.att.com:dist/smb/pnet.ext.ps.Z or ftp.morningstar.com:pub/papers/pnet.ext.ps.Z.

4.8. Selective Gateway Encryption

Encryption is not available in software exported from the USA.

If *pppd* is invoked with the *gw-crypt* option, the next word on the command line will be interpreted as the name of a file containing keys to be used for DES encryption and decryption. When *pppd* is about to transmit a packet, it compares the packet's source and destination addresses with the endpoint values specified on each line of the key file. If the packet's addresses match the endpoints in a line in the key file, the packet's contents are passed through a DES encrypter, using the key specified on the key file line. When *pppd* receives a packet with IP addresses matching an entry in the key file, the associated key is used to decrypt the packet.

In the key file, the endpoint addresses may be specified as either names or literal addresses. The addresses may correspond to individual hosts, or to entire networks, or to subnets with network masks specified after a separator slash ('/'). This way, all traffic between particular LANs can be encrypted during its traversal of an intervening insecure internet, but traffic between hosts on those LANs and hosts on any other connected LAN will be transmitted in the clear.

Morning Star PPP's packet encryption leaves the packet's IP headers unchanged, so the packet will pass through an intervening IP internet just as it would without encryption. The operation encrypts the TCP, UDP, or ICMP header, along with the user data segment of the packet. Snoopers will be able to count packets passing between the gateway encrypter endpoints, but will be unable to observe their content type, since that information is contained in the encrypted TCP header.

[17] Woodburn, R. and Mills, D, 'Scheme for an internet encapsulation protocol: Version 1', RFC 1241, SAIC and University of Delaware, July 1991.

34

5. Observing *pppd*'s actions

Pppd records its state in two places: the argument vector and the log file. It can also optionally supply session statistics in an accounting file.

5.1. The Argument Vector

As *pppd* runs, it updates its argument vector. You can see its progress by typing **ps -axww | grep ppp** (or **ps -ef | grep ppp** on a System V machine). Some UNIX systems don't show the current argument vector in *ps*, but on those that do, the connection status is described by several comma-separated fields inside a pair of brackets ('[' and ']'). Only the first field will always appear, but when other information is available, the fields appear in the following order:

- The state of the connection: dialing, connecting, disconnecting, up, or off, optionally including a description of the reason for a connection failure.
- The name of the network interface used by this connection, such as **du0**.
- The name of the serial interface device in use. If an inbound *pppd* is using **/dev/ttya**, this field would say **ttya**. If an outbound *pppd* is using **/dev/cub**, it would say **cub**.
- The Internet address of the peer.
- The current reception and transmission rates, separated by a slash, in bits per second.
- The current percentages of transmitted data successfully received at each end of the link. The two rates, separated by a slash, are the percentage of data our peer transmitted that we received and the percentage of data we transmitted that was actually received by our peer. This field will only be displayed if both ends of the link agree to do LQM and some loss has occurred recently.
- The idle timer value: the number of seconds that have passed since the link last carried a packet described in the *keepup* line.

The fields following the trailing ']' are the actual arguments with which *pppd* was invoked.

5.2. The Log File

The log file (default **/usr/adm/pppd.log**) also contains reports about the daemon's progress. Higher debugging levels provide more detailed logging output. At extremely high debugging levels such as 8 or 9, the log file will contain a record of each frame or even each byte sent or received. Such extreme detail should be avoided for normal operations, since the log file

User Guide: Security

5. Observing *pppd*'s actions

Pppd records its state in two places: the argument vector and the log file. It can also optionally supply session statistics in an accounting file.

5.1. The Argument Vector

As *pppd* runs, it updates its argument vector. You can see its progress by typing **ps -axww | grep ppp** (or **ps -ef | grep ppp** on a System V machine). Some UNIX systems don't show the current argument vector in *ps*, but on those that do, the connection status is described by several comma-separated fields inside a pair of brackets ('[' and ']'). Only the first field will always appear, but when other information is available, the fields appear in the following order:

- The state of the connection: dialing, connecting, disconnecting, up, or off, optionally including a description of the reason for a connection failure.
- The name of the network interface used by this connection, such as **du0**.
- The name of the serial interface device in use. If an inbound *pppd* is using **/dev/ttya**, this field would say **ttya**. If an outbound *pppd* is using **/dev/cub**, it would say **cub**.
- The Internet address of the peer.
- The current reception and transmission rates, separated by a slash, in bits per second.
- The current percentages of transmitted data successfully received at each end of the link. The two rates, separated by a slash, are the percentage of data our peer transmitted that we received and the percentage of data we transmitted that was actually received by our peer. This field will only be displayed if both ends of the link agree to do LQM and some loss has occurred recently.
- The idle timer value: the number of seconds that have passed since the link last carried a packet described in the *keepup* line.

The fields following the trailing ']' are the actual arguments with which *pppd* was invoked.

5.2. The Log File

The log file (default **/usr/adm/pppd.log**) also contains reports about the daemon's progress. Higher debugging levels provide more detailed logging output. At extremely high debugging levels such as 8 or 9, the log file will contain a record of each frame or even each byte sent or received. Such extreme detail should be avoided for normal operations, since the log file

35

can quickly consume prodigious amounts of disk space, and since the very act of logging can occasionally cause protocol timeout problems that only Heisenberg could solve. Lower debugging levels can show progress through PPP's finite state machine, or allow observation of the daemon's progress through the chat scripts in **Systems** and **Dialers**.

Each line in the log file begins with a date and time stamp, followed by the process ID of the daemon, followed a description of the event that caused the log message.

5.3. The Accounting File

If *pppd* is invoked with the **acct** command-line argument, link traffic statistics are appended the specified file when the link shuts down because of an idle timeout, SIGHUP, or other reason. If the specified accounting file is the same as the log file, the link traffic statistics will follow the "Disconnected from" message.

Each line in the accounting file contains this information:

dd/mm	The current date
hh:mm:ss	The current time
pid	*Pppd*'s process ID
elapsed	The elapsed time since the connection came up. If less than 24 hours, this will look like 'hh:mm:ss', otherwise it will look like 'days+hh:mm:ss'.
in-octets	The number of received octets (bytes), the LQM InGoodOctets counter. As per RFC 1333, this includes LCP packets and LQRs as well as IP packets. It includes one flag octet and two FCS octets plus packet framing before any IP or PPP decompression has occurred, but after Async-Control-Character-Map escaping has been processed. These same rules are followed for out-octets, in-packets, and out-packets.
out-octets	The number of transmitted octets (bytes), the LQM ifOutOctets counter.
in-packets	The number of received packets, the LQM ifInUniPackets counter.
out-packets	The number of transmitted packets, the LQM ifOutUniPackets counter.
in-errors	The number of input errors, the LQM ifInErrors counter.

Morning Star PPP version 1.4.1

can quickly consume prodigious amounts of disk space, and since the very act of logging can occasionally cause protocol timeout problems that only Heisenberg could solve. Lower debugging levels can show progress through PPP's finite state machine, or allow observation of the daemon's progress through the chat scripts in **Systems** and **Dialers**.

Each line in the log file begins with a date and time stamp, followed by the process ID of the daemon, followed a description of the event that caused the log message.

5.3. The Accounting File

If *pppd* is invoked with the **acct** command-line argument, link traffic statistics are appended the specified file when the link shuts down because of an idle timeout, SIGHUP, or other reason. If the specified accounting file is the same as the log file, the link traffic statistics will follow the "Disconnected from" message.

Each line in the accounting file contains this information:

dd/mm	The current date
hh:mm:ss	The current time
pid	*Pppd*'s process ID
elapsed	The elapsed time since the connection came up. If less than 24 hours, this will look like 'hh:mm:ss', otherwise it will look like 'days+hh:mm:ss'.
in-octets	The number of received octets (bytes), the LQM InGoodOctets counter. As per RFC 1333, this includes LCP packets and LQRs as well as IP packets. It includes one flag octet and two FCS octets plus packet framing before any IP or PPP decompression has occurred, but after Async-Control-Character-Map escaping has been processed. These same rules are followed for out-octets, in-packets, and out-packets.
out-octets	The number of transmitted octets (bytes), the LQM ifOutOctets counter.
in-packets	The number of received packets, the LQM ifInUniPackets counter.
out-packets	The number of transmitted packets, the LQM ifOutUniPackets counter.
in-errors	The number of input errors, the LQM ifInErrors counter.

36

out-errors — If LQM is in use, then this is the cumulative number of input errors the peer has reported in the LQR PeerInErrors field. If LQM is not in use, then this field contains a question mark ('?').

local-IP — The local IP address, if any.

remote-IP — The remote IP address, if any.

auth-ID — The peer's authentication ID as revealed through PAP or CHAP. This field is empty if authentication is not in use.

6. IP Routing Tips

The UNIX host's IP implementation sees Morning Star PPP as a point-to-point network connection between two known addresses. If neither endpoint resides on an IP-based local area network (LAN), packets will simply flow in both directions as soon as the PPP connection is established. When the PPP link connects a remote host to a LAN, or provides a connection between two LANs, or connects a host or a LAN to the worldwide Internet, the systems involved must be concerned with routing.

In the examples below, we'll describe how to establish static routes when the machines boot. This is cumbersome, because any topology change requires that all the machines even remotely involved be reconfigured by editing their boot-time shell scripts. An alternative to static routes would be to use some automated system for updating all the hosts' routing tables. This is usually implemented as a daemon running on all the hosts involved. Many networks use the RIP protocol[18] and run *in.routed* on their UNIX systems. If you use *in.routed* to propagate routing information, you'll need to create a file called **/etc/gateways** (as described in **routed**(8)) on the system running *pppd*, and specify the PPP link as leading to a *passive* gateway.

Some sites prefer other routing protocols, and they use the Gate Daemon[19] instead. If you use *gated*, you should invoke *pppd* with the *netmask* argument set to the same value as used on the LAN, if that subnet mask is different from the default for the class of your network.

[18] Hedrick, C.L., 'Routing Information Protocol', RFC 1058, Rutgers, June 1988.

[19] gated.cornell.edu:pub/gated/gated-2.1.tar.Z or gated-alpha.tar.Z, also available via anonymous PPP/FTP from Morning Star Technologies.

User Guide: Observing pppd

out-errors — If LQM is in use, then this is the cumulative number of input errors the peer has reported in the LQR PeerInErrors field. If LQM is not in use, then this field contains a question mark ('?').

local-IP — The local IP address, if any.

remote-IP — The remote IP address, if any.

auth-ID — The peer's authentication ID as revealed through PAP or CHAP. This field is empty if authentication is not in use.

6. IP Routing Tips

The UNIX host's IP implementation sees Morning Star PPP as a point-to-point network connection between two known addresses. If neither endpoint resides on an IP-based local area network (LAN), packets will simply flow in both directions as soon as the PPP connection is established. When the PPP link connects a remote host to a LAN, or provides a connection between two LANs, or connects a host or a LAN to the worldwide Internet, the systems involved must be concerned with routing.

In the examples below, we'll describe how to establish static routes when the machines boot. This is cumbersome, because any topology change requires that all the machines even remotely involved be reconfigured by editing their boot-time shell scripts. An alternative to static routes would be to use some automated system for updating all the hosts' routing tables. This is usually implemented as a daemon running on all the hosts involved. Many networks use the RIP protocol[18] and run *in.routed* on their UNIX systems. If you use *in.routed* to propagate routing information, you'll need to create a file called **/etc/gateways** (as described in **routed**(8)) on the system running *pppd*, and specify the PPP link as leading to a *passive* gateway.

Some sites prefer other routing protocols, and they use the Gate Daemon[19] instead. If you use *gated*, you should invoke *pppd* with the *netmask* argument set to the same value as used on the LAN, if that subnet mask is different from the default for the class of your network.

[18] Hedrick, C.L., 'Routing Information Protocol', RFC 1058, Rutgers, June 1988.

[19] gated.cornell.edu:pub/gated/gated-2.1.tar.Z or gated-alpha.tar.Z, also available via anonymous PPP/FTP from Morning Star Technologies.

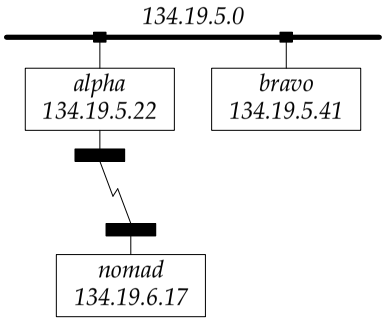
37

6.1. Connecting a Host to a LAN

There are two conventional approaches for connecting a set of standalone hosts to a LAN via PPP.

6.1.1. Separate Network

The method that will cause the least confusion is to assign a network or subnet for use by all the remote machines. For example, suppose the organization's class B network number is 134.19, and they are subnetting with a class C-sized network mask of 0xffffff00. The departmental LAN is subnet 134.19.5.0, populated by hosts *alpha* (134.19.5.22) and *bravo* (134.19.5.41). A modem is attached to one of *alpha*'s serial ports, and *alpha*'s **Login** shell script is the generic one described above. A laptop SPARCstation clone named *nomad* wishes to connect to the network.



Designate subnet 6 for remote machines. Assign *nomad* the IP address 134.19.6.17. The Morning Star PPP daemon on *nomad* would be started in the **$PPPHOME/Startup** script (called from **/etc/rc.local**) as

```
pppd 134.19.6.17:134.19.5.22 auto idle 180
```

or, if all the names can be found in the local **/etc/hosts** (or resolved via NIS/YP, NetInfo, the Domain Name Service, or some other mechanism without first needing to bring up the PPP link), it could look like

```
pppd nomad:alpha auto idle 180
```

The next line in *nomad*'s **$PPPHOME/Startup** would set up an IP route through the dial-in gateway:

```
route add net 134.19.0.0 134.19.5.22 1
```

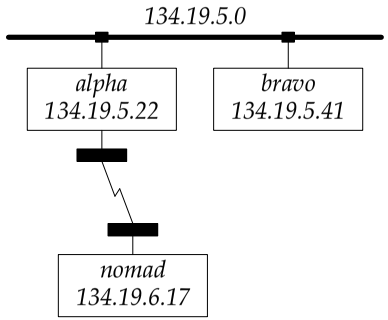

Morning Star PPP version 1.4.1

6.1. Connecting a Host to a LAN

There are two conventional approaches for connecting a set of standalone hosts to a LAN via PPP.

6.1.1. Separate Network

The method that will cause the least confusion is to assign a network or subnet for use by all the remote machines. For example, suppose the organization's class B network number is 134.19, and they are subnetting with a class C-sized network mask of 0xffffff00. The departmental LAN is subnet 134.19.5.0, populated by hosts *alpha* (134.19.5.22) and *bravo* (134.19.5.41). A modem is attached to one of *alpha*'s serial ports, and *alpha*'s **Login** shell script is the generic one described above. A laptop SPARCstation clone named *nomad* wishes to connect to the network.



Designate subnet 6 for remote machines. Assign *nomad* the IP address 134.19.6.17. The Morning Star PPP daemon on *nomad* would be started in the **$PPPHOME/Startup** script (called from **/etc/rc.local**) as

```
pppd 134.19.6.17:134.19.5.22 auto idle 180
```

or, if all the names can be found in the local **/etc/hosts** (or resolved via NIS/YP, NetInfo, the Domain Name Service, or some other mechanism without first needing to bring up the PPP link), it could look like

```
pppd nomad:alpha auto idle 180
```

The next line in *nomad*'s **$PPPHOME/Startup** would set up an IP route through the dial-in gateway:

```
route add net 134.19.0.0 134.19.5.22 1
```

Alternatively, and necessarily if the LAN were also connected to the Internet,

```
route add default alpha 1
```

Similarly, the PPP daemon on *alpha* would be started as

```
pppd alpha:nomad auto idle 180
```

bravo's **/etc/rc.local** would contain a line like

```
route add net 134.19.6.0 alpha 1
```

6.1.1.1. Proxy ARP

The Proxy ARP[20] daemon can be used in a subnetted environment to accommodate hosts with older IP implementations that don't work correctly with subnetting. Suppose, in the 'Separate Network' example above, the host *bravo* were running a version of IP based on BSD 4.1c or 4.2, rather than on the more recent BSD 4.3 networking code. To enable *bravo* to find its way to *nomad*, one could run a **proxyarpd** on *alpha* and provide it the following **proxytab** configuration file:

```
# Proxy ARP table for proxyarpd
# Service provided for hosts on 134.19.5.0 that do not understand
# internet subnetting.
#
# Fields are:
# 1) interface to service (same as on command line)
# 2) net to tell attached hosts that we "are"
# 3) host on net 1) to send traffic to (gateway)
#
le0   134.19.6.0   134.19.5.22
```

6.1.2. ARP[21] table manipulation

If a separate subnet number is unavailable for use by remote-access machines, it is possible to assign them addresses on the same subnet number as the departmental LAN. As above, suppose the organization's class B network number is 134.19, and they are subnetting with a class C-sized network mask of 0xffffff00. The departmental LAN is subnet 134.19.5.0, populated by hosts *alpha* (134.19.5.22) and *bravo* (134.19.5.41). A modem is

[20] Available from ftp.cis.ohio-state.edu:pub/proxyarp/proxyarpd.shar.Z or via anonymous PPP/FTP from Morning Star Technologies.

[21] Plummer, D.C., 'Ethernet Address Resolution Protocol', RFC 826, Symbolics, November 1982.

User Guide: IP Routing Tips

Alternatively, and necessarily if the LAN were also connected to the Internet,

```
route add default alpha 1
```

Similarly, the PPP daemon on *alpha* would be started as

```
pppd alpha:nomad auto idle 180
```

bravo's **/etc/rc.local** would contain a line like

```
route add net 134.19.6.0 alpha 1
```

6.1.1.1. Proxy ARP

The Proxy ARP[20] daemon can be used in a subnetted environment to accommodate hosts with older IP implementations that don't work correctly with subnetting. Suppose, in the 'Separate Network' example above, the host *bravo* were running a version of IP based on BSD 4.1c or 4.2, rather than on the more recent BSD 4.3 networking code. To enable *bravo* to find its way to *nomad*, one could run a **proxyarpd** on *alpha* and provide it the following **proxytab** configuration file:

```
# Proxy ARP table for proxyarpd
# Service provided for hosts on 134.19.5.0 that do not understand
# internet subnetting.
#
# Fields are:
# 1) interface to service (same as on command line)
# 2) net to tell attached hosts that we "are"
# 3) host on net 1) to send traffic to (gateway)
#
le0   134.19.6.0   134.19.5.22
```

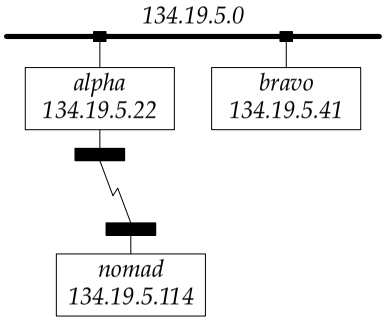
6.1.2. ARP[21] table manipulation

If a separate subnet number is unavailable for use by remote-access machines, it is possible to assign them addresses on the same subnet number as the departmental LAN. As above, suppose the organization's class B network number is 134.19, and they are subnetting with a class C-sized network mask of 0xffffff00. The departmental LAN is subnet 134.19.5.0, populated by hosts *alpha* (134.19.5.22) and *bravo* (134.19.5.41). A modem is

[20] Available from ftp.cis.ohio-state.edu:pub/proxyarp/proxyarpd.shar.Z or via anonymous PPP/FTP from Morning Star Technologies.

[21] Plummer, D.C., 'Ethernet Address Resolution Protocol', RFC 826, Symbolics, November 1982.

attached to one of *alpha*'s serial ports, and *alpha*'s **Login** shell script is the generic one described above. A laptop SPARCstation clone named *nomad* wishes to connect to the network.



Assign *nomad* the IP address 134.19.5.114. The Morning Star PPP daemon on *nomad* would be started in the **$PPPHOME/Startup** script (called from **/etc/rc.local**) as

```
pppd 134.19.5.114:134.19.5.22 auto idle 180
```

or, if all the names can be found in the local /etc/hosts,

```
pppd nomad:alpha auto idle 180
```

The next line in *nomad*'s **$PPPHOME/Startup** would set up an IP route through the dial-in gateway:

```
route add net 134.19.0.0 134.19.5.22 1
```

Alternatively, and necessarily if the LAN were also connected to the Internet,

```
route add default alpha 1
```

Similarly, the PPP daemon on *alpha* would be started as

```
pppd alpha:nomad auto idle 180
```

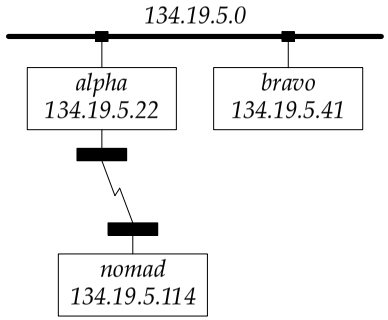
Alpha's **/etc/rc.local** would contain a line like

```
arp -s nomad `ifconfig le0 | sed -n "/ether/s/ether//gp"` pub
```

(If your system's Ethernet interface is named something other than 'le0', use that name instead.) This would add a permanent entry to *alpha*'s ARP

Morning Star PPP version 1.4.1

attached to one of *alpha*'s serial ports, and *alpha*'s **Login** shell script is the generic one described above. A laptop SPARCstation clone named *nomad* wishes to connect to the network.



Assign *nomad* the IP address 134.19.5.114. The Morning Star PPP daemon on *nomad* would be started in the **$PPPHOME/Startup** script (called from **/etc/rc.local**) as

```
pppd 134.19.5.114:134.19.5.22 auto idle 180
```

or, if all the names can be found in the local /etc/hosts,

```
pppd nomad:alpha auto idle 180
```

The next line in *nomad*'s **$PPPHOME/Startup** would set up an IP route through the dial-in gateway:

```
route add net 134.19.0.0 134.19.5.22 1
```

Alternatively, and necessarily if the LAN were also connected to the Internet,

```
route add default alpha 1
```

Similarly, the PPP daemon on *alpha* would be started as

```
pppd alpha:nomad auto idle 180
```

Alpha's **/etc/rc.local** would contain a line like

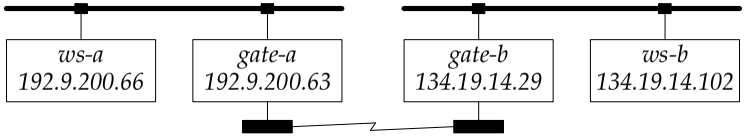
```
arp -s nomad `ifconfig le0 | sed -n "/ether/s/ether//gp"` pub
```

(If your system's Ethernet interface is named something other than 'le0', use that name instead.) This would add a permanent entry to *alpha*'s ARP

table, and cause it to be provided to other systems on the local Ethernet. Any time a host on that LAN tries to find the Ethernet address corresponding to *nomad*'s IP address, the request will be answered with instructions to forward the packets to *alpha*. Since *nomad* appears to be directly connected to the LAN, no hosts on the LAN, nor on any other IP-connected network, would require routing table modifications.

6.2. Connecting two LANs

Suppose *gate-a* (192.9.200.63) and *ws-a* (192.9.200.66) are on one LAN, with *gate-a* supporting a modem. Also suppose *gate-b* (134.19.14.29) and *ws-b* (134.19.14.102) are on another LAN across town, with *gate-b* supporting a modem.



gate-b's PPP daemon should be started as

```
pppd gate-b:gate-a auto idle 130
```

and *gate-b* should have a route like

```
route add net 192.9.200.0 gate-a 1
```

ws-b should have a route like

```
route add net 192.9.200.0 gate-b 1
```

Similarly, *gate-a*'s PPP daemon should be started as

```
pppd gate-a:gate-b auto idle 130
```

and *gate-a* should have a route like

```
route add net 134.19.14.0 gate-b 1
```

or, depending upon the structure of LAN b, maybe

```
route add net 134.19.0.0 gate-b 1
```

ws-a should have a route like

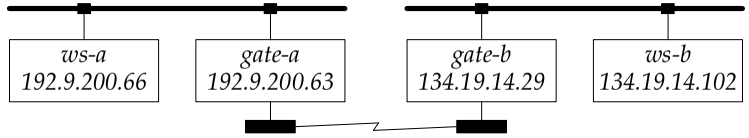
```
route add net 134.19.14.0 gate-a 1
```


User Guide: IP Routing Tips

table, and cause it to be provided to other systems on the local Ethernet. Any time a host on that LAN tries to find the Ethernet address corresponding to *nomad*'s IP address, the request will be answered with instructions to forward the packets to *alpha*. Since *nomad* appears to be directly connected to the LAN, no hosts on the LAN, nor on any other IP-connected network, would require routing table modifications.

6.2. Connecting two LANs

Suppose *gate-a* (192.9.200.63) and *ws-a* (192.9.200.66) are on one LAN, with *gate-a* supporting a modem. Also suppose *gate-b* (134.19.14.29) and *ws-b* (134.19.14.102) are on another LAN across town, with *gate-b* supporting a modem.



gate-b's PPP daemon should be started as

```
pppd gate-b:gate-a auto idle 130
```

and *gate-b* should have a route like

```
route add net 192.9.200.0 gate-a 1
```

ws-b should have a route like

```
route add net 192.9.200.0 gate-b 1
```

Similarly, *gate-a*'s PPP daemon should be started as

```
pppd gate-a:gate-b auto idle 130
```

and *gate-a* should have a route like

```
route add net 134.19.14.0 gate-b 1
```

or, depending upon the structure of LAN b, maybe

```
route add net 134.19.0.0 gate-b 1
```

ws-a should have a route like

```
route add net 134.19.14.0 gate-a 1
```

or, again depending upon the structure of LAN b, perhaps

```
route add net 134.19.0.0 gate-a 1
```

6.3. Connecting a host or LAN to the Internet

If your LAN is connected to the Internet, or if you have arranged an account at a Point Of Presence (POP) of a PPP- or SLIP-talking Internet connectivity vendor (say, foo.net), then you should arrange for your *default* route to point through the gateway at the other end of the PPP connection. If *hotel* supported a modem to call a POP, it would start its PPP daemon like

```
pppd hotel:pop.foo.net auto idle 240
```

and would arrange a route as

```
route add default pop.foo.net 1
```

Any hosts on the LAN 'behind' *hotel* would set a route like

```
route add default hotel 1
```

A machine's default route should point to the next machine along its path 'outward' to the Internet. If *hotel* were a remote machine dialing into one machine in a complex corporate internet, its default route should point to that hub machine, expecting that the hub will deal with the issues of routing *hotel*'s packets to their destination, whether on the LAN or elsewhere on the corporate internet or onto the Internet.

6.4. A Common Test Setup

Upon receiving Morning Star PPP, users often want to test its performance, and to practice configuring the software by running it between two workstations in one location, before moving one end of the PPP link to a remote site. This is a good strategy, providing that proper caution is employed while assigning addresses to the endpoints of the PPP link.

To avoid routing ambiguities, the endpoints of the PPP link should be given addresses on a different IP network (or subnet) number than the network (or subnet) connecting the machines over Ethernet. For example, if the Ethernet interfaces are at 134.19.5.22 and 134.19.5.41, the PPP interfaces should **not** be on the 134.19.5 subnet. Instead, the tester should pick an unused subnet number from the same IP address space, or even use something totally unassigned. A good choice might be for one end of the PPP link to be 134.19.17.53 and the other to be 134.19.17.68. This way, normal services will continue to flow across the Ethernet as usual. To cause traffic to cross the PPP link (whether a null-modem cable or a modem pair), make

Morning Star PPP version 1.4.1

or, again depending upon the structure of LAN b, perhaps

```
route add net 134.19.0.0 gate-a 1
```

6.3. Connecting a host or LAN to the Internet

If your LAN is connected to the Internet, or if you have arranged an account at a Point Of Presence (POP) of a PPP- or SLIP-talking Internet connectivity vendor (say, foo.net), then you should arrange for your *default* route to point through the gateway at the other end of the PPP connection. If *hotel* supported a modem to call a POP, it would start its PPP daemon like

```
pppd hotel:pop.foo.net auto idle 240
```

and would arrange a route as

```
route add default pop.foo.net 1
```

Any hosts on the LAN 'behind' *hotel* would set a route like

```
route add default hotel 1
```

A machine's default route should point to the next machine along its path 'outward' to the Internet. If *hotel* were a remote machine dialing into one machine in a complex corporate internet, its default route should point to that hub machine, expecting that the hub will deal with the issues of routing *hotel*'s packets to their destination, whether on the LAN or elsewhere on the corporate internet or onto the Internet.

6.4. A Common Test Setup

Upon receiving Morning Star PPP, users often want to test its performance, and to practice configuring the software by running it between two workstations in one location, before moving one end of the PPP link to a remote site. This is a good strategy, providing that proper caution is employed while assigning addresses to the endpoints of the PPP link.

To avoid routing ambiguities, the endpoints of the PPP link should be given addresses on a different IP network (or subnet) number than the network (or subnet) connecting the machines over Ethernet. For example, if the Ethernet interfaces are at 134.19.5.22 and 134.19.5.41, the PPP interfaces should **not** be on the 134.19.5 subnet. Instead, the tester should pick an unused subnet number from the same IP address space, or even use something totally unassigned. A good choice might be for one end of the PPP link to be 134.19.17.53 and the other to be 134.19.17.68. This way, normal services will continue to flow across the Ethernet as usual. To cause traffic to cross the PPP link (whether a null-modem cable or a modem pair), make

42

the connection from one testing machine to the IP address of the other machine's PPP interface (e.g. *telnet 134.19.17.68*).

7. Observations about on-demand dialup IP

7.1. Application behavior

The scheme used to support on-demand dialups in Morning Star PPP depends upon network- and higher-layer protocol timeouts typically being longer than the time needed to allocate a modem, dial it, complete the call, login to the remote system, start up the PPP protocol handler there, and establish LCP and IPCP connectivity. This is a reasonable assumption, since a local call will typically require about 25 seconds between the daemon's receipt of the first 'bringup' packet and the establishment of IP-level connectivity (of that, more than 20 seconds are consumed with dialing the call and training the modems). This scheme works even if the first remote modem is busy and the dialing pppd must try a second telephone number, so long as the dialer script is carefully written to include appropriate ABORT and TIMEOUT strings. The user's application will simply wait for the connection to be established and continue as if the connection had always been in place. This even works well when a link times out with active TCP sessions in place, such as a *telnet* connection to the remote end. When the user types, or when an application writes output, a new call is placed from the end sending the data and the session is reestablished without the application noticing anything was amiss.

Unfortunately, if the connection cannot be reestablished, TCP will time out and the application may fail ungracefully. This most often happens during times of resource contention (no free modems to place or answer the call) or acute connectivity problems (telephone system call-routing breakdown or extreme service degradation). The effect will be the same as if the machine at the 'other' end had crashed ungracefully, since the application will only be able to tell that it is unable to exchange packets with its partner.

7.2. Dealing with bandwidth limitations

The Internet's TCP/IP protocol suite is remarkably flexible and robust, with a wide variety of applications for use over media ranging from multi-gigabit data superhighways to long-delay satellite channels to local area networks to dialup modems to amateur radio to carrier pigeons[22]. While

[22] Waitzman, D., 'Standard for the transmission of IP datagrams on avian carri-

User Guide: IP Routing Tips

the connection from one testing machine to the IP address of the other machine's PPP interface (e.g. *telnet 134.19.17.68*).

7. Observations about on-demand dialup IP

7.1. Application behavior

The scheme used to support on-demand dialups in Morning Star PPP depends upon network- and higher-layer protocol timeouts typically being longer than the time needed to allocate a modem, dial it, complete the call, login to the remote system, start up the PPP protocol handler there, and establish LCP and IPCP connectivity. This is a reasonable assumption, since a local call will typically require about 25 seconds between the daemon's receipt of the first 'bringup' packet and the establishment of IP-level connectivity (of that, more than 20 seconds are consumed with dialing the call and training the modems). This scheme works even if the first remote modem is busy and the dialing pppd must try a second telephone number, so long as the dialer script is carefully written to include appropriate ABORT and TIMEOUT strings. The user's application will simply wait for the connection to be established and continue as if the connection had always been in place. This even works well when a link times out with active TCP sessions in place, such as a *telnet* connection to the remote end. When the user types, or when an application writes output, a new call is placed from the end sending the data and the session is reestablished without the application noticing anything was amiss.

Unfortunately, if the connection cannot be reestablished, TCP will time out and the application may fail ungracefully. This most often happens during times of resource contention (no free modems to place or answer the call) or acute connectivity problems (telephone system call-routing breakdown or extreme service degradation). The effect will be the same as if the machine at the 'other' end had crashed ungracefully, since the application will only be able to tell that it is unable to exchange packets with its partner.

7.2. Dealing with bandwidth limitations

The Internet's TCP/IP protocol suite is remarkably flexible and robust, with a wide variety of applications for use over media ranging from multi-gigabit data superhighways to long-delay satellite channels to local area networks to dialup modems to amateur radio to carrier pigeons[22]. While

[22] Waitzman, D., 'Standard for the transmission of IP datagrams on avian carri-

by definition all IP-based applications may be transparently used over links traversing any combination of media, some applications are better suited to media with the relatively low bandwidth and moderate latency and delay characteristics of asynchronous dialup connections.

7.2.1. Applications with few problems on thin wires

PPP over current-technology dial modems[23] provides satisfactory performance for most typical TCP/IP and UDP/IP wide-area applications. Users will experience useful file transfer throughput (V.32/V.42bis yields 1.7–2.8 Kbytes/sec for a typical large binary data file) and reasonable interactive response in applications such as *telnet*, *rlogin*, and the like. Plenty of bandwidth is available for network infrastructure applications such as SMTP electronic mail, NNTP network news, NTP clock synchronization, Domain Name Service, etc.

7.2.2. Applications with some problems on thin wires

The speed limitation of the dialup medium becomes more apparent when larger amounts of data are transferred, particularly for interactive applications such as *xterm* or other display-oriented programs. While large bitmap editors and CAD packages will operate correctly, users may find that the modem simply isn't able to keep up with their demands for interactive response.

7.2.3. Applications requiring special care on thin wires

Applications that are heavy users of communications bandwidth, such as Sun's Network File System (NFS), should be used with care over dialup links. NFS is able to easily overwhelm a modem link. While performance is acceptable for read-only file access, NFS's synchronous write semantics will make file creation and writing operations noticeably slower than on a local file system. Attempting to execute a program stored on a remotely-mounted filesystem will have this problem too, since paging will occur from the remote executable image.

Fortunately, there are usually other approaches more appropriate for wide-area networking over low-bandwidth links to solving the problems that NFS addresses. Use Berkeley's *rdist* system to keep the important segments of two sites' file structures in reasonable synchrony. Also, use a package

ers', RFC 1149, BBN, April 1990.

[23] CCITT V.32 (9600) or V.32bis (14400) carrier, with V.42 error correction and V.42bis data compression, and the host serial interface latched at 38400

Morning Star PPP version 1.4.1

by definition all IP-based applications may be transparently used over links traversing any combination of media, some applications are better suited to media with the relatively low bandwidth and moderate latency and delay characteristics of asynchronous dialup connections.

7.2.1. Applications with few problems on thin wires

PPP over current-technology dial modems[23] provides satisfactory performance for most typical TCP/IP and UDP/IP wide-area applications. Users will experience useful file transfer throughput (V.32/V.42bis yields 1.7–2.8 Kbytes/sec for a typical large binary data file) and reasonable interactive response in applications such as *telnet*, *rlogin*, and the like. Plenty of bandwidth is available for network infrastructure applications such as SMTP electronic mail, NNTP network news, NTP clock synchronization, Domain Name Service, etc.

7.2.2. Applications with some problems on thin wires

The speed limitation of the dialup medium becomes more apparent when larger amounts of data are transferred, particularly for interactive applications such as *xterm* or other display-oriented programs. While large bitmap editors and CAD packages will operate correctly, users may find that the modem simply isn't able to keep up with their demands for interactive response.

7.2.3. Applications requiring special care on thin wires

Applications that are heavy users of communications bandwidth, such as Sun's Network File System (NFS), should be used with care over dialup links. NFS is able to easily overwhelm a modem link. While performance is acceptable for read-only file access, NFS's synchronous write semantics will make file creation and writing operations noticeably slower than on a local file system. Attempting to execute a program stored on a remotely-mounted filesystem will have this problem too, since paging will occur from the remote executable image.

Fortunately, there are usually other approaches more appropriate for wide-area networking over low-bandwidth links to solving the problems that NFS addresses. Use Berkeley's *rdist* system to keep the important segments of two sites' file structures in reasonable synchrony. Also, use a package

ers', RFC 1149, BBN, April 1990.

[23] CCITT V.32 (9600) or V.32bis (14400) carrier, with V.42 error correction and V.42bis data compression, and the host serial interface latched at 38400

44

like *ange-ftp.el*[24] in your GNU Emacs to automatically manage FTP connections that are transparently associated with your editing buffers. This gives the appearance of the ability to edit files while they reside on a remote machine, without needing to use NFS to mount the remote filesystems across the relatively slow PPP link.

7.2.4. Tuning NFS for slow links

To use NFS over dialup links, increase the *timeo* timeout parameter in **/etc/fstab** to as much as 750 (i.e. 75 seconds) to accommodate network delays such as establishing modem connections. You should also set *rsize=512* and *wsize=512* (or perhaps even a smaller value like 256) to reduce the amount of fragmentation and UDP congestion, and set *actimeo=120* to reduce the amount of NFS overhead traffic that crosses the link.

To help guard against file corruption, you should enable UDP checksum calculations on both the NFS client and the NFS server. For example, on a Sun, do this by saying

```
# echo "udp_cksum/W 1" | adb -k -w /vmunix /dev/mem
# echo "udp_cksum?W 1" | adb -k -w /vmunix /dev/mem
```

Packets with bad checksums are discarded by the receiver, and the sender will retransmit the packets that were damaged in transit.

7.2.5. Preparing the user community for thin wire connectivity

It is important to prepare your user community so that they are familiar with and understand the limitations of low-speed IP connectivity. Test critical applications with your modems to verify their suitability in the new environment before widespread deployment. Often, an application can be more cleverly partitioned between 'local' and 'remote' parts to reduce the communication bandwidth needed for satisfactory operation. Current modem technology simply does not provide Ethernet-speed connectivity over dialup lines. If the users (or the writers of applications) appreciate the existence of connectivity itself, their expectations are more likely to be satisfied.

[24] Written by Andy Norman <ange@hplb.hpl.hp.com>, available from ftp.gnu.ai.mit.edu:/ange-ftp/ange-ftp.el.Z, or via anonymous UUCP from osu-cis, or via anonymous PPP/FTP from Morning Star Technologies.

User Guide: Observations

like *ange-ftp.el*[24] in your GNU Emacs to automatically manage FTP connections that are transparently associated with your editing buffers. This gives the appearance of the ability to edit files while they reside on a remote machine, without needing to use NFS to mount the remote filesystems across the relatively slow PPP link.

7.2.4. Tuning NFS for slow links

To use NFS over dialup links, increase the *timeo* timeout parameter in **/etc/fstab** to as much as 750 (i.e. 75 seconds) to accommodate network delays such as establishing modem connections. You should also set *rsize=512* and *wsize=512* (or perhaps even a smaller value like 256) to reduce the amount of fragmentation and UDP congestion, and set *actimeo=120* to reduce the amount of NFS overhead traffic that crosses the link.

To help guard against file corruption, you should enable UDP checksum calculations on both the NFS client and the NFS server. For example, on a Sun, do this by saying

```
# echo "udp_cksum/W 1" | adb -k -w /vmunix /dev/mem
# echo "udp_cksum?W 1" | adb -k -w /vmunix /dev/mem
```

Packets with bad checksums are discarded by the receiver, and the sender will retransmit the packets that were damaged in transit.

7.2.5. Preparing the user community for thin wire connectivity

It is important to prepare your user community so that they are familiar with and understand the limitations of low-speed IP connectivity. Test critical applications with your modems to verify their suitability in the new environment before widespread deployment. Often, an application can be more cleverly partitioned between 'local' and 'remote' parts to reduce the communication bandwidth needed for satisfactory operation. Current modem technology simply does not provide Ethernet-speed connectivity over dialup lines. If the users (or the writers of applications) appreciate the existence of connectivity itself, their expectations are more likely to be satisfied.

[24] Written by Andy Norman <ange@hplb.hpl.hp.com>, available from ftp.gnu.ai.mit.edu:/ange-ftp/ange-ftp.el.Z, or via anonymous UUCP from osu-cis, or via anonymous PPP/FTP from Morning Star Technologies.

8. Cabling

Most systems and modems use the EIA RS-232[25] signaling conventions for their asynchronous serial ports. In the tables below, there is no difference between the pins referred to as 'DTE pins' or 'Modem pins', nor between 'Local pins' and 'Remote pins', except notational convenience. If any of the following cables have the same physical connector type on each end (both DB-25 or both MiniDIN-8), they are completely symmetrical and may be flipped end-for-end with no effect.

8.1. Asynchronous Modem cables

If your system is to be connected to an asynchronous modem, and if the system uses DB-25 connectors, the pins on the system (DTE) end of the cable should be connected straight through to the same-numbered pins on the DB-25 modem end.

In order of importance for proper operation, the pins you should connect are listed in the table entitled "DB-25 Modem Cable".

DB-25 Modem Cable

DTE DB-25 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	Protective Ground	1	both
7	GND (Signal Ground)	7	both
2	TD (Transmit Data)	2	from DTE
3	RD (Receive Data)	3	from Modem
6	DSR (Data Set Ready)	6	from Modem
20	DTR (Data Terminal Ready)	20	from DTE
4	RTS (Request To Send)	4	from DTE
5	CTS (Clear To Send)	5	from Modem
8	DCD (Data Carrier Detect)	8	from Modem
22	RI (Ring Indicator)	22	from Modem

The serial ports on the Sun SPARCstation IPC/IPX have MiniDIN-8 connectors. Though they may look similar, these connectors are not the same as the connectors on Apple Macintosh products, and Mac modem cables will not work correctly with any of these MiniDIN-8 UNIX systems. A cable

[25] Electronic Industries Association, EIA Standard RS-232-C, 'Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange', August 1969.

Morning Star PPP version 1.4.1

8. Cabling

Most systems and modems use the EIA RS-232[25] signaling conventions for their asynchronous serial ports. In the tables below, there is no difference between the pins referred to as 'DTE pins' or 'Modem pins', nor between 'Local pins' and 'Remote pins', except notational convenience. If any of the following cables have the same physical connector type on each end (both DB-25 or both MiniDIN-8), they are completely symmetrical and may be flipped end-for-end with no effect.

8.1. Asynchronous Modem cables

If your system is to be connected to an asynchronous modem, and if the system uses DB-25 connectors, the pins on the system (DTE) end of the cable should be connected straight through to the same-numbered pins on the DB-25 modem end.

In order of importance for proper operation, the pins you should connect are listed in the table entitled "DB-25 Modem Cable".

DB-25 Modem Cable

DTE DB-25 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	Protective Ground	1	both
7	GND (Signal Ground)	7	both
2	TD (Transmit Data)	2	from DTE
3	RD (Receive Data)	3	from Modem
6	DSR (Data Set Ready)	6	from Modem
20	DTR (Data Terminal Ready)	20	from DTE
4	RTS (Request To Send)	4	from DTE
5	CTS (Clear To Send)	5	from Modem
8	DCD (Data Carrier Detect)	8	from Modem
22	RI (Ring Indicator)	22	from Modem

The serial ports on the Sun SPARCstation IPC/IPX have MiniDIN-8 connectors. Though they may look similar, these connectors are not the same as the connectors on Apple Macintosh products, and Mac modem cables will not work correctly with any of these MiniDIN-8 UNIX systems. A cable

[25] Electronic Industries Association, EIA Standard RS-232-C, 'Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange', August 1969.

46

to connect a SPARCstation IPC or IPX systems to a DB-25 asynchronous modem are described in the table entitled "SPARC MiniDIN-8 Modem Cable"[26]

SPARC MiniDin-8 Modem Cable

DTE SPARC Mini-DIN-8 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	DTR	20	from DTE
2	CTS	5	from Modem
3	TD	2	from DTE
4	GND	7	both
5	RD	3	from Modem
6	RTS	4	from DTE
7	DCD	8	from Modem
8	*N/C*	*N/C*	Receive Clock (sync only)
N/C	DSR	6	from Modem
N/C	RI	22	from Modem

The serial ports on the NeXTstation, Tadpole SPARCbook, and Silicon Graphics Personal Iris have MiniDIN-8 connectors. Though they may look similar, these connectors are not the same as the connectors on Apple Macintosh products, and Mac modem cables will not work correctly with any of these MiniDIN-8 UNIX systems. A cable to connect one of these UNIX systems to a DB-25 asynchronous modem is described in the table entitled "NeXT etc. MiniDIN-8 Modem Cable"[27]

The Hewlett-Packard 9000/700 series provides a DB-9 for connectivity with asynchronous serial devices. Hewlett-Packard recommends their cable part number 24542M (*not 24542G, which is a printer cable!*) to connect one of these HP systems to a DB-25 asynchronous modem. If you can't get the authentic HP part, it is described in the table entitled "HP Modem Cable".

8.2. Asynchronous 'Null-Modem' cables

If your system is to be connected directly to another system, the pins on the local system's end of the cable should be connected with the symmetric-function pins on the remote system's end. This is commonly called a null-

[26] 'Network and System Administration', Chapter 13 'Attaching Peripheral Devices', section on 'Serial Port Connector and Cable Specifications', pp. 186–188, NeXT Computer Inc., 1990.

User Guide: Cabling

to connect a SPARCstation IPC or IPX systems to a DB-25 asynchronous modem are described in the table entitled "SPARC MiniDIN-8 Modem Cable"[26]

SPARC MiniDin-8 Modem Cable

DTE SPARC Mini-DIN-8 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	DTR	20	from DTE
2	CTS	5	from Modem
3	TD	2	from DTE
4	GND	7	both
5	RD	3	from Modem
6	RTS	4	from DTE
7	DCD	8	from Modem
8	*N/C*	*N/C*	Receive Clock (sync only)
N/C	DSR	6	from Modem
N/C	RI	22	from Modem

The serial ports on the NeXTstation, Tadpole SPARCbook, and Silicon Graphics Personal Iris have MiniDIN-8 connectors. Though they may look similar, these connectors are not the same as the connectors on Apple Macintosh products, and Mac modem cables will not work correctly with any of these MiniDIN-8 UNIX systems. A cable to connect one of these UNIX systems to a DB-25 asynchronous modem is described in the table entitled "NeXT etc. MiniDIN-8 Modem Cable"[27]

The Hewlett-Packard 9000/700 series provides a DB-9 for connectivity with asynchronous serial devices. Hewlett-Packard recommends their cable part number 24542M (*not 24542G, which is a printer cable!*) to connect one of these HP systems to a DB-25 asynchronous modem. If you can't get the authentic HP part, it is described in the table entitled "HP Modem Cable".

8.2. Asynchronous 'Null-Modem' cables

If your system is to be connected directly to another system, the pins on the local system's end of the cable should be connected with the symmetric-function pins on the remote system's end. This is commonly called a null-

[26] 'Network and System Administration', Chapter 13 'Attaching Peripheral Devices', section on 'Serial Port Connector and Cable Specifications', pp. 186–188, NeXT Computer Inc., 1990.

NeXT etc. MiniDIN-8 Modem Cable

DTE MiniDIN-8 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	DTR	20	from DTE
2	DCD	8	from Modem
3	TD	2	from DTE
4	GND	7	both
5	RD	3	from Modem
6	RTS	4	from DTE
7	*N/C*	*N/C*	*N/C*
8	CTS	5	from Modem
N/C	DSR	6	from Modem
N/C	RI	22	from Modem

HP Modem Cable

DTE DB-9 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	CD	8	from Modem
2	RD	3	from Modem
3	TD	2	from DTE
4	DTR	20	from DTE
5	GND	7	both
6	DSR	6	from Modem
7	RTS	4	from DTE
8	CTS	5	from Modem
9	RI	22	from Modem

modem cable.

In order of importance for proper operation, the pins you should attach between two systems with DB-25 connectors are described in the table entitled "DB-25 Null-Modem Cable".

The serial ports on the NeXTstation, Tadpole SPARCbook, and Silicon Graphics Personal Iris have MiniDIN-8 connectors. A null-modem cable to connect one of these systems to another system that has DB-25 connectors is described in the table entitled "Mini-DIN DB25 Null-Modem Cable".

Morning Star PPP version 1.4.1

NeXT etc. MiniDIN-8 Modem Cable

DTE MiniDIN-8 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	DTR	20	from DTE
2	DCD	8	from Modem
3	TD	2	from DTE
4	GND	7	both
5	RD	3	from Modem
6	RTS	4	from DTE
7	*N/C*	*N/C*	*N/C*
8	CTS	5	from Modem
N/C	DSR	6	from Modem
N/C	RI	22	from Modem

HP Modem Cable

DTE DB-9 pin	RS-232 Signal	Modem DB-25 pin	Direction
1	CD	8	from Modem
2	RD	3	from Modem
3	TD	2	from DTE
4	DTR	20	from DTE
5	GND	7	both
6	DSR	6	from Modem
7	RTS	4	from DTE
8	CTS	5	from Modem
9	RI	22	from Modem

modem cable.

In order of importance for proper operation, the pins you should attach between two systems with DB-25 connectors are described in the table entitled "DB-25 Null-Modem Cable".

The serial ports on the NeXTstation, Tadpole SPARCbook, and Silicon Graphics Personal Iris have MiniDIN-8 connectors. A null-modem cable to connect one of these systems to another system that has DB-25 connectors is described in the table entitled "Mini-DIN DB25 Null-Modem Cable".

48

DB-25 Null-Modem Cable

Local DB-25 pin	Local RS-232 Signal	Remote DB-25 pin	Remote RS-232 Signal
1	Protective Ground	1	Protective Ground
7	GND	7	GND
2	TD	3	RD
3	RD	2	TD
6+8	DSR+CD	20	DTR
20	DTR	6+8	DSR+CD
4	RTS	5	CTS
5	CTS	4	RTS

Mini-DIN DB25 Null-Modem Cable

Local MiniDIN-8 pin	Local RS-232 Signal	Remote DB-25 pin	Remote RS-232 Signal
1	DTR	8	DCD
2	DCD	20	DTR
3	TD	3	RD
4	GND	7	GND
5	RD	2	TD
6	RTS	5	CTS
7	*N/C*	*N/C*	*N/C*
8	CTS	4	RTS
N/C	DSR	6	DSR
N/C	RI	22	RI

The serial ports on the NeXTstation, Tadpole SPARCbook, Silicon Graphics Personal Iris, and Sun SPARCstation IPC/IPX have MiniDIN-8 connectors. A null-modem cable to connect a pair of these systems is described in the table entitled "NeXT etc. Null-Modem Cable".

9. Modem parameters

9.1. Flow control

If your UNIX system supports it, use out-of-band 'hardware' (RTS/CTS) flow control between your system and your modem, or between two systems over a null-modem cable. On most systems, specify 'rtscts' either on

User Guide: Cabling

DB-25 Null-Modem Cable

Local DB-25 pin	Local RS-232 Signal	Remote DB-25 pin	Remote RS-232 Signal
1	Protective Ground	1	Protective Ground
7	GND	7	GND
2	TD	3	RD
3	RD	2	TD
6+8	DSR+CD	20	DTR
20	DTR	6+8	DSR+CD
4	RTS	5	CTS
5	CTS	4	RTS

Mini-DIN DB25 Null-Modem Cable

Local MiniDIN-8 pin	Local RS-232 Signal	Remote DB-25 pin	Remote RS-232 Signal
1	DTR	8	DCD
2	DCD	20	DTR
3	TD	3	RD
4	GND	7	GND
5	RD	2	TD
6	RTS	5	CTS
7	*N/C*	*N/C*	*N/C*
8	CTS	4	RTS
N/C	DSR	6	DSR
N/C	RI	22	RI

The serial ports on the NeXTstation, Tadpole SPARCbook, Silicon Graphics Personal Iris, and Sun SPARCstation IPC/IPX have MiniDIN-8 connectors. A null-modem cable to connect a pair of these systems is described in the table entitled "NeXT etc. Null-Modem Cable".

9. Modem parameters

9.1. Flow control

If your UNIX system supports it, use out-of-band 'hardware' (RTS/CTS) flow control between your system and your modem, or between two systems over a null-modem cable. On most systems, specify 'rtscts' either on

49

NeXT etc. Null-Modem Cable

Local MiniDIN-8 pin	Local RS-232 Signal	Remote MiniDIN-8 pin	Remote RS-232 Signal
1	DTR	2	DCD
2	DCD	1	DTR
3	TD	5	RD
4	GND	4	GND
5	RD	3	TD
6	RTS	8	CTS
7	*N/C*	7	*N/C*
8	CTS	6	RTS

the *pppd* command line, or in the Optional Parameters field of the line in **Devices**(5). On a NeXT, specify 'cufa' in the Device field in **Devices**(5) and use the name 'ttydfa' in **/etc/ttys**.

If, for whatever reason, you are forced to use in-band 'software' (XON/XOFF, ^Q/^S) flow control, then specify 'xonxoff' on the *pppd* command line or in **Devices**(5), and use 'cua' on a NeXT.

The daemon's default behavior is to use no flow control.

SunOS 4.1.1 implements hardware flow control on the native CPU serial ports only for transmission[28]. Workstations running this OS respect the modem's use of CTS (Clear To Send) to indicate its readiness to receive characters from the host, but do not use RTS (Request To Send) to throttle the modem's (incoming) data stream to the host. This means that when presented with a heavy incoming traffic load, the Sun's native CPU serial ports will be overloaded, and the console will report a series of occasional 'zs*x*: silo overflow' errors. This is unfortunate but unavoidable by *pppd*, introduces no errors into the user data being transferred across the network, and does not significantly affect the PPP link's throughput or responsiveness.

9.2. General Recommendations

You should connect your modem to your computer at the highest asynchronous serial speed that both can support (typically 38400 baud, as found in **/usr/include/sys/ttydev.h** or **/usr/include/sys/termio.h**), and allow the modem's internal carrier speed matching capability to make a usable connection with whatever type of modem is in use at the other end. This will

[27] See the Output Modes section of **termio**(4) and the IOCTLS section of **zs**(4s).

Morning Star PPP version 1.4.1

NeXT etc. Null-Modem Cable

Local MiniDIN-8 pin	Local RS-232 Signal	Remote MiniDIN-8 pin	Remote RS-232 Signal
1	DTR	2	DCD
2	DCD	1	DTR
3	TD	5	RD
4	GND	4	GND
5	RD	3	TD
6	RTS	8	CTS
7	*N/C*	7	*N/C*
8	CTS	6	RTS

the *pppd* command line, or in the Optional Parameters field of the line in **Devices**(5). On a NeXT, specify 'cufa' in the Device field in **Devices**(5) and use the name 'ttydfa' in **/etc/ttys**.

If, for whatever reason, you are forced to use in-band 'software' (XON/XOFF, ^Q/^S) flow control, then specify 'xonxoff' on the *pppd* command line or in **Devices**(5), and use 'cua' on a NeXT.

The daemon's default behavior is to use no flow control.

SunOS 4.1.1 implements hardware flow control on the native CPU serial ports only for transmission[28]. Workstations running this OS respect the modem's use of CTS (Clear To Send) to indicate its readiness to receive characters from the host, but do not use RTS (Request To Send) to throttle the modem's (incoming) data stream to the host. This means that when presented with a heavy incoming traffic load, the Sun's native CPU serial ports will be overloaded, and the console will report a series of occasional 'zs*x*: silo overflow' errors. This is unfortunate but unavoidable by *pppd*, introduces no errors into the user data being transferred across the network, and does not significantly affect the PPP link's throughput or responsiveness.

9.2. General Recommendations

You should connect your modem to your computer at the highest asynchronous serial speed that both can support (typically 38400 baud, as found in **/usr/include/sys/ttydev.h** or **/usr/include/sys/termio.h**), and allow the modem's internal carrier speed matching capability to make a usable connection with whatever type of modem is in use at the other end. This will

[27] See the Output Modes section of **termio**(4) and the IOCTLS section of **zs**(4s).

50

allow you to take maximum advantage of the modem's data compression capabilities.

If your modem supports error correction, you should enable its use unless your tests show your application has better performance without it. This will allow line noise problems to be corrected at as low a level in the protocol stack as possible. If the modem has both MNP level 4 and CCITT V.42, choose the latter so that you can also use CCITT V.42bis data compression.

If your modem supports data compression, you should enable its use unless, again, your tests show your application has better performance without it. This will allow you to pass as much information across the PPP line as possible. If the modem has both MNP5 and CCITT V.42bis, choose the latter because it has a higher maximum compression ratio and because it behaves better with precompressed data streams.

The most flexible PPP installation allows inbound and outbound connections over any available modem. To allow bidirectional use of the modem, plus use by other applications (such as *uucp*, *tip*, *cu*, or remote logins), configure the modem as follows:

- Answer after one ring. For many modems that use the AT command set, set **S0=1**.
- Lock the DTE interface to the selected speed. The modem will use flow control and buffering as needed to accommodate any carrier speed. Many modems don't have an explicit register for the speed, but simply store the value that was in use when the **&w** command was issued.
- Configure flow control appropriately. If both your computer and your modem can use hardware (RTS/CTS) flow control, then use it. If not, configure the modem for XON/XOFF flow control and make sure both ends of the PPP connection have the 0x000A0000 bits turned on in their Async Control Character Maps (this is the default for Morning Star PPP). If you use hardware flow control, make sure that the cable carries the RTS and CTS signals. Regardless of which flow control scheme you choose, make sure the computer is configured to use the same type of flow control as the modem. This may mean using a special tty device to enable hardware flow control, or using the **rtscts** or **xonxoff** option on the *pppd* command line or in the **Devices** file. A computer and modem using software flow control can talk to a computer and modem using hardware flow control, but both ends must have the asyncmap set to accommodate software flow control.
- Disable printing of result codes by the modem when processing an incoming call. On some modems this is only possible by also disabling

User Guide: Modem parameters

allow you to take maximum advantage of the modem's data compression capabilities.

If your modem supports error correction, you should enable its use unless your tests show your application has better performance without it. This will allow line noise problems to be corrected at as low a level in the protocol stack as possible. If the modem has both MNP level 4 and CCITT V.42, choose the latter so that you can also use CCITT V.42bis data compression.

If your modem supports data compression, you should enable its use unless, again, your tests show your application has better performance without it. This will allow you to pass as much information across the PPP line as possible. If the modem has both MNP5 and CCITT V.42bis, choose the latter because it has a higher maximum compression ratio and because it behaves better with precompressed data streams.

The most flexible PPP installation allows inbound and outbound connections over any available modem. To allow bidirectional use of the modem, plus use by other applications (such as *uucp*, *tip*, *cu*, or remote logins), configure the modem as follows:

- Answer after one ring. For many modems that use the AT command set, set **S0=1**.
- Lock the DTE interface to the selected speed. The modem will use flow control and buffering as needed to accommodate any carrier speed. Many modems don't have an explicit register for the speed, but simply store the value that was in use when the **&w** command was issued.
- Configure flow control appropriately. If both your computer and your modem can use hardware (RTS/CTS) flow control, then use it. If not, configure the modem for XON/XOFF flow control and make sure both ends of the PPP connection have the 0x000A0000 bits turned on in their Async Control Character Maps (this is the default for Morning Star PPP). If you use hardware flow control, make sure that the cable carries the RTS and CTS signals. Regardless of which flow control scheme you choose, make sure the computer is configured to use the same type of flow control as the modem. This may mean using a special tty device to enable hardware flow control, or using the **rtscts** or **xonxoff** option on the *pppd* command line or in the **Devices** file. A computer and modem using software flow control can talk to a computer and modem using hardware flow control, but both ends must have the asyncmap set to accommodate software flow control.
- Disable printing of result codes by the modem when processing an incoming call. On some modems this is only possible by also disabling

51

result codes for outgoing calls. The dialer for such a modem must start with "" **ATE1** or its equivalent rather than the more common "" **AT**.

- Better dialer performance is possible if the modem is set up to print extended result codes such as **BUSY** when dialing out. This can be done in the **Dialers** file entry if necessary.
- Configure the modem to assert the Carrier Detect (CD, also DCD) signal only when carrier is established with another modem.
- Configure the modem to disconnect the phone call and restore the modem parameters to their saved values when the DTR (Data Terminal Ready) signal is deasserted by the computer.

9.3. Specific examples

In the file **Examples/Dialers.ex** you'll find dialer descriptions for several types of modems, including register setup and switch setting summaries. Since your modems will likely be used for purposes besides PPP (e.g. UUCP or interactive users), it's best to set their default parameters to accommodate dial-in applications and have outgoing UUCP or PPP dialers change them if necessary. The PPP-specific register settings in **Dialers.ex** ensure that an otherwise general-purpose modem will work as well as possible with PPP, for the duration of the PPP session.

In the examples below, we'll show how to configure a typical modern modem, including a picture of its working register settings and a command string that will set it up correctly. We'll also describe what each of those register settings means, so that if you use a different type of modem, you should be able to set it up similarly.

We find that a Telebit T1600 works well with the following register settings:

```
at&v
T1600 - Version LA1.00  - Active Configuration
 B1  E1  L0  M0  Q2  T   V1  X12  Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R3 &S1 &T4 &X0
S000:1  S001=0   S002=43  S003=13 S004=10 S005=8 S006=2  S007:120
S008=2  S009=6   S010=14  S011=70 S012=50 S018=0 S025=5  S026=1
S038=0  S041=0   S045=0   S046=0  S047=4  S048:1 S050=0  S051:6
S056=17 S057=19  S058:2   S059:15 S060=0  S061:0 S062=15 S063:2
S064=0  S068=255 S069=0   S090=0  S093=8  S094=1 S100=0  S102=0
S104=0  S105=1   S111=255 S112=1  S180=2  S181=1 S183=25 S190=1
S253=10 S254=255 S255=255
OK
```

You can make a T1600 work like this by giving it the following command:

Morning Star PPP version 1.4.1

result codes for outgoing calls. The dialer for such a modem must start with "" **ATE1** or its equivalent rather than the more common "" **AT**.

- Better dialer performance is possible if the modem is set up to print extended result codes such as **BUSY** when dialing out. This can be done in the **Dialers** file entry if necessary.
- Configure the modem to assert the Carrier Detect (CD, also DCD) signal only when carrier is established with another modem.
- Configure the modem to disconnect the phone call and restore the modem parameters to their saved values when the DTR (Data Terminal Ready) signal is deasserted by the computer.

9.3. Specific examples

In the file **Examples/Dialers.ex** you'll find dialer descriptions for several types of modems, including register setup and switch setting summaries. Since your modems will likely be used for purposes besides PPP (e.g. UUCP or interactive users), it's best to set their default parameters to accommodate dial-in applications and have outgoing UUCP or PPP dialers change them if necessary. The PPP-specific register settings in **Dialers.ex** ensure that an otherwise general-purpose modem will work as well as possible with PPP, for the duration of the PPP session.

In the examples below, we'll show how to configure a typical modern modem, including a picture of its working register settings and a command string that will set it up correctly. We'll also describe what each of those register settings means, so that if you use a different type of modem, you should be able to set it up similarly.

We find that a Telebit T1600 works well with the following register settings:

```
at&v
T1600 - Version LA1.00  - Active Configuration
 B1  E1  L0  M0  Q2  T   V1  X12  Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R3 &S1 &T4 &X0
S000:1  S001=0   S002=43  S003=13 S004=10 S005=8 S006=2  S007:120
S008=2  S009=6   S010=14  S011=70 S012=50 S018=0 S025=5  S026=1
S038=0  S041=0   S045=0   S046=0  S047=4  S048:1 S050=0  S051:6
S056=17 S057=19  S058:2   S059:15 S060=0  S061:0 S062=15 S063:2
S064=0  S068=255 S069=0   S090=0  S093=8  S094=1 S100=0  S102=0
S104=0  S105=1   S111=255 S112=1  S180=2  S181=1 S183=25 S190=1
S253=10 S254=255 S255=255
OK
```

You can make a T1600 work like this by giving it the following command:

```
at &f s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=2tq2x12&c1&d3&s1 &w
```

You can make a Telebit QBlazer work like this by giving it the following command:

```
at &f s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=2tq0x4&c1&d3&s1 &w
```

You can make a Telebit T3000 work like this by giving it the following command:

```
at &f9 s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=1tq2x12&c1&d3&s1 &w
```

The T1600 string accomplishes the following:

&f	Loads factory default settings.
s0=1	Answer after one ring.
s7=120	Wait 120 seconds for a valid carrier tone to be sent from the remote modem.
s48=1	Compare all eight bits when checking for control characters.
s51=6	Latch the DTE interface at 38400 bps.
s58=2	Use full-duplex RTS/CTS flow control. When RTS is OFF, the modem will not send data to the local DTE. When RTS is ON the modem sends data to the local DTE.
s59=15	Use the following result code suffixes: Possible link protocol suffixes: nothing, REL, or LAPM Possible compression suffixes: nothing or COMP
s61=0	Local reaction to a break signal on the serial interface is the same as specified in S63.
s63=2	When a break signal is transmitted by the local DTE during an error controlled connection, the modem will discard any buffered data and send the break.
q2	Modem reports result codes when originating a call, but does not return result codes when answering a call.
t	Modem uses DTMF tone dialing.
x12	Result codes include the following: BUSY, DIALING, ERROR, NO CARRIER, NO DIALTONE, OK, RING, RRING, CONNECT 300, CONNECT 1200, CONNECT 2400, CONNECT 4800, CONNECT 7200, CONNECT 9600,

User Guide: Modem parameters

at &f s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=2tq2x12&c1&d3&s1 &w

You can make a Telebit QBlazer work like this by giving it the following command:

at &f s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=2tq0x4&c1&d3&s1 &w

You can make a Telebit T3000 work like this by giving it the following command:

at &f9 s0=1s7=120s48=1s51=6s58=2s59=15s61=0s63=1tq2x12&c1&d3&s1 &w

The T1600 string accomplishes the following:

&f	Loads factory default settings.
s0=1	Answer after one ring.
s7=120	Wait 120 seconds for a valid carrier tone to be sent from the remote modem.
s48=1	Compare all eight bits when checking for control characters.
s51=6	Latch the DTE interface at 38400 bps.
s58=2	Use full-duplex RTS/CTS flow control. When RTS is OFF, the modem will not send data to the local DTE. When RTS is ON the modem sends data to the local DTE.
s59=15	Use the following result code suffixes: Possible link protocol suffixes: nothing, REL, or LAPM Possible compression suffixes: nothing or COMP
s61=0	Local reaction to a break signal on the serial interface is the same as specified in S63.
s63=2	When a break signal is transmitted by the local DTE during an error controlled connection, the modem will discard any buffered data and send the break.
q2	Modem reports result codes when originating a call, but does not return result codes when answering a call.
t	Modem uses DTMF tone dialing.
x12	Result codes include the following: BUSY, DIALING, ERROR, NO CARRIER, NO DIALTONE, OK, RING, RRING, CONNECT 300, CONNECT 1200, CONNECT 2400, CONNECT 4800, CONNECT 7200, CONNECT 9600,

53

CONNECT 12000, CONNECT 14400, CONNECT 19200, and CONNECT 38400.

&c1 When a carrier is detected from the remote modem, the DCD signal is turned ON after the CONNECT result code is sent to the DTE. The DCD signal is turned OFF when the carrier is dropped.

&d3 The modem resets and enters command mode when the DTR signal is switched from ON to OFF, recalling the current user configuration parameters from nonvolatile memory.

&s1 DSR is ON after the answer tone is detected and stays ON throughout the connection.

&w Save the current configuration settings to nonvolatile RAM.

If you have some other sort of modem that's not described here, you should configure it with similar functions (e.g. RTS/CTS flow control) using that modem's own command set and register semantics. Several modem types are described in **Dialers.ex**.

10. Interoperability with other PPP implementations

Morning Star PPP has been tested with several other PPP implementations, including the Telebit NetBlazer, FTP Software's PC/TCP, Novell's LAN WorkPlace for DOS, Brixton Systems' BrxPPP, SCO PPP, the cisco AGS and CGS, the 3Com NETBuilder, the Proteon cnx500, the Network Application Technology LANB-820, the Xylogics Annex-3, Xyplex terminal servers, Merit's PPP servers, KA9Q, and the Perkins/Clements/Fox/Christy free PPP for SunOS. It has also run successfully (in SLIP mode) with the SLIP implementations in several types of terminal servers, PCs, LAN probes, Macintoshes, and other workstations.

10.1. The Telebit NetBlazer

Morning Star PPP has been successfully tested with version 1.41x11 of Telebit's NetBlazer software. If your NetBlazer is running an earlier release, you may need to put *novjcomp* on the *pppd* command line.

10.1.1. Dialing into a NetBlazer from a UNIX system

This configuration can occur when several remote workstations dial into a NetBlazer serving as a hub for a LAN, or when connecting a remote workstation or LAN to the Internet through an IP connectivity vendor's NetBlazer POP.

Morning Star PPP version 1.4.1

CONNECT 12000, CONNECT 14400, CONNECT 19200, and CONNECT 38400.

&c1 When a carrier is detected from the remote modem, the DCD signal is turned ON after the CONNECT result code is sent to the DTE. The DCD signal is turned OFF when the carrier is dropped.

&d3 The modem resets and enters command mode when the DTR signal is switched from ON to OFF, recalling the current user configuration parameters from nonvolatile memory.

&s1 DSR is ON after the answer tone is detected and stays ON throughout the connection.

&w Save the current configuration settings to nonvolatile RAM.

If you have some other sort of modem that's not described here, you should configure it with similar functions (e.g. RTS/CTS flow control) using that modem's own command set and register semantics. Several modem types are described in **Dialers.ex**.

10. Interoperability with other PPP implementations

Morning Star PPP has been tested with several other PPP implementations, including the Telebit NetBlazer, FTP Software's PC/TCP, Novell's LAN WorkPlace for DOS, Brixton Systems' BrxPPP, SCO PPP, the cisco AGS and CGS, the 3Com NETBuilder, the Proteon cnx500, the Network Application Technology LANB-820, the Xylogics Annex-3, Xyplex terminal servers, Merit's PPP servers, KA9Q, and the Perkins/Clements/Fox/Christy free PPP for SunOS. It has also run successfully (in SLIP mode) with the SLIP implementations in several types of terminal servers, PCs, LAN probes, Macintoshes, and other workstations.

10.1. The Telebit NetBlazer

Morning Star PPP has been successfully tested with version 1.41x11 of Telebit's NetBlazer software. If your NetBlazer is running an earlier release, you may need to put *novjcomp* on the *pppd* command line.

10.1.1. Dialing into a NetBlazer from a UNIX system

This configuration can occur when several remote workstations dial into a NetBlazer serving as a hub for a LAN, or when connecting a remote workstation or LAN to the Internet through an IP connectivity vendor's NetBlazer POP.

54

10.1.1.1. Configuring the NetBlazer to receive the call from the UNIX system

The NetBlazer may be set up as if the UNIX machine were just another remote 'dynamic-interface' NetBlazer, using the PPP encapsulation protocol in 'packet mode'.

Configure the NetBlazer as described in chapter 3 of the NetBlazer Reference Manual, noting particularly the discussion of the *ipdial* command in the section on Setting Up Remote IP Destinations. When queried for 'Name of dial IP interface to add', respond with the name of the UNIX system. Morning Star PPP's authentication mechanisms have not been tested with the NetBlazer's 'crypto handshake'. Use PPP rather than SLIP, and specify 1500 for the MTU. When asked to enter the password for the dial-in user for use by the UNIX system, note that password for later inclusion in the UNIX system's **Systems** entry that describes how to dial into this NetBlazer.

10.1.1.2. Configuring the UNIX system to call the NetBlazer

In your UNIX system's **Systems** file, the username provided by the login portion of the chat script will be the name of the UNIX system itself. The password will be the one provided when arranging for the dial-in user on the NetBlazer.

In your **$PPPHOME/Startup** shell script (called from **/etc/rc.local**), start the Morning Star PPP daemon as you normally would when calling another MST PPP site.

10.1.2. Dialing into a UNIX system from a NetBlazer

This arrangement would occur if a hub NetBlazer needed to connect on demand to several remote workstations.

10.1.2.1. Configuring the UNIX system to receive the call from the NetBlazer

In order to accommodate a NetBlazer dialing into a UNIX system running Morning Star PPP, the following changes must be made to the UNIX system. First, make an entry in **/etc/gettytab** that's a duplicate of the entry you would normally have used, except with the addition of the **:p8:** (8 bits, no parity) parameter[29] (see **gettytab**(5)), like this:

[28] The **:p8** *gettytab* parameter works in SunOS 4.1 and later versions, and on other operating systems supported by Morning Star PPP, but a bug in **login** caused **:p8:** not to work in SunOS 4.0.

User Guide: Interoperability

10.1.1.1. Configuring the NetBlazer to receive the call from the UNIX system

The NetBlazer may be set up as if the UNIX machine were just another remote 'dynamic-interface' NetBlazer, using the PPP encapsulation protocol in 'packet mode'.

Configure the NetBlazer as described in chapter 3 of the NetBlazer Reference Manual, noting particularly the discussion of the *ipdial* command in the section on Setting Up Remote IP Destinations. When queried for 'Name of dial IP interface to add', respond with the name of the UNIX system. Morning Star PPP's authentication mechanisms have not been tested with the NetBlazer's 'crypto handshake'. Use PPP rather than SLIP, and specify 1500 for the MTU. When asked to enter the password for the dial-in user for use by the UNIX system, note that password for later inclusion in the UNIX system's **Systems** entry that describes how to dial into this NetBlazer.

10.1.1.2. Configuring the UNIX system to call the NetBlazer

In your UNIX system's **Systems** file, the username provided by the login portion of the chat script will be the name of the UNIX system itself. The password will be the one provided when arranging for the dial-in user on the NetBlazer.

In your **$PPPHOME/Startup** shell script (called from **/etc/rc.local**), start the Morning Star PPP daemon as you normally would when calling another MST PPP site.

10.1.2. Dialing into a UNIX system from a NetBlazer

This arrangement would occur if a hub NetBlazer needed to connect on demand to several remote workstations.

10.1.2.1. Configuring the UNIX system to receive the call from the NetBlazer

In order to accommodate a NetBlazer dialing into a UNIX system running Morning Star PPP, the following changes must be made to the UNIX system. First, make an entry in **/etc/gettytab** that's a duplicate of the entry you would normally have used, except with the addition of the **:p8:** (8 bits, no parity) parameter[29] (see **gettytab**(5)), like this:

[28] The **:p8** *gettytab* parameter works in SunOS 4.1 and later versions, and on other operating systems supported by Morning Star PPP, but a bug in **login** caused **:p8:** not to work in SunOS 4.0.

55

```
h|std.38400|38400-baud:sp#38400:
w|P.38400|38400-baud:sp#38400:p8:
```

Then change **/etc/ttytab** to use the new entry, like this:

```
#ttya   "/usr/etc/getty std.38400"      dialup  on
ttya    "/usr/etc/getty P.38400"        dialup  on
```

This change in parity will have an adverse effect on the ability of some other users with other machines and other applications to dial into this port. Future releases of the NetBlazer software may include the ability to talk to a typical 7-bit UNIX *getty*, so the **:p8:** switch would become unnecessary, and all normal UNIX dial-ins would work as expected.

The login shell script for the NetBlazer's incoming connection must tell the NetBlazer what it expects to hear ('Packet mode enabled') before starting the PPP LCP option negotiation phase of the connection. Make the file **$PPPHOME/Login-netblazer** look like this:

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
echo Packet mode enabled
exec pppd `hostname`: idle 130 rtscts
```

Make sure it is executable:

```
# chmod 755 /etc/ppp/Login-netblazer
```

Don't specify *rtscts* if you're on a NeXT system; use 'cufa' for outbound links and **ttydfa** in **/etc/ttys** instead.

If the NetBlazer hangs up before it sees the 'Packet Mode Enabled' welcome message, it could be seeing too much text from the UNIX system first. You can keep that 'user' from seeing the **/etc/motd** by saying

```
# touch ~netblazer-login/.hushlogin
```

where *netblazer-login* is the name of the Netblazer's entry in the UNIX system's **passwd** database.

Morning Star PPP version 1.4.1

```
h|std.38400|38400-baud:sp#38400:
w|P.38400|38400-baud:sp#38400:p8:
```

Then change **/etc/ttytab** to use the new entry, like this:

```
#ttya   "/usr/etc/getty std.38400"      dialup  on
ttya    "/usr/etc/getty P.38400"        dialup  on
```

This change in parity will have an adverse effect on the ability of some other users with other machines and other applications to dial into this port. Future releases of the NetBlazer software may include the ability to talk to a typical 7-bit UNIX *getty*, so the **:p8:** switch would become unnecessary, and all normal UNIX dial-ins would work as expected.

The login shell script for the NetBlazer's incoming connection must tell the NetBlazer what it expects to hear ('Packet mode enabled') before starting the PPP LCP option negotiation phase of the connection. Make the file **$PPPHOME/Login-netblazer** look like this:

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
echo Packet mode enabled
exec pppd `hostname`: idle 130 rtscts
```

Make sure it is executable:

```
# chmod 755 /etc/ppp/Login-netblazer
```

Don't specify *rtscts* if you're on a NeXT system; use 'cufa' for outbound links and **ttydfa** in **/etc/ttys** instead.

If the NetBlazer hangs up before it sees the 'Packet Mode Enabled' welcome message, it could be seeing too much text from the UNIX system first. You can keep that 'user' from seeing the **/etc/motd** by saying

```
# touch ~netblazer-login/.hushlogin
```

where *netblazer-login* is the name of the Netblazer's entry in the UNIX system's **passwd** database.

56

10.1.2.2. Configuring the NetBlazer to call the UNIX system

Add the following entry to the NetBlazer's CHAT.TXT file:

```
# For a UNIX system running Morning Star Technologies PPP
#  no crypto challenge/response, longer timeouts, short
#  expect strings login shell script must `echo Packet mode
#  enabled` before `exec pppd`
:unix
e1,20,30,2,in:
u2,5,100,3
s3,5,100,4,\r
e4,10,30,5,word:
o99,Packet mode enabled
p5,5,100,6
s6,5,100,7,\r
e7,20,30,99,Packet mode enabled
o32,in:

s30,5,100,31,\r\r
e31,20,100,32,in:
u32,5,100,33
s33,5,100,34,\r
e34,10,100,35,word:
o99,Packet mode enabled
p35,5,100,36
s36,5,100,37,\r
e37,20,100,99,Packet mode enabled
o100,in:

r99,0
r100,1
#
```

You'll need to reboot the NetBlazer to cause any CHAT.TXT changes to take effect.

When configuring the NetBlazer's dynamic interface to call the UNIX system as described above in the section on **Configuring the NetBlazer to receive the call from the UNIX system**, specify **unix** for the chat script, rather than the default **ics**.

10.2. FTP Software Inc's PC/TCP Network Software for DOS

Morning Star PPP interoperates with version 2.2 of FTP Software's PC/TCP PPP implementation with no special accommodations.

Morning Star PPP interoperates with version 2.10 or 2.11 of FTP Software's PC/TCP PPP (PC-227) implementation, but with some adjustments. You must specify **nolqm** on the *pppd* command line because that version of PC/TCP PPP doesn't correctly Configure-Reject LQM during LCP

User Guide: Interoperability

10.1.2.2. Configuring the NetBlazer to call the UNIX system

Add the following entry to the NetBlazer's CHAT.TXT file:

```
# For a UNIX system running Morning Star Technologies PPP
#  no crypto challenge/response, longer timeouts, short
#  expect strings login shell script must `echo Packet mode
#  enabled` before `exec pppd`
:unix
e1,20,30,2,in:
u2,5,100,3
s3,5,100,4,\r
e4,10,30,5,word:
o99,Packet mode enabled
p5,5,100,6
s6,5,100,7,\r
e7,20,30,99,Packet mode enabled
o32,in:

s30,5,100,31,\r\r
e31,20,100,32,in:
u32,5,100,33
s33,5,100,34,\r
e34,10,100,35,word:
o99,Packet mode enabled
p35,5,100,36
s36,5,100,37,\r
e37,20,100,99,Packet mode enabled
o100,in:

r99,0
r100,1
#
```

You'll need to reboot the NetBlazer to cause any CHAT.TXT changes to take effect.

When configuring the NetBlazer's dynamic interface to call the UNIX system as described above in the section on **Configuring the NetBlazer to receive the call from the UNIX system**, specify **unix** for the chat script, rather than the default **ics**.

10.2. FTP Software Inc's PC/TCP Network Software for DOS

Morning Star PPP interoperates with version 2.2 of FTP Software's PC/TCP PPP implementation with no special accommodations.

Morning Star PPP interoperates with version 2.10 or 2.11 of FTP Software's PC/TCP PPP (PC-227) implementation, but with some adjustments. You must specify **nolqm** on the *pppd* command line because that version of PC/TCP PPP doesn't correctly Configure-Reject LQM during LCP

57

negotiations.

If your PC is running version 2.05 of PC/TCP, you must specify both **rfc1172-addresses** and **nolqm** on the *pppd* command line.

10.2.1. Getting ready for a DOS PC to dial into a UNIX system

The Login script used by the PC should specify the IP addresses of both the UNIX system and the PC, and should specify **passive** to smooth the option negotiation process, along with **nolqm** if the PC/TCP predates version 2.2. It should not specify an idle timer because PC/TCP is unable to re-open a timed-out connection.

10.2.2. Getting a DOS PC ready to dial into a UNIX system

The PC should be configured as described in FTP Software's manual. No special arrangements are required in order to talk to a UNIX system running Morning Star PPP.

10.3. Novell LAN WorkPlace for DOS

Morning Star PPP Interoperates with version 4.1 of Novell's Lan WorkPlace for DOS. It appears that you must specify both the UNIX system's IP address, as well as the PC's IP address, on the MST *pppd* command line. Negotiations will progress a little faster if you specify **rfc1172-addresses** as well.

10.4. Brixton Systems' BrxPPP

Morning Star PPP interoperates with version 1.2.1 of Brixton Systems' BrxPPP software for SPARC systems. You must specify either **echolqm** or **nolqm** on the MST *pppd* command line, because BrxPPP doesn't yet support the new style of Link Quality Monitoring, yet doesn't respond with a Configure-Reject during LCP negotiations.

10.5. SCO UNIX/ODT PPP

Morning Star PPP interoperates with the PPP implementation included with SCO TCP/IP version 1.2 (also part of SCO Open Desktop 2.0). You must specify **asyncmap 0xffffffff** on the MST *pppd* command line, because SCO's PPP doesn't comply with the second full paragraph of section 5 of RFC 1548, and the associated Implementation Note.

This problem is reportedly fixed in the PPP included with SCO Open Desktop 3.0 (TCP/IP 1.2.1), so that the **asyncmap 0xffffffff** is no longer required on the MST *pppd* command line. However, you must specify either

Morning Star PPP version 1.4.1

negotiations.

If your PC is running version 2.05 of PC/TCP, you must specify both **rfc1172-addresses** and **nolqm** on the *pppd* command line.

10.2.1. Getting ready for a DOS PC to dial into a UNIX system

The Login script used by the PC should specify the IP addresses of both the UNIX system and the PC, and should specify **passive** to smooth the option negotiation process, along with **nolqm** if the PC/TCP predates version 2.2. It should not specify an idle timer because PC/TCP is unable to re-open a timed-out connection.

10.2.2. Getting a DOS PC ready to dial into a UNIX system

The PC should be configured as described in FTP Software's manual. No special arrangements are required in order to talk to a UNIX system running Morning Star PPP.

10.3. Novell LAN WorkPlace for DOS

Morning Star PPP Interoperates with version 4.1 of Novell's Lan WorkPlace for DOS. It appears that you must specify both the UNIX system's IP address, as well as the PC's IP address, on the MST *pppd* command line. Negotiations will progress a little faster if you specify **rfc1172-addresses** as well.

10.4. Brixton Systems' BrxPPP

Morning Star PPP interoperates with version 1.2.1 of Brixton Systems' BrxPPP software for SPARC systems. You must specify either **echolqm** or **nolqm** on the MST *pppd* command line, because BrxPPP doesn't yet support the new style of Link Quality Monitoring, yet doesn't respond with a Configure-Reject during LCP negotiations.

10.5. SCO UNIX/ODT PPP

Morning Star PPP interoperates with the PPP implementation included with SCO TCP/IP version 1.2 (also part of SCO Open Desktop 2.0). You must specify **asyncmap 0xffffffff** on the MST *pppd* command line, because SCO's PPP doesn't comply with the second full paragraph of section 5 of RFC 1548, and the associated Implementation Note.

This problem is reportedly fixed in the PPP included with SCO Open Desktop 3.0 (TCP/IP 1.2.1), so that the **asyncmap 0xffffffff** is no longer required on the MST *pppd* command line. However, you must specify either

58

echolqm or **nolqm** on the MST *pppd* command line, since SCO's PPP by default doesn't respond with a Configure-Reject during LCP negotiations. You must also either instruct the SCO PPP to send its IP address during IPCP negotiations, or specify either **rfc1172-addresses** or both the local and remote IP addresses on the MST *pppd* command line.

10.6. Network Application Technology LANB-820

Morning Star PPP interoperates with Network Application Technology's LANB-820 router. You must specify the **nomru**, **nomagic**, **noipaddress**, and **nolqm** options on the *pppd* command line, or the NAT router will send malformed LCP Configure-Ack messages to MST PPP.

10.7. Proteon cnx500

Morning Star PPP interoperates with the Proteon cnx500 router, if the cnx500 is running software load 'V12.0c [PPP fix]', 12.1, or release 13.

10.8. Xylogics Annex-3

Morning Star PPP interoperates with the Xylogics Annex-3 communications server running v7.0.10beta of the Annex firmware. You must specify **rfc1172-vj** on the *pppd* command line, else your interactive responsiveness will suffer.

10.9. Xyplex Terminal Servers

Morning Star PPP interoperates with Xyplex terminal servers running PPP. You must specify either **echolqm** or **nolqm** on the *pppd* command line unless the Xyplex terminal server is running software "special" version V5-0-1S19.

10.10. Livingston Portmaster

Morning Star PPP interoperates with the Livingston Portmaster 2e terminal server/dialup router. No special measures are needed for the UNIX system to dial into the Portmaster. When the Portmaster is dialing into the UNIX system, the Login script should look something like

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
echo PPP
exec pppd `hostname`: idle 300 rtscts
```


User Guide: Interoperability

echolqm or **nolqm** on the MST *pppd* command line, since SCO's PPP by default doesn't respond with a Configure-Reject during LCP negotiations. You must also either instruct the SCO PPP to send its IP address during IPCP negotiations, or specify either **rfc1172-addresses** or both the local and remote IP addresses on the MST *pppd* command line.

10.6. Network Application Technology LANB-820

Morning Star PPP interoperates with Network Application Technology's LANB-820 router. You must specify the **nomru**, **nomagic**, **noipaddress**, and **nolqm** options on the *pppd* command line, or the NAT router will send malformed LCP Configure-Ack messages to MST PPP.

10.7. Proteon cnx500

Morning Star PPP interoperates with the Proteon cnx500 router, if the cnx500 is running software load 'V12.0c [PPP fix]', 12.1, or release 13.

10.8. Xylogics Annex-3

Morning Star PPP interoperates with the Xylogics Annex-3 communications server running v7.0.10beta of the Annex firmware. You must specify **rfc1172-vj** on the *pppd* command line, else your interactive responsiveness will suffer.

10.9. Xyplex Terminal Servers

Morning Star PPP interoperates with Xyplex terminal servers running PPP. You must specify either **echolqm** or **nolqm** on the *pppd* command line unless the Xyplex terminal server is running software "special" version V5-0-1S19.

10.10. Livingston Portmaster

Morning Star PPP interoperates with the Livingston Portmaster 2e terminal server/dialup router. No special measures are needed for the UNIX system to dial into the Portmaster. When the Portmaster is dialing into the UNIX system, the Login script should look something like

```
#!/bin/sh

PATH=/usr/bin:/usr/etc:/usr/ucb:/usr/bsd:/etc:/bin

mesg n
stty -tostop
echo PPP
exec pppd `hostname`: idle 300 rtscts
```

59

Note the additional 'echo PPP' to accommodate the Portmaster's chat script needs.

10.11. KA9Q

Morning Star PPP interoperates with the KA9Q NOS PPP implementation for MS-DOS. You must specify **nolqm** on the *pppd* command line, else your link will be terminated within one minute of connection.

10.12. The Free UNIX-based PPP implementations

Several PPP implementations for UNIX systems are freely available, though not in the public domain. Many are based on the work by Drew Perkins, Greg Clements, Karl Fox, Greg Christy, and other maintainers and contributors since. They seem to share a common bug, as discussed in the section on Link Quality Monitoring above: You must specify **echolqm** on the *pppd* command line, else your link will be terminated within one minute of connection.

10.13. HP LanProbe

Morning Star PPP, running in its SLIP mode, interoperates with the SLIP implementation in the Hewlett-Packard HP 4995A LanProbe II/Ethernet. You must specify **extra-slip-end** on the *pppd* command line.

11. Getting Help

If you obtained Morning Star PPP from a reseller, please contact that organization's own technical support staff for assistance with your installation, configuration, and any other problems you might encounter. If that reseller needs help, they will coordinate the problem resolution with Morning Star Technologies' support staff.

If you bought Morning Star PPP directly from Morning Star Technologies, call our technical support center at +1 800 558 7827 or +1 614 451 1883, or send a FAX to +1 614 459 5054, or send electronic mail to

```
Support@MorningStar.Com
```

Electronic mail is usually the best way to discuss issues with Morning Star's technical support staff, because it will receive the attention of a large group of people, because it may be dealt with at any time of the day or night, and because all the necessary information (configuration and log files, etc.) is readily available to everyone at MST who might be able to offer assistance.

Morning Star PPP version 1.4.1

Note the additional 'echo PPP' to accommodate the Portmaster's chat script needs.

10.11. KA9Q

Morning Star PPP interoperates with the KA9Q NOS PPP implementation for MS-DOS. You must specify **nolqm** on the *pppd* command line, else your link will be terminated within one minute of connection.

10.12. The Free UNIX-based PPP implementations

Several PPP implementations for UNIX systems are freely available, though not in the public domain. Many are based on the work by Drew Perkins, Greg Clements, Karl Fox, Greg Christy, and other maintainers and contributors since. They seem to share a common bug, as discussed in the section on Link Quality Monitoring above: You must specify **echolqm** on the *pppd* command line, else your link will be terminated within one minute of connection.

10.13. HP LanProbe

Morning Star PPP, running in its SLIP mode, interoperates with the SLIP implementation in the Hewlett-Packard HP 4995A LanProbe II/Ethernet. You must specify **extra-slip-end** on the *pppd* command line.

11. Getting Help

If you obtained Morning Star PPP from a reseller, please contact that organization's own technical support staff for assistance with your installation, configuration, and any other problems you might encounter. If that reseller needs help, they will coordinate the problem resolution with Morning Star Technologies' support staff.

If you bought Morning Star PPP directly from Morning Star Technologies, call our technical support center at +1 800 558 7827 or +1 614 451 1883, or send a FAX to +1 614 459 5054, or send electronic mail to

Support@MorningStar.Com

Electronic mail is usually the best way to discuss issues with Morning Star's technical support staff, because it will receive the attention of a large group of people, because it may be dealt with at any time of the day or night, and because all the necessary information (configuration and log files, etc.) is readily available to everyone at MST who might be able to offer assistance.

60

Join the electronic mailing list of Morning Star PPP users to share hints, tips, critiques, feature suggestions, questions about configuration quirks, and anything else related to the product. Morning Star will announce new releases and newly-supported hardware on the list. Our engineering, support, and marketing departments are well represented on the list, so that we can listen to your concerns and offer help too.

To send a message to the other members of the list, address it to

```
PPP-Users@MorningStar.Com
```

To request addition to the list, write to

```
PPP-Users-request@MorningStar.Com
```

12. Getting updated software and documentation

You can reach the Morning Star Technologies support server via anonymous FTP over the Internet by connecting to ftp.MorningStar.Com.

If you are not connected to the Internet, then you can dial into the support server's modems to establish a private temporary PPP link. Install entries in your **Systems** file, as found in **$PPPHOME/Systems.ex**, so that you can dial into 137.175.42.42 using your system's own modems. Then start a *pppd* as described in **$PPPHOME/Startup.ex**.

Use 'ping' or 'ftp' to 137.175.42.42 to cause pppd to dial the Morning Star Technologies support machine. If you use ftp, it will fail to connect because the IP session addresses on your local machine are not assigned until login is complete, so you will need to run ftp again. Once the PPP link is up, open an ftp session to 137.175.42.42 (or to ftp.MorningStar.Com if you are coming in over the Internet rather than dialing directly). When you are asked, provide the user name 'anonymous' and provide your e-mail address for the password. Navigate the archive using the standard ftp commands, and retrieve the files you need. When you request a file that is protected, you will be denied access until you provide the correct group password for that file. While your software is under warranty, or while you have a current support contract, you can get a valid password from the Morning Star Technologies support hotline.

In the example below, the requester wanted to get the current MST PPP distribution for DECstations running Ultrix, but received the "550 ... Permission denied" response before identifying herself to the FTP server. Upon calling MST's support hotline, since her support agreement was effective through December of 1993, she found that she could use the group password 'blURfg3l' to get the software. That password will be valid through

User Guide: Getting Help

Join the electronic mailing list of Morning Star PPP users to share hints, tips, critiques, feature suggestions, questions about configuration quirks, and anything else related to the product. Morning Star will announce new releases and newly-supported hardware on the list. Our engineering, support, and marketing departments are well represented on the list, so that we can listen to your concerns and offer help too.

To send a message to the other members of the list, address it to

PPP-Users@MorningStar.Com

To request addition to the list, write to

PPP-Users-request@MorningStar.Com

12. Getting updated software and documentation

You can reach the Morning Star Technologies support server via anonymous FTP over the Internet by connecting to ftp.MorningStar.Com.

If you are not connected to the Internet, then you can dial into the support server's modems to establish a private temporary PPP link. Install entries in your **Systems** file, as found in **$PPPHOME/Systems.ex**, so that you can dial into 137.175.42.42 using your system's own modems. Then start a *pppd* as described in **$PPPHOME/Startup.ex**.

Use 'ping' or 'ftp' to 137.175.42.42 to cause pppd to dial the Morning Star Technologies support machine. If you use ftp, it will fail to connect because the IP session addresses on your local machine are not assigned until login is complete, so you will need to run ftp again. Once the PPP link is up, open an ftp session to 137.175.42.42 (or to ftp.MorningStar.Com if you are coming in over the Internet rather than dialing directly). When you are asked, provide the user name 'anonymous' and provide your e-mail address for the password. Navigate the archive using the standard ftp commands, and retrieve the files you need. When you request a file that is protected, you will be denied access until you provide the correct group password for that file. While your software is under warranty, or while you have a current support contract, you can get a valid password from the Morning Star Technologies support hotline.

In the example below, the requester wanted to get the current MST PPP distribution for DECstations running Ultrix, but received the "550 ... Permission denied" response before identifying herself to the FTP server. Upon calling MST's support hotline, since her support agreement was effective through December of 1993, she found that she could use the group password 'blURfg3l' to get the software. That password will be valid through

61

the end of her support agreement, and she will use it at her convenience to get new software from time to time.

Here is a typical session:

```
5:44pm> ftp -v ftp.MorningStar.Com
Connected to remora.MorningStar.Com.
220 remora FTP server (Version 6.14 Thu Dec 26
    11:24:28 EST 1993) ready.
Name (ftp.MorningStar.Com:jru): anonymous
331 Guest login ok, send e-mail address as password.
Password:
230-Welcome to the Morning Star Technologies
    support server at Thu Dec 26 17:44:13 1993
230-
230 Guest login ok, access restrictions apply.
ftp> cd pub/ppp
250 CWD command successful.
ftp> bin
200 Type set to I.
ftp> hash
Hash mark printing on (8192 bytes/hash mark).
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for /bin/ls.
total 2801
-rw-r--r-- 1 59 staff    1365 Jul 15 21:26 Free-SLIP-and-PPP
-rw-rw-r-- 2 59 staff    2884 Dec 17 05:01 MST-PPP-At-A-Glance
-rw-r--r-- 2 56 staff  269671 Aug 16 20:13 PPP-Literature.ps.Z
-rw-r--r-- 1 59 staff  371586 Sep  6 16:46 PPP-Literature.ps.Z.uue
-rw-r--r-- 2 56 staff    4018 Aug 22 13:24 PPP-Literature.txt
-rw-rw-r-- 2 59 staff    3784 Aug 22 12:27 PPP-Sun-comp.newprod
-rw-r--r-- 2 59 staff    3049 Aug 14 13:55 PPP-Sun-press-release
-rw-r----- 1 59 sparc  400445 Dec 26 18:16 mst-sparc-ppp-1.4.tar.Z
-rw-r----- 1 59 ultrix 400589 Dec 26 21:54 mst-ultrix-ppp-1.4.tar.Z
-rw-rw-r-- 1 59 daemon   8397 Oct 30 20:22 ppp-button.ps
-rw-rw-r-- 2 59 daemon 121881 Dec 24 02:33 ppp-doc.shar.Z
-rw-r--r-- 1 51 staff  425209 Jul 16 02:02 ppp-mail-archive.Z
-rw-rw-r-- 1 51 staff   22840 Oct 28 12:45 ppp-refcard-back.ps.Z
-rw-rw-r-- 1 51 staff   15814 Oct 28 12:45 ppp-refcard-front.ps.Z
-rw-rw-r-- 3 59 staff  176186 Dec 20 21:31 ppp-users-mail-archive
drwxrwsr-x 2 59 staff     512 Nov 16 05:59 rfc
-rw-rw-r-- 2 59 daemon 112901 Dec 24 02:33 user-guide-1up.ps.Z
-rw-rw-r-- 2 59 daemon 121001 Dec 24 02:33 user-guide-2up.ps.Z
-rw-rw-r-- 1 59 staff  164580 Dec 19 12:25 user-guide-2up.ps.Z.uue
-rw-rw-r-- 1 59 daemon 121395 Dec 24 02:33 user-guide-book.ps.Z
#
226 Transfer complete.
1510 bytes received in 0.77 seconds (1.9 Kbytes/s)
ftp> get user-guide-2up.ps.Z
200 PORT command successful.
```


Morning Star PPP version 1.4.1

the end of her support agreement, and she will use it at her convenience to get new software from time to time.

Here is a typical session:

```
5:44pm> ftp -v ftp.MorningStar.Com
Connected to remora.MorningStar.Com.
220 remora FTP server (Version 6.14 Thu Dec 26
    11:24:28 EST 1993) ready.
Name (ftp.MorningStar.Com:jru): anonymous
331 Guest login ok, send e-mail address as password.
Password:
230-Welcome to the Morning Star Technologies
    support server at Thu Dec 26 17:44:13 1993
230-
230 Guest login ok, access restrictions apply.
ftp> cd pub/ppp
250 CWD command successful.
ftp> bin
200 Type set to I.
ftp> hash
Hash mark printing on (8192 bytes/hash mark).
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for /bin/ls.
total 2801
-rw-r--r-- 1 59 staff    1365 Jul 15 21:26 Free-SLIP-and-PPP
-rw-rw-r-- 2 59 staff    2884 Dec 17 05:01 MST-PPP-At-A-Glance
-rw-r--r-- 2 56 staff  269671 Aug 16 20:13 PPP-Literature.ps.Z
-rw-r--r-- 1 59 staff  371586 Sep  6 16:46 PPP-Literature.ps.Z.uue
-rw-r--r-- 2 56 staff    4018 Aug 22 13:24 PPP-Literature.txt
-rw-rw-r-- 2 59 staff    3784 Aug 22 12:27 PPP-Sun-comp.newprod
-rw-r--r-- 2 59 staff    3049 Aug 14 13:55 PPP-Sun-press-release
-rw-r----- 1 59 sparc  400445 Dec 26 18:16 mst-sparc-ppp-1.4.tar.Z
-rw-r----- 1 59 ultrix 400589 Dec 26 21:54 mst-ultrix-ppp-1.4.tar.Z
-rw-rw-r-- 1 59 daemon   8397 Oct 30 20:22 ppp-button.ps
-rw-rw-r-- 2 59 daemon 121881 Dec 24 02:33 ppp-doc.shar.Z
-rw-r--r-- 1 51 staff  425209 Jul 16 02:02 ppp-mail-archive.Z
-rw-rw-r-- 1 51 staff   22840 Oct 28 12:45 ppp-refcard-back.ps.Z
-rw-rw-r-- 1 51 staff   15814 Oct 28 12:45 ppp-refcard-front.ps.Z
-rw-rw-r-- 3 59 staff  176186 Dec 20 21:31 ppp-users-mail-archive
drwxrwsr-x 2 59 staff     512 Nov 16 05:59 rfc
-rw-rw-r-- 2 59 daemon 112901 Dec 24 02:33 user-guide-1up.ps.Z
-rw-rw-r-- 2 59 daemon 121001 Dec 24 02:33 user-guide-2up.ps.Z
-rw-rw-r-- 1 59 staff  164580 Dec 19 12:25 user-guide-2up.ps.Z.uue
-rw-rw-r-- 1 59 daemon 121395 Dec 24 02:33 user-guide-book.ps.Z
#
226 Transfer complete.
1510 bytes received in 0.77 seconds (1.9 Kbytes/s)
ftp> get user-guide-2up.ps.Z
200 PORT command successful.
```

62

```
150 Opening BINARY mode data connection
    for user-guide-2up.ps.Z (121001 bytes).
##########################
226 Transfer complete.
local: user-guide-2up.ps.Z remote: user-guide-2up.ps.Z
121001 bytes received in 0.74 seconds (1.6e+02 Kbytes/s)
ftp> get mst-ultrix-ppp-1.4.tar.Z
200 PORT command successful.
550 mst-ultrix-ppp-1.4.tar.Z: Permission denied.
ftp> quote site group ultrix9312
200 Request for access to group ultrix9312 accepted.
ftp> quote site gpass blURfg3l
200 Group access enabled.
ftp> get mst-ultrix-ppp-1.4.tar.Z
200 PORT command successful.
150 Opening BINARY mode data connection for
    mst-ultrix-ppp-1.4.tar.Z (400445 bytes).
########################################
########################################
226 Transfer complete.
local: mst-ultrix-ppp-1.4.tar.Z remote: mst-ultrix-ppp-1.4.tar.Z
400445 bytes received in 2.7 seconds (1.5e+02 Kbytes/s)
ftp> quit
221 Goodbye.
5:45pm>
```

Because the scheme used to assign IP addresses to incoming anonymous PPP calls is based on their incoming port, a reconnection attempt after an idle timeout or a line failure may be unsuccessful. If the second call, intended to reconnect the TCP stream, comes in on a different TTY port on MST's PPP server, the calling system will be assigned a different IP address, and the two systems will have no way of reconnecting the TCP streams. Just exit the ftp and start over.

Another characteristic of the auto-dial scheme may cause your first FTP client attempt to be unable to connect with the MST FTP server, even though your PPP daemon is successfully connected. Simply start a new FTP session and continue with the rest of your business.

If you want to use Morning Star's PPP dialups to test your own configuration, you might be surprised or disappointed by some activities that are disallowed by the filters and timers that are in place on the link. The server imposes a 120-second idle timer. Only FTP and ICMP packets are allowed to cross the link. If you try to telnet to 137.175.42.42 you won't get a response, but that's not necessarily because your end is misconfigured. Try using ping(8) or ftp(1) to test the link instead. Also, you may be disappointed that we don't allow IP routing to the rest of our network (nor to the

User Guide: Getting Updates


```
150 Opening BINARY mode data connection
    for user-guide-2up.ps.Z (121001 bytes).
##########################
226 Transfer complete.
local: user-guide-2up.ps.Z remote: user-guide-2up.ps.Z
121001 bytes received in 0.74 seconds (1.6e+02 Kbytes/s)
ftp> get mst-ultrix-ppp-1.4.tar.Z
200 PORT command successful.
550 mst-ultrix-ppp-1.4.tar.Z: Permission denied.
ftp> quote site group ultrix9312
200 Request for access to group ultrix9312 accepted.
ftp> quote site gpass blURfg3l
200 Group access enabled.
ftp> get mst-ultrix-ppp-1.4.tar.Z
200 PORT command successful.
150 Opening BINARY mode data connection for
    mst-ultrix-ppp-1.4.tar.Z (400445 bytes).
########################################
########################################
226 Transfer complete.
local: mst-ultrix-ppp-1.4.tar.Z remote: mst-ultrix-ppp-1.4.tar.Z
400445 bytes received in 2.7 seconds (1.5e+02 Kbytes/s)
ftp> quit
221 Goodbye.
5:45pm>
```


Because the scheme used to assign IP addresses to incoming anonymous PPP calls is based on their incoming port, a reconnection attempt after an idle timeout or a line failure may be unsuccessful. If the second call, intended to reconnect the TCP stream, comes in on a different TTY port on MST's PPP server, the calling system will be assigned a different IP address, and the two systems will have no way of reconnecting the TCP streams. Just exit the ftp and start over.

Another characteristic of the auto-dial scheme may cause your first FTP client attempt to be unable to connect with the MST FTP server, even though your PPP daemon is successfully connected. Simply start a new FTP session and continue with the rest of your business.

If you want to use Morning Star's PPP dialups to test your own configuration, you might be surprised or disappointed by some activities that are disallowed by the filters and timers that are in place on the link. The server imposes a 120-second idle timer. Only FTP and ICMP packets are allowed to cross the link. If you try to telnet to 137.175.42.42 you won't get a response, but that's not necessarily because your end is misconfigured. Try using ping(8) or ftp(1) to test the link instead. Also, you may be disappointed that we don't allow IP routing to the rest of our network (nor to the

general Internet) across these anonymous dialup links, but you shouldn't be surprised.

13. Credits

The *pppd* daemon was written by Karl Fox <karl@MorningStar.Com>, with assistance from Bob Sutterfield <bob@MorningStar.Com>, Kim Toms <kim@MorningStar.Com>, Steve Wilson <steve@MorningStar.Com>, and Laine Stump <laine@MorningStar.Com>. The documentation was written by Bob Sutterfield and revised by Mark Seiden <mis@seiden.com>, Steve Neruda <neruda@MorningStar.Com>, and Aydin Edguer <edguer@MorningStar.Com>. Parts of the PPP protocol engine are derived from code written by Drew Perkins <perkins+@cmu.edu>. The TCP header compression and interactive fast-queue features are derived from code written by Van Jacobson <van@helios.ee.lbl.gov>. The CHAP feature uses the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

14. Copyright Information

Morning Star PPP version 1.4.1

general Internet) across these anonymous dialup links, but you shouldn't be surprised.

13. Credits

The *pppd* daemon was written by Karl Fox <karl@MorningStar.Com>, with assistance from Bob Sutterfield <bob@MorningStar.Com>, Kim Toms <kim@MorningStar.Com>, Steve Wilson <steve@MorningStar.Com>, and Laine Stump <laine@MorningStar.Com>. The documentation was written by Bob Sutterfield and revised by Mark Seiden <mis@seiden.com>, Steve Neruda <neruda@MorningStar.Com>, and Aydin Edguer <edguer@MorningStar.Com>. Parts of the PPP protocol engine are derived from code written by Drew Perkins <perkins+@cmu.edu>. The TCP header compression and interactive fast-queue features are derived from code written by Van Jacobson <van@helios.ee.lbl.gov>. The CHAP feature uses the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

14. Copyright Information

This software and associated documentation is Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies, all rights reserved. It contains software developed at Carnegie Mellon University, which is Copyright © 1989 Carnegie Mellon University, all rights reserved. It contains software developed at the University of California, Berkeley, which is Copyright © 1989 Regents of the University of California, all rights reserved. It contains software that is Copyright © 1990, RSA Data Security, Inc., all rights reserved.

64

NAME

tun – IP network tunnel driver

CONFIG

pseudo-device tun[*n*]

SYNOPSIS

#include <sys/tun.h>
open("/dev/tun*n***", mode);**

DESCRIPTION

When IP packets are written to **/dev/tun***n* or **/dev/tun***n*+*M*, they will be received by the kernel's IP layer on the network interface **du***n*. When the kernel's IP layer sends packets to the IP interface **du***n*, they will be available for reading on **/dev/tun***n* or **/dev/tun***n*+*M*.

Instead of having hardware and an associated kernel interface that support network functions, the **tun** driver allows a network interface to be implemented as a user-space process. While talking to the same set of tunnel drivers on the same system, different network interface processes can implement different IP encapsulation methods, such as RFC 877 for use over CCITT X.25-based public data networks, or RFC 1055 SLIP or RFC 1548/1332 PPP for use over dedicated lines and dialup modems.

The **tun** driver provides support for a pair of devices collectively known as an *IP tunnel*. The two devices comprising a tunnel are known as the *inbound* and *outbound sides*, similar to the pairing between **/dev/tty***n* (the inbound terminal) and **/dev/cu***n* (the outbound 'auto-call unit' available on many systems). The outbound side's minor device number is that of the inbound side plus *M*, though they together appear to IP as one interface. If both the inbound and outbound sides of a tunnel device are open, packets received from IP are delivered to only the inbound side. On BSD systems, *M* is 128. On AIX systems, *M* is 100. On SysV systems, *M* is 64.

If a TCP packet received from IP is part of a telnet, rlogin, or FTP command stream, it will be put in a *fast queue*. All packets in the fast queue are delivered to the user before any packets in the normal queue.

IOCTLS

A few special **ioctl**s are provided for use on the **/dev/tun*** devices to supply the functionality needed by applications programs to emulate real hardware interfaces. The complete list of supported **ioctl**s is:

TUN(4) Morning Star Technologies TUN(4)

NAME

tun – IP network tunnel driver

CONFIG

pseudo-device tun[*n*]

SYNOPSIS

#include <sys/tun.h>
open("/dev/tun*n***", mode);**

DESCRIPTION

When IP packets are written to **/dev/tun***n* or **/dev/tun***n*+*M*, they will be received by the kernel's IP layer on the network interface **du***n*. When the kernel's IP layer sends packets to the IP interface **du***n*, they will be available for reading on **/dev/tun***n* or **/dev/tun***n*+*M*.

Instead of having hardware and an associated kernel interface that support network functions, the **tun** driver allows a network interface to be implemented as a user-space process. While talking to the same set of tunnel drivers on the same system, different network interface processes can implement different IP encapsulation methods, such as RFC 877 for use over CCITT X.25-based public data networks, or RFC 1055 SLIP or RFC 1548/1332 PPP for use over dedicated lines and dialup modems.

The **tun** driver provides support for a pair of devices collectively known as an *IP tunnel*. The two devices comprising a tunnel are known as the *inbound* and *outbound sides*, similar to the pairing between **/dev/tty***n* (the inbound terminal) and **/dev/cu***n* (the outbound 'auto-call unit' available on many systems). The outbound side's minor device number is that of the inbound side plus *M*, though they together appear to IP as one interface. If both the inbound and outbound sides of a tunnel device are open, packets received from IP are delivered to only the inbound side. On BSD systems, *M* is 128. On AIX systems, *M* is 100. On SysV systems, *M* is 64.

If a TCP packet received from IP is part of a telnet, rlogin, or FTP command stream, it will be put in a *fast queue*. All packets in the fast queue are delivered to the user before any packets in the normal queue.

IOCTLS

A few special **ioctl**s are provided for use on the **/dev/tun*** devices to supply the functionality needed by applications programs to emulate real hardware interfaces. The complete list of supported **ioctl**s is:

2 Aug 12 1994 Morning Star IP Tunnel

TUIOSPTPT Set or clear the IFF_POINTOPOINT in the associated network interface. **TUIOSADRMD** Set or clear 'address mode', in which packets read are prefaced with four octets containing the destination IP address in network byte order. The third argument is a pointer to an integer containing either a zero or a one, indicating whether 'address mode' should be cleared or set, respectively. If both 'address mode' and 'packed buffer mode' are set, each packet's length will come first, followed by the packet's destination address, followed by the packet itself.

TUIOGADRMD Get the current status of 'address mode'.

TUIOSPKBMD Set or clear 'packed buffer mode' where multiple packets are encoded in single read/write buffers. The third argument is a pointer to an integer containing either a zero or a one, indicating whether 'packed buffer mode' should be cleared or set, respectively. If set (1), each packet is preceded by four octets representing the next packet's length in octets. The following packet will then be aligned to the next multiple of four octets. If cleared (0), packets will be delivered one per read(3) from the tunnel device. If both 'address mode' and 'packed buffer mode' are set, each packet's length will come first, followed by the packet's address, followed by the packet itself.

TUIOGPKBMD Get the current status of 'packed buffer mode'.

TUIOSPKMAX Set the max number of IP frames to send back in a packet buffer read.

TUIOGPKMAX Get the PKMAX value.

TUIOSPKPAD Set the number of long word zeroes to put on the front of each packet read in packed buffer mode.

TUIOGPKPAD Get the number of pad words.

TUIOSNAME Set the interface name (may only be invoked by the superuser).

TUIOGNAME Get the interface name.

FIONBIO Set or clear non-blocking mode for I/O operations.

TUN(4) Morning Star Technologies TUN(4)

TUIOSPTPT Set or clear the IFF_POINTOPOINT in the associated network interface. **TUIOSADRMD** Set or clear 'address mode', in which packets read are prefaced with four octets containing the destination IP address in network byte order. The third argument is a pointer to an integer containing either a zero or a one, indicating whether 'address mode' should be cleared or set, respectively. If both 'address mode' and 'packed buffer mode' are set, each packet's length will come first, followed by the packet's destination address, followed by the packet itself.

TUIOGADRMD Get the current status of 'address mode'.

TUIOSPKBMD Set or clear 'packed buffer mode' where multiple packets are encoded in single read/write buffers. The third argument is a pointer to an integer containing either a zero or a one, indicating whether 'packed buffer mode' should be cleared or set, respectively. If set (1), each packet is preceded by four octets representing the next packet's length in octets. The following packet will then be aligned to the next multiple of four octets. If cleared (0), packets will be delivered one per read(3) from the tunnel device. If both 'address mode' and 'packed buffer mode' are set, each packet's length will come first, followed by the packet's address, followed by the packet itself.

TUIOGPKBMD Get the current status of 'packed buffer mode'.

TUIOSPKMAX Set the max number of IP frames to send back in a packet buffer read.

TUIOGPKMAX Get the PKMAX value.

TUIOSPKPAD Set the number of long word zeroes to put on the front of each packet read in packed buffer mode.

TUIOGPKPAD Get the number of pad words.

TUIOSNAME Set the interface name (may only be invoked by the superuser).

TUIOGNAME Get the interface name.

FIONBIO Set or clear non-blocking mode for I/O operations.

Morning Star IP Tunnel Aug 12 1994 3

EXAMPLES

```
#include <sys/tun.h>
int tun_fd = -1, len;
char *packet;

tun_fd = open("/dev/tun0", O_RDWR);
ioctl(tun_fd, TUIOSNAME, "du");
len = read(tun_fd, packet, size);
write(tun_fd, packet, len);
```

ERRORS

If a packet is delivered to the interface for an address family other than AF_INET, EAFNOSUPPORT will be returned.

FILES

/dev/tun0 through **/dev/tun***M-1* 'inbound' tunnel devices
/dev/tun*M* through **/dev/tun***2*M-1* 'outbound' tunnel devices

SEE ALSO

if(4n), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055, RFC 877, and (for philosophical comparison only) RFC 1241 and either research.att.com:dist/smb/pnet.ext.ps.Z or ftp.MorningStar.Com:pub/papers/pnet.ext.ps.Z.

COPYRIGHT INFORMATION

TUN(4) Morning Star Technologies TUN(4)

EXAMPLES

```
#include <sys/tun.h>
int tun_fd = -1, len;
char *packet;

tun_fd = open("/dev/tun0", O_RDWR);
ioctl(tun_fd, TUIOSNAME, "du");
len = read(tun_fd, packet, size);
write(tun_fd, packet, len);
```

ERRORS

If a packet is delivered to the interface for an address family other than AF_INET, EAFNOSUPPORT will be returned.

FILES

/dev/tun0 through **/dev/tun***M-1* 'inbound' tunnel devices
/dev/tun*M* through **/dev/tun***2*M-1* 'outbound' tunnel devices

SEE ALSO

if(4n), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055, RFC 877, and (for philosophical comparison only) RFC 1241 and either research.att.com:dist/smb/pnet.ext.ps.Z or ftp.MorningStar.Com:pub/papers/pnet.ext.ps.Z.

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.; all rights reserved.

4 Aug 12 1994 Morning Star IP Tunnel

NAME

ppp.Auth – PPP authentication file format

DESCRIPTION

The file **/etc/ppp/Auth** (or **/usr/lib/ppp/Auth** on SCO systems) contains values used by Morning Star PPP's implementation of the link-level authentication protocols, CHAP (Challenge Handshake Authentication Protocol) and PAP (Password Authentication Protocol). This implementation of both CHAP and PAP conforms to RFC 1334, *PPP Authentication Protocols*. Interoperability with draft versions of CHAP is provided through the use of *pppd*'s **oldchap** or **olderchap** command line options.

CHAP is a stronger authentication mechanism and should be used whenever possible, in preference over PAP.

FORMAT

Each authentication specification is on its own single line of up to 1023 characters. Comments begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Fields are separated by horizontal white space (blanks or tabs).

If *pppd* is using CHAP authentication, the first word on the line must match the peer's *Name* as received in a CHAP Challenge or Response packet and the second word is used for the *Secret*. If *pppd* is using PAP authentication, the first word on the line must match the *Peer-ID* in a transmitted or received PAP Authenticate-Request packet and the second word is used for the *Password*. The default value used for the Name in transmitted CHAP packets or for the Peer-ID in transmitted PAP packets is the *hostname*(1) of the machine *pppd* is running on.

In the midst of the Name/Peer-ID and Secret/Password strings, ^*x* is translated into the appropriate control character before matching, and **\xxx** represents the character corresponding to the octal number **xxx**. Other special sequences are:

\s Matches a space character (ASCII 0x20)

\t Matches a horizontal tab character (ASCII 0x09)

\n Matches a line feed character (ASCII 0x0a)

\r Matches a carriage return character (ASCII 0x0d)

The fields have the following meaning:

PPP.AUTH(5) Morning Star Technologies PPP.AUTH(5)

NAME

ppp.Auth – PPP authentication file format

DESCRIPTION

The file /etc/ppp/Auth (or /usr/lib/ppp/Auth on SCO systems) contains values used by Morning Star PPP's implementation of the link-level authentication protocols, CHAP (Challenge Handshake Authentication Protocol) and PAP (Password Authentication Protocol). This implementation of both CHAP and PAP conforms to RFC 1334, PPP Authentication Protocols. Interoperability with draft versions of CHAP is provided through the use of pppd's oldchap or olderchap command line options.

CHAP is a stronger authentication mechanism and should be used whenever possible, in preference over PAP.

FORMAT

Each authentication specification is on its own single line of up to 1023 characters. Comments begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Fields are separated by horizontal white space (blanks or tabs).

If pppd is using CHAP authentication, the first word on the line must match the peer's Name as received in a CHAP Challenge or Response packet and the second word is used for the Secret. If pppd is using PAP authentication, the first word on the line must match the Peer-ID in a transmitted or received PAP Authenticate-Request packet and the second word is used for the Password. The default value used for the Name in transmitted CHAP packets or for the Peer-ID in transmitted PAP packets is the hostname(1) of the machine pppd is running on.

In the midst of the Name/Peer-ID and Secret/Password strings, ^x is translated into the appropriate control character before matching, and \xxx represents the character corresponding to the octal number xxx. Other special sequences are:

\s Matches a space character (ASCII 0x20)

\t Matches a horizontal tab character (ASCII 0x09)

\n Matches a line feed character (ASCII 0x0a)

\r Matches a carriage return character (ASCII 0x0d)

The fields have the following meaning:

Morning Star PPP 1.4.1 Aug 12 1994 5

name The Name field of a sent or received CHAP Challenge or Response message, or the Peer-ID field of a sent or received PAP Authenticate-Request message. For transmitted packets, this is the hostname unless overridden by the *pppd* **name** option.

secret The secret word that the peer also knows.

optional address restrictions
A set of zero or more patterns restricting the addresses that we will allow to be used with the named peer. Patterns are separated by spaces or tabs and are parsed from left to right. Each pattern may begin with an exclamation mark to indicate that the following pattern should not be allowed. The rest of the pattern consists of digits and periods, and optionally a leading or trailing asterisk, which will match anything. If none of the patterns match, then the address will be allowed if the last pattern began with an exclamation point, and will be disallowed otherwise.

EXAMPLE

The following **Auth** provides *pppd* with a secret for use when a peer claims to be other-host, robin, or 'Jack's machine'.

```
#
#  Auth - PPP authentication name/secret file
#  Format:
#name           secret       optional address restrictions
other-host      secret-key   !137.175.9.2 137.175.9.*/0xffffff00
robin           dK3ig8G8hs   137.175.11.4
Jack's\smachine I\sam\sa\sjelly\sdonut.
```

SECURITY CONCERNS

The file **/etc/ppp/Auth** should be mode 600 or 400, and owned by root.

SEE ALSO

tun(4), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), services(5), pppd(8), RFC 792, RFC 1548, RFC 1332, RFC 1334.

Brian Lloyd and William A. Simpson, "The PPP Authentication

PPP.AUTH(5) Morning Star Technologies PPP.AUTH(5)

name The Name field of a sent or received CHAP Challenge or Response message, or the Peer-ID field of a sent or received PAP Authenticate-Request message. For transmitted packets, this is the hostname unless overridden by the *pppd* **name** option.

secret The secret word that the peer also knows.

optional address restrictions
A set of zero or more patterns restricting the addresses that we will allow to be used with the named peer. Patterns are separated by spaces or tabs and are parsed from left to right. Each pattern may begin with an exclamation mark to indicate that the following pattern should not be allowed. The rest of the pattern consists of digits and periods, and optionally a leading or trailing asterisk, which will match anything. If none of the patterns match, then the address will be allowed if the last pattern began with an exclamation point, and will be disallowed otherwise.

EXAMPLE

The following **Auth** provides *pppd* with a secret for use when a peer claims to be other-host, robin, or 'Jack's machine'.

```
#
#  Auth - PPP authentication name/secret file
#  Format:
#name           secret       optional address restrictions
other-host      secret-key   !137.175.9.2 137.175.9.*/0xffffff00
robin           dK3ig8G8hs   137.175.11.4
Jack's\smachine I\sam\sa\sjelly\sdonut.
```

SECURITY CONCERNS

The file **/etc/ppp/Auth** should be mode 600 or 400, and owned by root.

SEE ALSO

tun(4), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), services(5), pppd(8), RFC 792, RFC 1548, RFC 1332, RFC 1334.

Brian Lloyd and William A. Simpson, "The PPP Authentication

6 Aug 12 1994 Morning Star PPP 1.4.1

Protocols,'' Internet Draft, May 1992.

COPYRIGHT INFORMATION

PPP.AUTH(5) Morning Star Technologies PPP.AUTH(5)

Protocols,'' Internet Draft, May 1992.

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.; all rights reserved.

Morning Star PPP 1.4.1 Aug 12 1994 7

NAME

ppp.Devices – PPP physical device description file format

DESCRIPTION

The file **/etc/ppp/Devices** (or **/usr/lib/ppp/Devices** on SCO systems) associates dialer types with physical devices and speeds. *Pppd* examines it when placing a call to a neighboring machine. If no suitable speed is found, or if all devices associated with that speed are busy, *pppd* will try again later.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions are significant. Fields on a line are separated by horizontal white space (blanks or tabs).

Each entry must contain three or more fields, in this order:

dialer Either the string 'Direct', or the name of the modem dialing chat script (found in **Dialers**) to use with this device, or the name of an external dialer program.

device The name of the device in the **/dev** directory (**ttya**, **cua**, etc.). Device names for SnapLink connections are followed by a slash and the port number in use (**rsd2a/0**, **rrz4a/2**, etc.).

speed The baud rate of the synchronous connection, or a string to be matched against the speed field of entries in **Systems** when the **Systems** device field is set to ACU. Speeds must either be valid async baud-rate numbers (as found in <sys/ttydev.h>) or must begin with them (2400, 38400, 19200-PEP, etc.), or must be speeds of which the SnapLink hardware is capable (9600, 56000, 64000, 1536000, etc.)

optional parameters

Any special handling for this device. Currently supported values include

rtscts Specifies that the line be conditioned for out-of-band EIA RS-232-D 'hardware' (RTS/CTS) flow control. The default is to use no flow control. For an outbound connection, this may be specified either in **Devices** or on the

PPP.DEVICES(5) Morning Star Technologies PPP.DEVICES(5)

NAME

ppp.Devices – PPP physical device description file format

DESCRIPTION

The file **/etc/ppp/Devices** (or **/usr/lib/ppp/Devices** on SCO systems) associates dialer types with physical devices and speeds. *Pppd* examines it when placing a call to a neighboring machine. If no suitable speed is found, or if all devices associated with that speed are busy, *pppd* will try again later.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions are significant. Fields on a line are separated by horizontal white space (blanks or tabs).

Each entry must contain three or more fields, in this order:

dialer Either the string 'Direct', or the name of the modem dialing chat script (found in **Dialers**) to use with this device, or the name of an external dialer program.

device The name of the device in the **/dev** directory (**ttya**, **cua**, etc.). Device names for SnapLink connections are followed by a slash and the port number in use (**rsd2a/0**, **rrz4a/2**, etc.).

speed The baud rate of the synchronous connection, or a string to be matched against the speed field of entries in **Systems** when the **Systems** device field is set to ACU. Speeds must either be valid async baud-rate numbers (as found in <sys/ttydev.h>) or must begin with them (2400, 38400, 19200-PEP, etc.), or must be speeds of which the SnapLink hardware is capable (9600, 56000, 64000, 1536000, etc.)

optional parameters

Any special handling for this device. Currently supported values include

rtscts Specifies that the line be conditioned for out-of-band EIA RS-232-D 'hardware' (RTS/CTS) flow control. The default is to use no flow control. For an outbound connection, this may be specified either in **Devices** or on the

8 Aug 12 1994 Morning Star PPP 1.4.1

pppd command line. On NeXT systems, enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. On Silicon Graphics systems systems, use **/dev/ttyf2** for a modem with hardware flow control instead.

crtscts — a synonym for rtscts

xonxoff — Specifies that the line be conditioned for in-band ('software') flow control, using the characters DC3 (^S, XOFF, ASCII 0x13) to stop the flow and DC1 (^Q, XON, ASCII 0x11) to resume. The default is to use no flow control. For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line.

internal-clocking — The SnapLink will provide the synchronous clock signal. By default, it expects the modem, CSU/DSU or modem eliminator to provide the clock signal. Internal-clocking cannot be used with RS-232 cables on the SnapLink.

32-bit-fcs — The SnapLink will calculate 32-bit FCS values for transmitted frames, and check received frames with 32-bit FCS calculations. This is not negotiable at connection establishment time. 32-bit FCS is only available when running synchronous PPP on the SnapLink.

min-flags=*minflags* — The number of additional HDLC flag characters the SnapLink should insert between data frames. The default and minimum is 2; the maximum is 16.

ignore-cd — Ignore the state of the CD (Carrier Detect, also called DCD, Data Carrier Detect) signal. This is useful for

PPP.DEVICES(5) Morning Star Technologies PPP.DEVICES(5)

pppd command line. On NeXT systems, enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. On Silicon Graphics systems systems, use **/dev/ttyf2** for a modem with hardware flow control instead.

crtscts — a synonym for rtscts

xonxoff — Specifies that the line be conditioned for in-band ('software') flow control, using the characters DC3 (^S, XOFF, ASCII 0x13) to stop the flow and DC1 (^Q, XON, ASCII 0x11) to resume. The default is to use no flow control. For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line.

internal-clocking — The SnapLink will provide the synchronous clock signal. By default, it expects the modem, CSU/DSU or modem eliminator to provide the clock signal. Internal-clocking cannot be used with RS-232 cables on the SnapLink.

32-bit-fcs — The SnapLink will calculate 32-bit FCS values for transmitted frames, and check received frames with 32-bit FCS calculations. This is not negotiable at connection establishment time. 32-bit FCS is only available when running synchronous PPP on the SnapLink.

min-flags=*minflags* — The number of additional HDLC flag characters the SnapLink should insert between data frames. The default and minimum is 2; the maximum is 16.

ignore-cd — Ignore the state of the CD (Carrier Detect, also called DCD, Data Carrier Detect) signal. This is useful for

Morning Star PPP 1.4.1 Aug 12 1994 9

systems that don't support CD but want to run PPP over a dedicated line.

EXTERNAL DIALER

The external dialer program is run with the following arguments:

device name	The contents of the Device field from the Devices entry.
speed	The contents of the Speed field of the Systems and Devices entries.
telephone number	The contents of the Phone Number field of the Systems entry.
optional parameters	Copied from the Optional Parameters section of the Devices entry.

If the external dialer program exits with status 0, then the dial attempt is considered to have succeeded. Any other exit status indicates a failure.

EXAMPLE

```
#
#       Devices - PPP devices file
#
#Dialer    device   speed      Optional parameters
T2500-PEP  cua      19200-PEP  rtscts
T1600      cub      38400      rtscts
Direct     rsd0a/0  1536000    internal-clocking
Oddball    rsd0a/1  64000      cua 9600 5551212
```

In the last line of this example, the 64Kb synchronous modem on the SnapLink's port 1 has an asynchronous dialer interface attached to the workstation's port 'a'. The Systems line would look like

```
host Oddball rsd0a/1 64000 0
```

There must be a program (or an executable shell script) called **/etc/ppp/Oddball** that dials the modem when invoked as

```
Oddball rsd0a/1 64000 0 cua 9600 5551212
```

A warning message will be printed for each unrecognized optional parameter if the *debug* level is 2 or more.

PPP.DEVICES(5) Morning Star Technologies PPP.DEVICES(5)

systems that don't support CD but want to run PPP over a dedicated line.

EXTERNAL DIALER

The external dialer program is run with the following arguments:

device name	The contents of the Device field from the Devices entry.
speed	The contents of the Speed field of the Systems and Devices entries.
telephone number	The contents of the Phone Number field of the Systems entry.
optional parameters	Copied from the Optional Parameters section of the Devices entry.

If the external dialer program exits with status 0, then the dial attempt is considered to have succeeded. Any other exit status indicates a failure.

EXAMPLE

```
#
#       Devices - PPP devices file
#
#Dialer    device   speed      Optional parameters
T2500-PEP  cua      19200-PEP  rtscts
T1600      cub      38400      rtscts
Direct     rsd0a/0  1536000    internal-clocking
Oddball    rsd0a/1  64000      cua 9600 5551212
```

In the last line of this example, the 64Kb synchronous modem on the SnapLink's port 1 has an asynchronous dialer interface attached to the workstation's port 'a'. The Systems line would look like

```
host Oddball rsd0a/1 64000 0
```

There must be a program (or an executable shell script) called **/etc/ppp/Oddball** that dials the modem when invoked as

```
Oddball rsd0a/1 64000 0 cua 9600 5551212
```

A warning message will be printed for each unrecognized optional parameter if the *debug* level is 2 or more.

10 Aug 12 1994 Morning Star PPP 1.4.1

CAVEATS

The **rtscts** flag is unsupported on the daemon's command line or in **Filter** on some systems, because RTS/CTS "hardware" flow control is configured instead by choosing a specific tty device. On a NeXTstation, use the devices **/dev/cufa** and **/dev/ttydfa** for hardware-flow-controlled dialout and dialin connections, respectively. On Silicon Graphics systems, use **/dev/ttyf2** for a modem with hardware flow control (see *serial*(7)).

The external dialer is invoked as **root**, so you should take appropriate security precautions with its content and file protection.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055.

COPYRIGHT INFORMATION

PPP.DEVICES(5) Morning Star Technologies PPP.DEVICES(5)

CAVEATS

The **rtscts** flag is unsupported on the daemon's command line or in **Filter** on some systems, because RTS/CTS "hardware" flow control is configured instead by choosing a specific tty device. On a NeXTstation, use the devices **/dev/cufa** and **/dev/ttydfa** for hardware-flow-controlled dialout and dialin connections, respectively. On Silicon Graphics systems, use **/dev/ttyf2** for a modem with hardware flow control (see *serial*(7)).

The external dialer is invoked as **root**, so you should take appropriate security precautions with its content and file protection.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055.

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.; all rights reserved.

Morning Star PPP 1.4.1 Aug 12 1994 11

NAME

ppp.Dialers – PPP dialer description file format

DESCRIPTION

The file **/etc/ppp/Dialers** (or **/usr/lib/ppp/Dialers** on SCO systems) describes how to dial each type of modem attached to the UNIX system that is to be made available for outbound PPP calls. *Pppd* examines it when placing a call to a neighboring machine.

When *pppd* selects a line from **Systems**, it uses the 'speed' field to select an entry in **Devices**, from which it uses the 'dialer' field to select an entry in **Dialers**. *Pppd* then interprets the 'chat script' field from that dialer description.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions in the dialer field are significant for matching purposes, as are strings in the chat script. Fields on a line are separated by horizontal white space (blanks or tabs). If a chat script ends with a backslash ('\'), the next line is considered a continuation of the chat script. Continuations may only occur in the midst of a chat script.

Each entry must contain these fields, in this order:

dialer — The name of this dialer, to be matched against the dialer field in **Devices**

chat-script — A description of the conversation that *pppd* holds with the modem.

CHAT SCRIPT PARTICULARS

A chat script takes the form of a space-separated list of expect-send pairs. Each pair consists (at minimum) of a field to expect the 'remote' end to send, then a field to send in response. Unless a 'send' string ends with **\c**, *pppd* will follow it by sending a carriage return character (ASCII 0x0d).

Chat scripts are 'expect send expect send ...' or 'expect-send-expect send ...', where the send following the hyphen is executed if the preceding expect fails to match received text.

Certain special words may be used in the chat script to control the behavior of *pppd* as it attempts to dial. Both ABORT and TIMEOUT must be in the 'expect' phase of the chat script.

PPP.DIALERS(5) Morning Star Technologies PPP.DIALERS(5)

NAME

ppp.Dialers – PPP dialer description file format

DESCRIPTION

The file **/etc/ppp/Dialers** (or **/usr/lib/ppp/Dialers** on SCO systems) describes how to dial each type of modem attached to the UNIX system that is to be made available for outbound PPP calls. *Pppd* examines it when placing a call to a neighboring machine.

When *pppd* selects a line from **Systems**, it uses the 'speed' field to select an entry in **Devices**, from which it uses the 'dialer' field to select an entry in **Dialers**. *Pppd* then interprets the 'chat script' field from that dialer description.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions in the dialer field are significant for matching purposes, as are strings in the chat script. Fields on a line are separated by horizontal white space (blanks or tabs). If a chat script ends with a backslash ('\'), the next line is considered a continuation of the chat script. Continuations may only occur in the midst of a chat script.

Each entry must contain these fields, in this order:

dialer — The name of this dialer, to be matched against the dialer field in **Devices**

chat-script — A description of the conversation that *pppd* holds with the modem.

CHAT SCRIPT PARTICULARS

A chat script takes the form of a space-separated list of expect-send pairs. Each pair consists (at minimum) of a field to expect the 'remote' end to send, then a field to send in response. Unless a 'send' string ends with **\c**, *pppd* will follow it by sending a carriage return character (ASCII 0x0d).

Chat scripts are 'expect send expect send ...' or 'expect-send-expect send ...', where the send following the hyphen is executed if the preceding expect fails to match received text.

Certain special words may be used in the chat script to control the behavior of *pppd* as it attempts to dial. Both ABORT and TIMEOUT must be in the 'expect' phase of the chat script.

12 Aug 12 1994 Morning Star PPP 1.4.1

ABORT *abort-string* — If *pppd* sees *abort-string* while executing the remainder of the chat script, abort the dialing attempt and note the failure in the log file.

TIMEOUT *timeout-time* — While executing the current chat script, wait *timeout-time* seconds for a response before considering the dialing attempt to have timed out. Writes have a fixed 60-second timeout.

The expect-send couplet of "" **P_***WORD* sets the line parity accordingly:

P_AUTO — Set transmission parity based on the parity observed in characters received in 'expect' strings. This is the default.

P_ZERO — Transmit characters with the parity bit set to zero (8 bits, no parity).

P_ONE — Transmit characters with the parity bit set to one.

P_EVEN — Transmit characters with even parity.

P_ODD — Transmit characters with odd parity.

In the midst of either an 'expect' string or a 'send' string, ^*x* gets translated into the appropriate control character, and *x* gets translated into *x*. Other special sequences are:

\s — Send or receive a space character (ASCII 0x20)

\t — Send or receive a horizontal tab character (ASCII 0x09)

\n — Send or receive a line feed character (ASCII 0x0a)

\r — Send or receive a carriage return character (ASCII 0x0d)

\\ — Send or receive a backslash character (ASCII 0x5c)

\^ — Send or receive a carat character (ASCII 0x5e)

^<character> — Send or receive the single character Ctrl-<character> (ASCII 0x00 through 0x1f)

PPP.DIALERS(5) Morning Star Technologies PPP.DIALERS(5)

ABORT *abort-string* — If *pppd* sees *abort-string* while executing the remainder of the chat script, abort the dialing attempt and note the failure in the log file.

TIMEOUT *timeout-time* — While executing the current chat script, wait *timeout-time* seconds for a response before considering the dialing attempt to have timed out. Writes have a fixed 60-second timeout.

The expect-send couplet of "" **P_***WORD* sets the line parity accordingly:

P_AUTO — Set transmission parity based on the parity observed in characters received in 'expect' strings. This is the default.

P_ZERO — Transmit characters with the parity bit set to zero (8 bits, no parity).

P_ONE — Transmit characters with the parity bit set to one.

P_EVEN — Transmit characters with even parity.

P_ODD — Transmit characters with odd parity.

In the midst of either an 'expect' string or a 'send' string, ^*x* gets translated into the appropriate control character, and *x* gets translated into *x*. Other special sequences are:

\s — Send or receive a space character (ASCII 0x20)

\t — Send or receive a horizontal tab character (ASCII 0x09)

\n — Send or receive a line feed character (ASCII 0x0a)

\r — Send or receive a carriage return character (ASCII 0x0d)

\\ — Send or receive a backslash character (ASCII 0x5c)

\^ — Send or receive a carat character (ASCII 0x5e)

^<character> — Send or receive the single character Ctrl-<character> (ASCII 0x00 through 0x1f)

Morning Star PPP 1.4.1 Aug 12 1994 13

ddd Send or receive a character, specified in octal *d*igits

\p Pause for .25 second before proceeding (send only)

\d Delay for two seconds before proceeding (send only)

\K Send a break (.25 second of zero bits)

\M Disable hangups (sets CLOCAL or LNOHANG)

\m enable hangups (unsets CLOCAL or LNOHANG) (the default)

\c Don't append a carriage return character after sending the preceding string (send only)

\q Don't print succeeding send strings (e.g. a password) in any debugging or logging output. Subsequent **\q** sequences toggle 'quiet' mode.

\T Insert the telephone number (found in the fifth field of **Systems**) here

EXAMPLE

```
#
#       Dialers - PPP dialers file
#
#Dialer Chat script
T1600  ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
       ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT ERROR TIMEOUT 5 "" AT OK-AT-OK \
       ATS111=0DT\T TIMEOUT 30 CONNECT
#
T2500-PEP \
       ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
       ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT ERROR TIMEOUT 5 "" AT OK-AT-OK \
       ATS111=0DT\T TIMEOUT 30 CONNECT\sFAST
#
USRv32bis \
       ABORT ERROR ABORT NO\sANSWER ABORT NO\sCARRIER \
       ABORT BUSY ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT NO\sDIAL\sTONE TIMEOUT 5 "" AT&F \
       OK-ATQ0-OK ATB0E0X7&B1&H1&I0&K3&R2&S1 OK-AT-OK \
       ATS01=1S02=255S19=0 OK-AT-OK ATDT\T TIMEOUT 30 \
       CONNECT
```

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC

PPP.DIALERS(5) Morning Star Technologies PPP.DIALERS(5)

ddd Send or receive a character, specified in octal *d*igits

\p Pause for .25 second before proceeding (send only)

\d Delay for two seconds before proceeding (send only)

\K Send a break (.25 second of zero bits)

\M Disable hangups (sets CLOCAL or LNOHANG)

\m enable hangups (unsets CLOCAL or LNOHANG) (the default)

\c Don't append a carriage return character after sending the preceding string (send only)

\q Don't print succeeding send strings (e.g. a password) in any debugging or logging output. Subsequent **\q** sequences toggle 'quiet' mode.

\T Insert the telephone number (found in the fifth field of **Systems**) here

EXAMPLE

```
#
#       Dialers - PPP dialers file
#
#Dialer Chat script
T1600  ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
       ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT ERROR TIMEOUT 5 "" AT OK-AT-OK \
       ATS111=0DT\T TIMEOUT 30 CONNECT
#
T2500-PEP \
       ABORT NO\sCARRIER ABORT NO\sDIALTONE ABORT BUSY \
       ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT ERROR TIMEOUT 5 "" AT OK-AT-OK \
       ATS111=0DT\T TIMEOUT 30 CONNECT\sFAST
#
USRv32bis \
       ABORT ERROR ABORT NO\sANSWER ABORT NO\sCARRIER \
       ABORT BUSY ABORT RRING\r\n\r\nRRING\r\n\r\nRRING \
       ABORT NO\sDIAL\sTONE TIMEOUT 5 "" AT&F \
       OK-ATQ0-OK ATB0E0X7&B1&H1&I0&K3&R2&S1 OK-AT-OK \
       ATS01=1S02=255S19=0 OK-AT-OK ATDT\T TIMEOUT 30 \
       CONNECT
```

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC

14 Aug 12 1994 Morning Star PPP 1.4.1

1055.

COPYRIGHT INFORMATION

PPP.DIALERS(5) Morning Star Technologies PPP.DIALERS(5)

1055.

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.;
all rights reserved.

Morning Star PPP 1.4.1 Aug 12 1994 15

NAME

ppp.Filter – PPP packet filter specification file format

DESCRIPTION

The file **/etc/ppp/Filter** (or **/usr/lib/ppp/Filter** on SCO systems) describes how on-demand PPP links are to be managed. By default, any type of packet causes the link (if down) to be brought up (connected to its remote end); any packet is allowed to traverse the link; and any packet is sufficient to reset the idle timer, expiration of which would cause the link to be shut down. This combination is not always appropriate behavior, so the filter file allows individual control based on the packet type and its source or destination. These selection criteria may be specified for any of the three phases of operation: bringing up the link, passing packets on the link, and shutting down the link due to inactivity. Packet logging detail may also be selected using the same criteria.

FORMAT

Comments begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Upper/lower case distinctions are ignored in hostname specifications, but are significant elsewhere. Fields are separated by horizontal or vertical white space (blanks or tabs or newlines).

If a line begins with a hostname or IP address or the special word 'default', that line is considered to be the beginning of a new set of filtering specifications. The filtering specifications will be applied to any packet crossing the point-to-point link connecting this host to the peer named by that initial hostname or IP address. The hostname or IP address in the first column of the filter file refers to the peer (system or router or terminal server) at the remote end of the point-to-point (PPP or SLIP) link. The hostname or IP address in the first column of the filter file, and associated with the link peer, is unrelated to the source or destination IP address of any packet crossing the link. If the link peer's address doesn't match any name or address specified in the first column of filter file, the filter specification following the special word 'default' will be used.

If a newline is followed by white space, that line is a continuation of the filtering specification already in progress.

There are four keywords to describe the actions taken by *pppd* in response to a particular packet:

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

NAME

ppp.Filter – PPP packet filter specification file format

DESCRIPTION

The file /etc/ppp/Filter (or /usr/lib/ppp/Filter on SCO systems) describes how on-demand PPP links are to be managed. By default, any type of packet causes the link (if down) to be brought up (connected to its remote end); any packet is allowed to traverse the link; and any packet is sufficient to reset the idle timer, expiration of which would cause the link to be shut down. This combination is not always appropriate behavior, so the filter file allows individual control based on the packet type and its source or destination. These selection criteria may be specified for any of the three phases of operation: bringing up the link, passing packets on the link, and shutting down the link due to inactivity. Packet logging detail may also be selected using the same criteria.

FORMAT

Comments begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Upper/lower case distinctions are ignored in hostname specifications, but are significant elsewhere. Fields are separated by horizontal or vertical white space (blanks or tabs or newlines).

If a line begins with a hostname or IP address or the special word 'default', that line is considered to be the beginning of a new set of filtering specifications. The filtering specifications will be applied to any packet crossing the point-to-point link connecting this host to the peer named by that initial hostname or IP address. The hostname or IP address in the first column of the filter file refers to the peer (system or router or terminal server) at the remote end of the point-to-point (PPP or SLIP) link. The hostname or IP address in the first column of the filter file, and associated with the link peer, is unrelated to the source or destination IP address of any packet crossing the link. If the link peer's address doesn't match any name or address specified in the first column of filter file, the filter specification following the special word 'default' will be used.

If a newline is followed by white space, that line is a continuation of the filtering specification already in progress.

There are four keywords to describe the actions taken by *pppd* in response to a particular packet:

16 Aug 12 1994 Morning Star PPP 1.4.1

bringup Describes those packets that will cause a call to be placed and a connection initiated. Packets of this sort also must qualify to 'pass' across the link, either by being explicitly mentioned or by inclusion in a larger class in the 'pass' section.

pass Describes those packets that will be allowed to traverse the link on an already-established connection. Only packets which would be passed can cause the link to be brought up. Any packet that is not passed is optionally logged, then discarded.

keepup Describes packets that will reset the idle timer, thereby keeping the line connected.

log Describes packets whose headers or contents are to be noted in the log file.

After each action keyword comes stanzas, separated by white space, describing packets that fit the criteria for that action. Each stanza is processed in the order shown in the file, and contain restrictions or permissions on the packets encountered. As soon as a pattern or a condition is found that matches the packet in question, *pppd* takes the indicated action and ignores the rest of the listed stanzas (i.e. inclusive *or* with shortcut evaluation).

Stanzas may contain IP protocol numbers, optionally hyphen-separated ranges of TCP or UDP port numbers along with the '/tcp' or '/udp' qualifier, numbers representing ICMP message types or codes (which can be found in **<netinet/ip_icmp.h>**) along with the '/icmp' qualifier, service names corresponding to entries in **/etc/services**, or names or IP addresses of hosts or networks, or the special keyword 'all', which is the default for all actions except 'log', where the default is '!all'. (Usually, it is unnecessary to use 'all'; as a convenience, *pppd* automatically adds a '!all' at the end of a stanza list if the last stanza *is not* negated, and add an 'all' at the end of a stanza list if the last stanza *is* negated. For example, in the typical case of 'log' this sensibly results in *only* those packets matching the stanzas shown being logged, and no others. In the typical case of 'pass', this results in certain listed packets being restricted, but allowing the passage of all others.) If a network is specified, either by name or by address, then the corresponding network mask must also be specified if it is of a different size than

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

bringup Describes those packets that will cause a call to be placed and a connection initiated. Packets of this sort also must qualify to 'pass' across the link, either by being explicitly mentioned or by inclusion in a larger class in the 'pass' section.

pass Describes those packets that will be allowed to traverse the link on an already-established connection. Only packets which would be passed can cause the link to be brought up. Any packet that is not passed is optionally logged, then discarded.

keepup Describes packets that will reset the idle timer, thereby keeping the line connected.

log Describes packets whose headers or contents are to be noted in the log file.

After each action keyword comes stanzas, separated by white space, describing packets that fit the criteria for that action. Each stanza is processed in the order shown in the file, and contain restrictions or permissions on the packets encountered. As soon as a pattern or a condition is found that matches the packet in question, *pppd* takes the indicated action and ignores the rest of the listed stanzas (i.e. inclusive *or* with shortcut evaluation).

Stanzas may contain IP protocol numbers, optionally hyphen-separated ranges of TCP or UDP port numbers along with the '/tcp' or '/udp' qualifier, numbers representing ICMP message types or codes (which can be found in **<netinet/ip_icmp.h>**) along with the '/icmp' qualifier, service names corresponding to entries in **/etc/services**, or names or IP addresses of hosts or networks, or the special keyword 'all', which is the default for all actions except 'log', where the default is '!all'. (Usually, it is unnecessary to use 'all'; as a convenience, *pppd* automatically adds a '!all' at the end of a stanza list if the last stanza *is not* negated, and add an 'all' at the end of a stanza list if the last stanza *is* negated. For example, in the typical case of 'log' this sensibly results in *only* those packets matching the stanzas shown being logged, and no others. In the typical case of 'pass', this results in certain listed packets being restricted, but allowing the passage of all others.) If a network is specified, either by name or by address, then the corresponding network mask must also be specified if it is of a different size than

Morning Star PPP 1.4.1 Aug 12 1994 17

the default for that class of network. The network mask and additional 'and' conditions within a stanza are separated by slashes ('/'), and may be specified either as a series of decimal numbers separated by periods, or as a single 32-bit hexadecimal number. The sense of a stanza may be negated by prefixing it with an exclamation mark ('!').

In the 'log' filter specification, the special keyword 'trace' causes the *contents* (as well as headers) of the indicated type of packet to be written to the log file. Also in the 'log' filter specification, the special flag 'rejected' signifies that the packet is to be logged only if it was rejected by the 'pass' filter.

Since TCP data streams are opened when the initiator sends a SYN packet to the intended recipient, *pppd* can distinguish between outbound (sent from this host) and inbound (coming from the other end of the link) uses of TCP applications such as telnet or FTP. The special keyword 'syn' allows filtering or logging these connection starters. Qualifying it with 'recv' or 'send' allows sessions to be started or logged only if they are initiated in the indicated direction. The special keyword 'fin' allows filtering or logging the packets that close TCP connections.

The 'src' and 'dst' keywords serve to distinguish ports, addresses or hostnames, as applying to the source or destination, respectively, of the packet. If both are applied to the same stanza (e.g. **.../src/dst**), then both the source and destination address and/or port must match.

The 'unreach=' keyword causes an ICMP Destination Unreachable message (RFC 792 and RFC 1122 section 3.2.2.1) to be sent to the packet's source address, bearing the indicated code field, which may be chosen from

net	The destination network is unreachable.
host	The destination host is unreachable.
prot	The designated transport protocol is not supported
protocol	The designated transport protocol is not supported
port	The designated transport protocol (e.g., UDP) is unable to demultiplex the

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

the default for that class of network. The network mask and additional 'and' conditions within a stanza are separated by slashes ('/'), and may be specified either as a series of decimal numbers separated by periods, or as a single 32-bit hexadecimal number. The sense of a stanza may be negated by prefixing it with an exclamation mark ('!').

In the 'log' filter specification, the special keyword 'trace' causes the *contents* (as well as headers) of the indicated type of packet to be written to the log file. Also in the 'log' filter specification, the special flag 'rejected' signifies that the packet is to be logged only if it was rejected by the 'pass' filter.

Since TCP data streams are opened when the initiator sends a SYN packet to the intended recipient, *pppd* can distinguish between outbound (sent from this host) and inbound (coming from the other end of the link) uses of TCP applications such as telnet or FTP. The special keyword 'syn' allows filtering or logging these connection starters. Qualifying it with 'recv' or 'send' allows sessions to be started or logged only if they are initiated in the indicated direction. The special keyword 'fin' allows filtering or logging the packets that close TCP connections.

The 'src' and 'dst' keywords serve to distinguish ports, addresses or hostnames, as applying to the source or destination, respectively, of the packet. If both are applied to the same stanza (e.g. **.../src/dst**), then both the source and destination address and/or port must match.

The 'unreach=' keyword causes an ICMP Destination Unreachable message (RFC 792 and RFC 1122 section 3.2.2.1) to be sent to the packet's source address, bearing the indicated code field, which may be chosen from

net	The destination network is unreachable.
host	The destination host is unreachable.
prot	The designated transport protocol is not supported
protocol	The designated transport protocol is not supported
port	The designated transport protocol (e.g., UDP) is unable to demultiplex the

18 Aug 12 1994 Morning Star PPP 1.4.1

	datagram but has no protocol mechanism to inform the sender.
needfrag	Fragmentation is needed and the Don't Fragment flag is set.
srcfail	Source route failed.
net-unknown	The destination network is unknown.
host-unknown	The destination host is unknown.
host-isolated	The source host is isolated.
net-prohibited	Communication with the destination network is administratively prohibited.
host-prohibited	Communication with the destination host is administratively prohibited.
net-tos	The destination network is unreachable for the designated type of service.
host-tos	The destination host is unreachable for the designated type of service.

The 'ip-opt=' keyword can be used to select packets based on whether they bear various IP options (RFC 1122 section 3.2.1.8 and RFC 791 section 3.1 (pps 16ff)), selected from

rr	Record Route is used to trace the route an internet datagram takes
ts	Time Stamp
security	Security is used to carry Security, Compartmentation, User Group (TCC), and Handling Restriction Codes compatible with DOD requirements.
lsrr	Loose Source Routing is used to route the internet datagram based on information supplied by the source.
satid	SATNET Stream Identifier (obsolete)
ssrr	Strict Source Routing is used to route the internet datagram based on information supplied by the source.
srcrt	Either Loose Source Routing or Strict Source Routing

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

	datagram but has no protocol mechanism to inform the sender.
needfrag	Fragmentation is needed and the Don't Fragment flag is set.
srcfail	Source route failed.
net-unknown	The destination network is unknown.
host-unknown	The destination host is unknown.
host-isolated	The source host is isolated.
net-prohibited	Communication with the destination network is administratively prohibited.
host-prohibited	Communication with the destination host is administratively prohibited.
net-tos	The destination network is unreachable for the designated type of service.
host-tos	The destination host is unreachable for the designated type of service.

The 'ip-opt=' keyword can be used to select packets based on whether they bear various IP options (RFC 1122 section 3.2.1.8 and RFC 791 section 3.1 (pps 16ff)), selected from

rr	Record Route is used to trace the route an internet datagram takes
ts	Time Stamp
security	Security is used to carry Security, Compartmentation, User Group (TCC), and Handling Restriction Codes compatible with DOD requirements.
lsrr	Loose Source Routing is used to route the internet datagram based on information supplied by the source.
satid	SATNET Stream Identifier (obsolete)
ssrr	Strict Source Routing is used to route the internet datagram based on information supplied by the source.
srcrt	Either Loose Source Routing or Strict Source Routing

Morning Star PPP 1.4.1 Aug 12 1994 19

any Any IP option - could even match the No Operation option.

EXAMPLES

Default Behavior

The following **Filter** file describes the default behavior of *pppd*, either in the absence of a filter specification file or in the case of an empty file:

```
#       Filter - PPP configuration file,
#       binding packet types to actions.
#       Describes the default behavior of the daemon:
default bringup all pass all keepup all log !all
```

The default behavior is no restriction of packets, and no logging.

Internet Firewall

A 'pass' line like this might be appropriate as a security firewall between an organizational network and the larger Internet:

```
internet-gateway
        bringup  !ntp !3/icmp !5/icmp !11/icmp !who !route
                 !nntp !89
        pass     nntp/137.39.1.2 !nntp
                 telnet/syn/recv/137.175.0.0
                 !telnet/syn/recv !ftp/syn/recv
                 !login/syn/recv !shell/syn/recv !who
                 !sunrpc !chargen !tftp !supdup/syn/recv
                 !exec !syslog !route !6000/tcp/syn/send
        keepup   !send !ntp !3/icmp !5/icmp !11/icmp
                 !who !route !89
        log      rejected
```

This 'pass' specification allows NNTP (Usenet news) transactions with one peer and no others. It allows incoming Telnet sessions from hosts on only one network, disallows all other incoming Telnet, SUPDUP, and FTP sessions, and allows all outgoing Telnet SUPDUP, and FTP sessions. It allows X Window System clients running elsewhere to display on local window servers, but it allows no local X clients to use displays located elsewhere. It disallows all SUN RPC traffic, thereby guarding the local YP/NIS and NFS servers from outside probes and filesystem mounts. Alas, it also disallows local machines from mounting filesystems resident on NFS servers elsewhere, but this can't be helped because NFS uses RPC which is a UDP service, and therefore without the SYN

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

any Any IP option - could even match the No Operation option.

EXAMPLES

Default Behavior

The following **Filter** file describes the default behavior of *pppd*, either in the absence of a filter specification file or in the case of an empty file:

```
#       Filter - PPP configuration file,
#       binding packet types to actions.
#       Describes the default behavior of the daemon:
default bringup all pass all keepup all log !all
```

The default behavior is no restriction of packets, and no logging.

Internet Firewall

A 'pass' line like this might be appropriate as a security firewall between an organizational network and the larger Internet:

```
internet-gateway
        bringup  !ntp !3/icmp !5/icmp !11/icmp !who !route
                 !nntp !89
        pass     nntp/137.39.1.2 !nntp
                 telnet/syn/recv/137.175.0.0
                 !telnet/syn/recv !ftp/syn/recv
                 !login/syn/recv !shell/syn/recv !who
                 !sunrpc !chargen !tftp !supdup/syn/recv
                 !exec !syslog !route !6000/tcp/syn/send
        keepup   !send !ntp !3/icmp !5/icmp !11/icmp
                 !who !route !89
        log      rejected
```

This 'pass' specification allows NNTP (Usenet news) transactions with one peer and no others. It allows incoming Telnet sessions from hosts on only one network, disallows all other incoming Telnet, SUPDUP, and FTP sessions, and allows all outgoing Telnet SUPDUP, and FTP sessions. It allows X Window System clients running elsewhere to display on local window servers, but it allows no local X clients to use displays located elsewhere. It disallows all SUN RPC traffic, thereby guarding the local YP/NIS and NFS servers from outside probes and filesystem mounts. Alas, it also disallows local machines from mounting filesystems resident on NFS servers elsewhere, but this can't be helped because NFS uses RPC which is a UDP service, and therefore without the SYN

20 Aug 12 1994 Morning Star PPP 1.4.1

and FIN packets that can be used to characterize the direction in which a TCP stream is being initiated. It blocks several other sorts of traffic that could be used for nefarious purposes, and the absence of a trailing '!all' means that any traffic not explicitly blocked is permitted to pass.

The 'bringup' and 'keepup' lines are appropriate for an intermittent dial-up connection, so that various error conditions won't cause the link to be established, nor to keep the call open beyond its usefulness. OSPF (Open Shortest Path First) routing packets (IP protocol number 89, from RFC-1340) will cross the link, but won't cause it to be brought up, nor keep it up if it's otherwise idle. Usenet news traffic won't bring up the link, but once started, the link won't be shut off in the middle of a news batch. The 'log rejected' line keeps a record of every packet that is blocked by the 'pass' line, so that unsuccessful penetration attempts will be noted.

An Extremely Complex Example

The following **Filter** file instructs the daemon that a connection to any neighbor except the host 'backbone' be brought up in response to any packet except for those generated by NTP, ICMP Destination Unreachable, and *rwhod*. If those are the only types of packets flowing across the link, it will not be kept up, but all packets are allowed to cross the link while it is up. Packets sent out will not reset the idle timer, but packets received from the peer will. If the peer goes down and modem problems cause the phone not to be hung up, (and the *idle* command-line argument has been specified) *pppd* will hang up the connection and retry.

In the special case of the host 'backbone' (perhaps a server belonging to a network connectivity vendor), only telnet and FTP sessions, SMTP electronic mail, NNTP network news, and Domain Name System queries are considered sufficient cause to bring the link up or to keep it up if otherwise idle.

Once the link is up, all the above plus NTP clock chimes and ICMP messages may flow across the link. No packets to or from a particular host, nor any packets except Domain Name System queries and responses for any host on subnet 42 of the class B network 137.175 are ever allowed to cross the link, nor would they cause the link to be initiated. We allow telnet and FTP sessions only if they are initiated in the outbound direction.

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

and FIN packets that can be used to characterize the direction in which a TCP stream is being initiated. It blocks several other sorts of traffic that could be used for nefarious purposes, and the absence of a trailing '!all' means that any traffic not explicitly blocked is permitted to pass.

The 'bringup' and 'keepup' lines are appropriate for an intermittent dial-up connection, so that various error conditions won't cause the link to be established, nor to keep the call open beyond its usefulness. OSPF (Open Shortest Path First) routing packets (IP protocol number 89, from RFC-1340) will cross the link, but won't cause it to be brought up, nor keep it up if it's otherwise idle. Usenet news traffic won't bring up the link, but once started, the link won't be shut off in the middle of a news batch. The 'log rejected' line keeps a record of every packet that is blocked by the 'pass' line, so that unsuccessful penetration attempts will be noted.

An Extremely Complex Example

The following **Filter** file instructs the daemon that a connection to any neighbor except the host 'backbone' be brought up in response to any packet except for those generated by NTP, ICMP Destination Unreachable, and *rwhod*. If those are the only types of packets flowing across the link, it will not be kept up, but all packets are allowed to cross the link while it is up. Packets sent out will not reset the idle timer, but packets received from the peer will. If the peer goes down and modem problems cause the phone not to be hung up, (and the *idle* command-line argument has been specified) *pppd* will hang up the connection and retry.

In the special case of the host 'backbone' (perhaps a server belonging to a network connectivity vendor), only telnet and FTP sessions, SMTP electronic mail, NNTP network news, and Domain Name System queries are considered sufficient cause to bring the link up or to keep it up if otherwise idle.

Once the link is up, all the above plus NTP clock chimes and ICMP messages may flow across the link. No packets to or from a particular host, nor any packets except Domain Name System queries and responses for any host on subnet 42 of the class B network 137.175 are ever allowed to cross the link, nor would they cause the link to be initiated. We allow telnet and FTP sessions only if they are initiated in the outbound direction.

Morning Star PPP 1.4.1 Aug 12 1994 21

We log one-line descriptions of various ICMP problem messages (Unreachable, Time Exceeded), and the complete contents of ICMP messages reporting IP header problems. We log all telnet and FTP sessions, including inbound attempts (though they will fail because they are excluded in the 'pass' specification above). We also log the header of the first packet of any electronic mail message flowing over this link on its way to or from a specific host.

```
#
#       Filter - PPP configuration file binding packet
#                types to actions.
#
#       For packets that would pass, these services
#       will bring up the link:
#
backbone bringup smtp nntp domain telnet ftp
#
#       Once brought up, these will pass (or not):
#
        pass     !131.119.250.104
                 domain/137.175.42.0/255.255.255.0
                 !137.175.42.0/0xffffff00
#                (alternative ways of
#                 expressing subnet mask)
                 !telnet/syn/recv !ftp/syn/recv
                 domain smtp nntp ntp icmp telnet ftp
#
#       Packets received for the services shown will
#       reset the idle timer.
#
        keepup   !send smtp nntp domain telnet ftp
#
#       Only these messages will have headers or contents
#       logged, unless higher-level debugging is set:
#
        log      3/icmp 11/icmp 12/icmp/trace
                 telnet/syn ftp/syn
                 smtp/syn/terminus.netsys.com
#
default bringup  !ntp !3/icmp !who
        keepup   !send !ntp !3/icmp !who
```

RECOMMENDATIONS

Simpler filter specifications allow *pppd* to start up quicker and run faster, with less processing overhead for each packet, but that overhead is likely to present a problem only at very high line speeds (like T1). The 'backbone' example shown above is severe overkill

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

We log one-line descriptions of various ICMP problem messages (Unreachable, Time Exceeded), and the complete contents of ICMP messages reporting IP header problems. We log all telnet and FTP sessions, including inbound attempts (though they will fail because they are excluded in the 'pass' specification above). We also log the header of the first packet of any electronic mail message flowing over this link on its way to or from a specific host.

```
#
#       Filter - PPP configuration file binding packet
#                types to actions.
#
#       For packets that would pass, these services
#       will bring up the link:
#
backbone bringup smtp nntp domain telnet ftp
#
#       Once brought up, these will pass (or not):
#
        pass     !131.119.250.104
                 domain/137.175.42.0/255.255.255.0
                 !137.175.42.0/0xffffff00
#                (alternative ways of
#                 expressing subnet mask)
                 !telnet/syn/recv !ftp/syn/recv
                 domain smtp nntp ntp icmp telnet ftp
#
#       Packets received for the services shown will
#       reset the idle timer.
#
        keepup   !send smtp nntp domain telnet ftp
#
#       Only these messages will have headers or contents
#       logged, unless higher-level debugging is set:
#
        log      3/icmp 11/icmp 12/icmp/trace
                 telnet/syn ftp/syn
                 smtp/syn/terminus.netsys.com
#
default bringup  !ntp !3/icmp !who
        keepup   !send !ntp !3/icmp !who
```

RECOMMENDATIONS

Simpler filter specifications allow *pppd* to start up quicker and run faster, with less processing overhead for each packet, but that overhead is likely to present a problem only at very high line speeds (like T1). The 'backbone' example shown above is severe overkill

22 Aug 12 1994 Morning Star PPP 1.4.1

for the sake of illustration, evolved over a period of several weeks, and took the authors several tries to get right. Start with a simple filter specification and add each special case only as the need arises, usually as the result of watching packet logs. Then test carefully to ensure that your change had only the desired effect.

Be very careful with header logging and even more careful with packet content tracing. Make the selection criteria very narrow, or the log file will grow extremely large in a short period of time. Also, if the daemon is running on a diskless workstation or if the log file is on a NFS-mounted file system, excessive amounts of logging information will drastically impede the daemon's ability to process at high packet rates. Remember, NFS writes are synchronous.

If you specify host names, be sure that their addresses are available locally, even with the connection down. If you find that you must bring up a connection to resolve a domain name, consider using that host's IP address (decimal numbers separated by periods) in both **Filter** and **Systems** instead.

If you want to specify all Domain Name System traffic, use 'domain' which will be expanded to entries for both 53/tcp and 53/udp. (Some DNS traffic uses each transport.) To allow queries but disable domain transfers, use '!domain/tcp'. Similarly, some systems' older **/etc/services** files, as distributed by the manufacturer, list NTP as a TCP service. When the current UDP NTP implementation was installed on your system, the administrator may have left the old 123/tcp entry along with the correct 123/udp. The correct solution is to remove the 123/tcp entry from **/etc/services**. A workaround would be to specify 123/udp in **Filter**.

DEC ULTRIX 4.2 and some other systems may have no entry for FTP's data socket in their **/etc/services** file. If you want to log the bulk data connections as well as the control connections, you'll need to either add an entry for 'ftp-data' to **/etc/services**, or use '20/tcp' explicitly in **Filter**. The former is preferable because it will cause the log file entry to contain the symbolic name ('ftp-data') rather than the socket/protocol notation.

If your **/etc/services** file is missing some application-level protocols that you consider useful, you can populate it with entries from the Assigned Numbers RFC, number 1340. For example, you may find

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

for the sake of illustration, evolved over a period of several weeks, and took the authors several tries to get right. Start with a simple filter specification and add each special case only as the need arises, usually as the result of watching packet logs. Then test carefully to ensure that your change had only the desired effect.

Be very careful with header logging and even more careful with packet content tracing. Make the selection criteria very narrow, or the log file will grow extremely large in a short period of time. Also, if the daemon is running on a diskless workstation or if the log file is on a NFS-mounted file system, excessive amounts of logging information will drastically impede the daemon's ability to process at high packet rates. Remember, NFS writes are synchronous.

If you specify host names, be sure that their addresses are available locally, even with the connection down. If you find that you must bring up a connection to resolve a domain name, consider using that host's IP address (decimal numbers separated by periods) in both **Filter** and **Systems** instead.

If you want to specify all Domain Name System traffic, use 'domain' which will be expanded to entries for both 53/tcp and 53/udp. (Some DNS traffic uses each transport.) To allow queries but disable domain transfers, use '!domain/tcp'. Similarly, some systems' older **/etc/services** files, as distributed by the manufacturer, list NTP as a TCP service. When the current UDP NTP implementation was installed on your system, the administrator may have left the old 123/tcp entry along with the correct 123/udp. The correct solution is to remove the 123/tcp entry from **/etc/services**. A workaround would be to specify 123/udp in **Filter**.

DEC ULTRIX 4.2 and some other systems may have no entry for FTP's data socket in their **/etc/services** file. If you want to log the bulk data connections as well as the control connections, you'll need to either add an entry for 'ftp-data' to **/etc/services**, or use '20/tcp' explicitly in **Filter**. The former is preferable because it will cause the log file entry to contain the symbolic name ('ftp-data') rather than the socket/protocol notation.

If your **/etc/services** file is missing some application-level protocols that you consider useful, you can populate it with entries from the Assigned Numbers RFC, number 1340. For example, you may find

it useful to add lines like

```
gopher     70/tcp
gopher     70/udp
kerberos   88/tcp
kerberos   88/udp
snmp       161/tcp
snmp       161/udp
nextstep   178/tcp
nextstep   178/udp
prospero   191/tcp
prospero   191/udp
x11        6000/tcp
```

if you're using those applications, and if they're not already in your **/etc/services** file as received from your system's manufacturer. If you augment your **/etc/services** this way, then instead of using entries like

```
pass     !6000/tcp/syn/send
```

your **Filter** could use entries like

```
pass     !x11/syn/send
```

which is much more readable. A list of TCP and UDP service numbers and names, culled from the Assigned Numbers RFC, is available in **Examples/services.ex**.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Keys(5), ppp.Systems(5), services(5), pppd(8), RFC 791, RFC 792, RFC 1055, RFC 1548, RFC 1332, RFC 1122, RFC 1144, RFC 1340.

COPYRIGHT INFORMATION

PPP.FILTER(5) Morning Star Technologies PPP.FILTER(5)

it useful to add lines like

```
gopher     70/tcp
gopher     70/udp
kerberos   88/tcp
kerberos   88/udp
snmp       161/tcp
snmp       161/udp
nextstep   178/tcp
nextstep   178/udp
prospero   191/tcp
prospero   191/udp
x11        6000/tcp
```

if you're using those applications, and if they're not already in your **/etc/services** file as received from your system's manufacturer. If you augment your **/etc/services** this way, then instead of using entries like

```
pass     !6000/tcp/syn/send
```

your **Filter** could use entries like

```
pass     !x11/syn/send
```

which is much more readable. A list of TCP and UDP service numbers and names, culled from the Assigned Numbers RFC, is available in **Examples/services.ex**.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Keys(5), ppp.Systems(5), services(5), pppd(8), RFC 791, RFC 792, RFC 1055, RFC 1548, RFC 1332, RFC 1122, RFC 1144, RFC 1340.

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.; all rights reserved.

24 Aug 12 1994 Morning Star PPP 1.4.1

NAME

ppp.Keys – PPP encryption keys file format

RESTRICTIONS

Encryption is not available in software exported from the USA.

DESCRIPTION

The keys file named in the **gw-crypt** option on the *pppd* command line contains key values used by Morning Star PPP's implementation of link-level encryption. Before transmission, packets with source and destination addresses matching the endpoints on a keys file line are encrypted using DES with the key specified on that keys file line. Upon reception, packets with source and destination addresses matching those on a keys file line are decrypted using DES with the key specified on that keys file line.

FORMAT

Each key specification is on its own single line of up to 1023 characters. Comments in the keys file begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Fields are separated by horizontal white space (blanks or tabs).

The first two words on a key line are compared with the source and destination addresses of each packet to be transmitted and each received packet. The endpoint address specifications may contain either host or network names, or host or network addresses. If a network is specified, either by name or by address, then the corresponding network mask must also be specified if it is of a different size than the default for that class of network. The mask is separated from the network name or address by a slash ('/'), and may be specified either as a series of decimal numbers separated by periods, or as a single 32-bit hexadecimal number, optionally with a C-style '0x' prefix.

The remainder of the key line is a 56 bit (14 digit) hexadecimal number (without the C-style '0x' prefix), used as the DES key between the specified pair of hosts or networks. The digits may be separated by horizontal white space for readability. If the key contains fewer or more than 14 hexadecimal digits, the line is ignored. If the key is weak or semi-weak, a warning message will be printed in the log file and the specified key will be used for encryption anyway.

PPP.KEYS(5) Morning Star Technologies PPP.KEYS(5)

NAME

ppp.Keys – PPP encryption keys file format

RESTRICTIONS

Encryption is not available in software exported from the USA.

DESCRIPTION

The keys file named in the **gw-crypt** option on the *pppd* command line contains key values used by Morning Star PPP's implementation of link-level encryption. Before transmission, packets with source and destination addresses matching the endpoints on a keys file line are encrypted using DES with the key specified on that keys file line. Upon reception, packets with source and destination addresses matching those on a keys file line are decrypted using DES with the key specified on that keys file line.

FORMAT

Each key specification is on its own single line of up to 1023 characters. Comments in the keys file begin with a '#' and extend to the end of the line; blank lines, or lines beginning with a '#', are ignored. Fields are separated by horizontal white space (blanks or tabs).

The first two words on a key line are compared with the source and destination addresses of each packet to be transmitted and each received packet. The endpoint address specifications may contain either host or network names, or host or network addresses. If a network is specified, either by name or by address, then the corresponding network mask must also be specified if it is of a different size than the default for that class of network. The mask is separated from the network name or address by a slash ('/'), and may be specified either as a series of decimal numbers separated by periods, or as a single 32-bit hexadecimal number, optionally with a C-style '0x' prefix.

The remainder of the key line is a 56 bit (14 digit) hexadecimal number (without the C-style '0x' prefix), used as the DES key between the specified pair of hosts or networks. The digits may be separated by horizontal white space for readability. If the key contains fewer or more than 14 hexadecimal digits, the line is ignored. If the key is weak or semi-weak, a warning message will be printed in the log file and the specified key will be used for encryption anyway.

Morning Star PPP 1.4.1 Aug 12 1994 25

EXAMPLE

The following keys file provides *pppd* with keys for use when encrypting or decrypting traffic between the indicated pairs of hosts or networks:

```
#
#  Keys - PPP encryption keys file
#
#  Format:
#endpoint               endpoint                key
frobozz.foo.com         glitznorf.baz.edu       feed face f00d aa
147.225.0.0             38.145.211.0/0xffffffc0 b1ff a c001 d00d 1
128.49.16.0/0xffffff00  198.137.240.100         0123456789abcd
193.124.250.136         143.231.1.0/0xffffff00  e1c3870e1c3870
```

RECOMMENDATIONS

Avoid using weak or semi-weak keys. These are weak DES keys:

```
00000000000000
FFFFFFFFFFFFFF
1E3C78F1E3C78F
E1C3870E1C3870
```

These are semi-weak DES keys:

```
01FC07F01FC07F
FE03F80FE03F80
1FC07F00FE03F8
E03F80FF01FC07
01C007001E0078
E003800F003C00
1FFC7FF0FFC3FF
FE3FF8FFE1FF87
003C00F001C007
1E007800E00380
E1FF87FF1FFC7F
FFC3FF0FFE3FF8
```

SECURITY CONCERNS

The keys file should be mode 600 or 400, and owned by root.

Packets' IP headers are not encrypted, though their TCP, UDP, or ICMP headers are encrypted along with the user data portion. This allows encrypted packets to traverse normal internetworks, but permits snoopers to analyze traffic by its endpoints.

Since the TCP, UDP, or ICMP header is encrypted, protocol-based filters along the packet's path will be unable to discern whether it is SMTP, Telnet, or any other network service. This means that

PPP.KEYS(5) Morning Star Technologies PPP.KEYS(5)

EXAMPLE

The following keys file provides *pppd* with keys for use when encrypting or decrypting traffic between the indicated pairs of hosts or networks:

```
#
#  Keys - PPP encryption keys file
#
#  Format:
#endpoint               endpoint                key
frobozz.foo.com         glitznorf.baz.edu       feed face f00d aa
147.225.0.0             38.145.211.0/0xffffffc0 b1ff a c001 d00d 1
128.49.16.0/0xffffff00  198.137.240.100         0123456789abcd
193.124.250.136         143.231.1.0/0xffffff00  e1c3870e1c3870
```

RECOMMENDATIONS

Avoid using weak or semi-weak keys. These are weak DES keys:

```
00000000000000
FFFFFFFFFFFFFF
1E3C78F1E3C78F
E1C3870E1C3870
```

These are semi-weak DES keys:

```
01FC07F01FC07F
FE03F80FE03F80
1FC07F00FE03F8
E03F80FF01FC07
01C007001E0078
E003800F003C00
1FFC7FF0FFC3FF
FE3FF8FFE1FF87
003C00F001C007
1E007800E00380
E1FF87FF1FFC7F
FFC3FF0FFE3FF8
```

SECURITY CONCERNS

The keys file should be mode 600 or 400, and owned by root.

Packets' IP headers are not encrypted, though their TCP, UDP, or ICMP headers are encrypted along with the user data portion. This allows encrypted packets to traverse normal internetworks, but permits snoopers to analyze traffic by its endpoints.

Since the TCP, UDP, or ICMP header is encrypted, protocol-based filters along the packet's path will be unable to discern whether it is SMTP, Telnet, or any other network service. This means that

26 Aug 12 1994 Morning Star PPP 1.4.1

encrypted traffic will only permeate packet-filtering firewalls if the firewall allows all traffic between the endpoints, regardless of traffic type. Morning Star Technologies PPP/SLIP software for UNIX systems, and PPP/SLIP/Frame Relay routers, when deployed as the endpoint gateways of the encrypted traffic, decrypt incoming encrypted traffic before applying their configured packet filtering rules.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Systems(5), pppd(8), RFC 792, RFC 1548, RFC 1332, RFC 1334.

COPYRIGHT INFORMATION

PPP.KEYS(5) Morning Star Technologies PPP.KEYS(5)

encrypted traffic will only permeate packet-filtering firewalls if the firewall allows all traffic between the endpoints, regardless of traffic type. Morning Star Technologies PPP/SLIP software for UNIX systems, and PPP/SLIP/Frame Relay routers, when deployed as the endpoint gateways of the encrypted traffic, decrypt incoming encrypted traffic before applying their configured packet filtering rules.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Systems(5), pppd(8), RFC 792, RFC 1548, RFC 1332, RFC 1334.

COPYRIGHT INFORMATION

Copyright © 1993, 1994 Morning Star Technologies Inc.; all rights reserved.

Morning Star PPP 1.4.1 Aug 12 1994 27

NAME

ppp.Systems – PPP neighboring systems description file format

DESCRIPTION

The file **/etc/ppp/Systems** (or **/usr/lib/ppp/Systems** on SCO systems) describes how to connect with neighboring systems via PPP.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions are ignored in hostname specifications, but are significant elsewhere. Fields on a line are separated by horizontal white space (blanks or tabs). If a chat script ends with a backslash ('\'), the next line is considered a continuation of the chat script. Continuations may only occur in the midst of a chat script.

Each entry must contain six fields, in the following order:

name The hostname or IP address of the destination machine, which should be resolvable locally.

when A string that indicates the days of the week and the times of day when the system can be called (for example, MoTuTh0800-1740). The day portion may be a list containing any of Su, Mo, Tu, We, Th, Fr or Sa. The day may also be Wk for any weekday (same as MoTuWeThFr) or Any for any day (same as SuMoTuWeThFrSa).

You can indicate hours in a range (for example, 0800-1230). If you do not specify a time, calls will be allowed at any time.

Note that a time range that spans 0000 is permitted. For example, 0800-0600 means that all times are allowed except times between 6 AM and 8 AM.

Multiple date specifications that are separated by a vertical bar (|) are allowed. For example, Any0100-0600|Sa|Su means that the system can be called any day between 1 AM and 6 AM or any time on Saturday and Sunday.

The entire (sequence of) days and times may be followed by a semicolon and up to three decimal numbers separated by hyphens:

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

NAME

ppp.Systems – PPP neighboring systems description file format

DESCRIPTION

The file **/etc/ppp/Systems** (or **/usr/lib/ppp/Systems** on SCO systems) describes how to connect with neighboring systems via PPP.

FORMAT

Entries are one to a line; blank lines are ignored. Comments begin with a '#' and extend to the end of the line. Upper/lower case distinctions are ignored in hostname specifications, but are significant elsewhere. Fields on a line are separated by horizontal white space (blanks or tabs). If a chat script ends with a backslash ('\'), the next line is considered a continuation of the chat script. Continuations may only occur in the midst of a chat script.

Each entry must contain six fields, in the following order:

name The hostname or IP address of the destination machine, which should be resolvable locally.

when A string that indicates the days of the week and the times of day when the system can be called (for example, MoTuTh0800-1740). The day portion may be a list containing any of Su, Mo, Tu, We, Th, Fr or Sa. The day may also be Wk for any weekday (same as MoTuWeThFr) or Any for any day (same as SuMoTuWeThFrSa).

You can indicate hours in a range (for example, 0800-1230). If you do not specify a time, calls will be allowed at any time.

Note that a time range that spans 0000 is permitted. For example, 0800-0600 means that all times are allowed except times between 6 AM and 8 AM.

Multiple date specifications that are separated by a vertical bar (|) are allowed. For example, Any0100-0600|Sa|Su means that the system can be called any day between 1 AM and 6 AM or any time on Saturday and Sunday.

The entire (sequence of) days and times may be followed by a semicolon and up to three decimal numbers separated by hyphens:

28 Aug 12 1994 Morning Star PPP 1.4.1

one If only one number follows the semicolon, it is used as the redial delay, which is the initial time (in seconds) before a failed call will be retried. For example, Any;60 means call any time, but wait at least 60 seconds after a failure has occurred before trying to call again. If a call retry fails, *pppd* will double the delay before trying again. If no initial retry delay is specified, 10 seconds is assumed.

two If two numbers follow the semicolon, the second number is used as the maximum redial delay, which is the maximum time (in seconds) to delay before retrying a call. The retry time will double with each unsuccessful call until it reaches this value, after which the call will be retried every time the maximum number of seconds passes. If no maximum retry delay is specified, 3600 seconds is assumed.

three If three numbers follow the semicolon, the first is used as the callback delay, the second as the redial delay, and the third as the maximum redial delay. The callback delay is the time (in seconds) to wait before attempting to re-establish a previously active connection that ended because of an abrupt line disconnection (a Hangup or SIGHUP event in the log file). The default is not to delay before calling back.

During the delay following an unsuccessful call, any level 7 debugging messages written to **pppd.log** will have the message 'dial failed' appended.

device If set to 'ACU', any device in **Devices** with a matching speed may be used. The device's dialer chat script will be executed first, followed by the **Systems** chat script.

If set to the name of a device in the **/dev** directory (**tty00**, **cua**, etc.), then there may be an optional corresponding **Direct** entry in **Devices**, **Dialers** will not be consulted, and only the **Systems** chat script will be executed.

If set to 'tcp', then it must be followed by a slash, then

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

one If only one number follows the semicolon, it is used as the redial delay, which is the initial time (in seconds) before a failed call will be retried. For example, Any;60 means call any time, but wait at least 60 seconds after a failure has occurred before trying to call again. If a call retry fails, *pppd* will double the delay before trying again. If no initial retry delay is specified, 10 seconds is assumed.

two If two numbers follow the semicolon, the second number is used as the maximum redial delay, which is the maximum time (in seconds) to delay before retrying a call. The retry time will double with each unsuccessful call until it reaches this value, after which the call will be retried every time the maximum number of seconds passes. If no maximum retry delay is specified, 3600 seconds is assumed.

three If three numbers follow the semicolon, the first is used as the callback delay, the second as the redial delay, and the third as the maximum redial delay. The callback delay is the time (in seconds) to wait before attempting to re-establish a previously active connection that ended because of an abrupt line disconnection (a Hangup or SIGHUP event in the log file). The default is not to delay before calling back.

During the delay following an unsuccessful call, any level 7 debugging messages written to **pppd.log** will have the message 'dial failed' appended.

device If set to 'ACU', any device in **Devices** with a matching speed may be used. The device's dialer chat script will be executed first, followed by the **Systems** chat script.

If set to the name of a device in the **/dev** directory (**tty00**, **cua**, etc.), then there may be an optional corresponding **Direct** entry in **Devices**, **Dialers** will not be consulted, and only the **Systems** chat script will be executed.

If set to 'tcp', then it must be followed by a slash, then

Morning Star PPP 1.4.1 Aug 12 1994 29

the hostname or IP address of the system that will serve as the destination of the PPP link, then another slash, then the socket number on which to contact the remote PPP daemon.

speed The speed of the connection. If the device field is ACU, the speed field will be string matched against entries in **Devices**. Speeds must either be valid speed numbers or must begin with them (2400, 38400, 19200-PEP, etc.). If the device field is 'tcp...' or 'telnet...', the speed field is ignored, but must be present as a place-holder.

phone number
The value to replace the **\T** escape sequence in the dialer script. If the device field names an entry in **/dev**, the phone number field is optional. If the device field is 'tcp...' or 'telnet...', the phone number field is ignored if present, but must be present as a placeholder.

chat script A description of the conversation that *pppd* holds with the remote machine.

CHAT SCRIPT PARTICULARS

A chat script takes the form of a word to expect the remote end to send, followed by a word to send in response. Unless a 'send' string ends with **\c**, *pppd* will follow it by sending a carriage return character (ASCII 0x0d).

Chat scripts are 'expect send expect send ...' or 'expect-send-expect send ...', where the send following the hyphen is executed if the preceding expect fails to match received text.

Certain special words may be used in chat script 'send' strings to control the behavior of *pppd* as it attempts to dial. Both ABORT and TIMEOUT must be in the 'expect' phase of the chat script.

ABORT *abort-string* If *pppd* sees *abort-string* while executing the remainder of the chat script, abort the dialing attempt and note the failure in the log file.

TIMEOUT *timeout-time* While executing the current chat script, wait *timeout-time* seconds for an expected response before regarding the dialing attempt as having failed. Writes have a fixed

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

the hostname or IP address of the system that will serve as the destination of the PPP link, then another slash, then the socket number on which to contact the remote PPP daemon.

speed The speed of the connection. If the device field is ACU, the speed field will be string matched against entries in **Devices**. Speeds must either be valid speed numbers or must begin with them (2400, 38400, 19200-PEP, etc.). If the device field is 'tcp...' or 'telnet...', the speed field is ignored, but must be present as a place-holder.

phone number
The value to replace the **\T** escape sequence in the dialer script. If the device field names an entry in **/dev**, the phone number field is optional. If the device field is 'tcp...' or 'telnet...', the phone number field is ignored if present, but must be present as a placeholder.

chat script A description of the conversation that *pppd* holds with the remote machine.

CHAT SCRIPT PARTICULARS

A chat script takes the form of a word to expect the remote end to send, followed by a word to send in response. Unless a 'send' string ends with **\c**, *pppd* will follow it by sending a carriage return character (ASCII 0x0d).

Chat scripts are 'expect send expect send ...' or 'expect-send-expect send ...', where the send following the hyphen is executed if the preceding expect fails to match received text.

Certain special words may be used in chat script 'send' strings to control the behavior of *pppd* as it attempts to dial. Both ABORT and TIMEOUT must be in the 'expect' phase of the chat script.

ABORT *abort-string* If *pppd* sees *abort-string* while executing the remainder of the chat script, abort the dialing attempt and note the failure in the log file.

TIMEOUT *timeout-time* While executing the current chat script, wait *timeout-time* seconds for an expected response before regarding the dialing attempt as having failed. Writes have a fixed

30 Aug 12 1994 Morning Star PPP 1.4.1

60-second timeout.

The expect-send couplet of **""** **P_***WORD* sets the line parity accordingly:

P_AUTO Set transmission parity based on the parity observed in characters received in 'expect' strings. This is the default.

P_ZERO Transmit characters with the parity bit set to zero (8 bits, no parity).

P_ONE Transmit characters with the parity bit set to one.

P_EVEN Transmit characters with even parity.

P_ODD Transmit characters with odd parity.

The backquote character (‘) surrounds the name of a program that is to be run before proceeding. If the program is run in the 'send' phase of a chat script couplet, its standard output will be sent to the peer when the program exits. Chat script processing continues when the program exits.

In the midst of either an 'expect' string or a 'send' string, ^*x* gets translated into the appropriate control character, and *x* gets translated into *x*. Other special sequences are:

\s Send or receive a space character (ASCII 0x20)

\t Send or receive a horizontal tab character (ASCII 0x09)

\n Send or receive a line feed character (ASCII 0x0a)

\r Send or receive a carriage return character (ASCII 0x0d)

\\ Send or receive a backslash character (ASCII 0x5c)

\^ Send or receive a carat character (ASCII 0x5e)

^<character>
Send or receive the single character Ctrl-<character> (ASCII 0x00 through 0x1f)

ddd Send or receive a character, specified in octal *d*igits

\p Pause for .25 second before proceeding (send only)

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

60-second timeout.

The expect-send couplet of **""** **P_***WORD* sets the line parity accordingly:

P_AUTO Set transmission parity based on the parity observed in characters received in 'expect' strings. This is the default.

P_ZERO Transmit characters with the parity bit set to zero (8 bits, no parity).

P_ONE Transmit characters with the parity bit set to one.

P_EVEN Transmit characters with even parity.

P_ODD Transmit characters with odd parity.

The backquote character (‘) surrounds the name of a program that is to be run before proceeding. If the program is run in the 'send' phase of a chat script couplet, its standard output will be sent to the peer when the program exits. Chat script processing continues when the program exits.

In the midst of either an 'expect' string or a 'send' string, ^*x* gets translated into the appropriate control character, and *x* gets translated into *x*. Other special sequences are:

\s Send or receive a space character (ASCII 0x20)

\t Send or receive a horizontal tab character (ASCII 0x09)

\n Send or receive a line feed character (ASCII 0x0a)

\r Send or receive a carriage return character (ASCII 0x0d)

\\ Send or receive a backslash character (ASCII 0x5c)

\^ Send or receive a carat character (ASCII 0x5e)

^<character>
Send or receive the single character Ctrl-<character> (ASCII 0x00 through 0x1f)

ddd Send or receive a character, specified in octal *d*igits

\p Pause for .25 second before proceeding (send only)

Morning Star PPP 1.4.1 Aug 12 1994 31

\d Delay for two seconds before proceeding (send only)

\K Send a break (.25 second of zero bits)

\M Disable hangups (sets CLOCAL or LNOHANG)

\m enable hangups (unsets CLOCAL or LNOHANG) (the default)

\c Don't append a carriage return character after sending the preceding string (send only)

\q Don't print following send strings (e.g. a password) in any debugging or logging output. Subsequent **\q** sequences toggle 'quiet' mode.

\A Parse the incoming string as an IP address, written as four decimal numbers separated by periods, and use it for the local end of the point-to-point connection (receive only)

EXAMPLE

In the example below, we call host 'everyone' using a Telebit PEP modem with its DTE interface set at 19200 bps. We call host 'nobody' using a V.32/V.42/V.42bis modem that's capable of driving a 38400 DTE, and we are connected to host 'someone' via a direct cable attached to /dev/ttya, running asynchronous PPP. We talk to 'anyone' via a T1 CSU/DSU attached to port 0 on a SnapLink. And we connect with pseudo-one via a PPP connection tunneled across a TCP stream to port 77 on realone.somewhere.com.

If we are unsuccessful at connecting with 'someone' we will try again in two seconds. If that attempt fails, we will wait four seconds before the next attempt; then eight, then sixteen, then thirty two, then forty seconds. We will continue attempting to contact 'someone' every forty seconds. Our retry intervals and maximum backoff values for 'everyone' and 'nobody' are the default '10-3600'.

The notation "" "" means to expect nothing, then send nothing (followed by a carriage return). The implicit carriage return is often useful for eliciting a response from a remote system.

```
#
#       Systems - PPP systems file
```


PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

\d Delay for two seconds before proceeding (send only)

\K Send a break (.25 second of zero bits)

\M Disable hangups (sets CLOCAL or LNOHANG)

\m enable hangups (unsets CLOCAL or LNOHANG) (the default)

\c Don't append a carriage return character after sending the preceding string (send only)

\q Don't print following send strings (e.g. a password) in any debugging or logging output. Subsequent **\q** sequences toggle 'quiet' mode.

\A Parse the incoming string as an IP address, written as four decimal numbers separated by periods, and use it for the local end of the point-to-point connection (receive only)

EXAMPLE

In the example below, we call host 'everyone' using a Telebit PEP modem with its DTE interface set at 19200 bps. We call host 'nobody' using a V.32/V.42/V.42bis modem that's capable of driving a 38400 DTE, and we are connected to host 'someone' via a direct cable attached to /dev/ttya, running asynchronous PPP. We talk to 'anyone' via a T1 CSU/DSU attached to port 0 on a SnapLink. And we connect with pseudo-one via a PPP connection tunneled across a TCP stream to port 77 on realone.somewhere.com.

If we are unsuccessful at connecting with 'someone' we will try again in two seconds. If that attempt fails, we will wait four seconds before the next attempt; then eight, then sixteen, then thirty two, then forty seconds. We will continue attempting to contact 'someone' every forty seconds. Our retry intervals and maximum backoff values for 'everyone' and 'nobody' are the default '10-3600'.

The notation "" "" means to expect nothing, then send nothing (followed by a carriage return). The implicit carriage return is often useful for eliciting a response from a remote system.

```
#
#       Systems - PPP systems file
```

32 Aug 12 1994 Morning Star PPP 1.4.1

```
#
everyone Any ACU 19200-PEP 5551212 in:--in: Pwe word: \qfoObar
nobody Any ACU 38400 5551213 in:--in: Pthey word: \qbaZz1ng
someone Any;2-40 cua 38400 0 in:--in: Pthem word: \qmeumBle
anyone Any rsd0a/0 1536000
pseudo-one Any;2-2 tcp/realone.somewhere.com/57
```

RECOMMENDATIONS

The default retry time and backoff (i.e. Any;10-3600) are appropriate for use with dialup connections where the PPP connection must be reestablished as quickly as possible after an interruption but where it is not desirable to continuously redial a host that may be down. A much shorter maximum would be appropriate for a dedicated line between two systems, or where call attempts cost nothing. Moderate call retry times, such as 60 seconds, work well on systems that can establish connections in either direction using dialup modems, to avoid deadlocks waiting for telephone busy signals from each calling the other at the same time. Because of the difference between the behaviors of originating and answering modems, the 60-second clocks will usually start ticking at different times, allowing one side to call the other without interference. Alternatively, different call retry times may be specified at either end of a link to help keep the two systems from calling each other simultaneously.

If you specify host names, be sure that their addresses are available locally, even with the connection down. If you find that you must bring up a connection to resolve a domain name, consider using that host's IP address (decimal numbers separated by periods) in both **Filter** and **Systems** instead.

Automatic failover recovery can be arranged between systems that each have multiple modems, or multiple connection methods. If two systems are connected via a dedicated line (sync or async), that entry should be first in **Systems**, followed by another entry describing an on-demand dial-up connection. See the Morning Star PPP User Guide for more details.

SECURITY CONCERNS

The file **/etc/ppp/Systems** should be mode 600.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Sevices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055.

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

#
everyone Any ACU 19200-PEP 5551212 in:--in: Pwe word: \qfoObar
nobody Any ACU 38400 5551213 in:--in: Pthey word: \qbaZz1ng
someone Any;2-40 cua 38400 0 in:--in: Pthem word: \qmeumBle
anyone Any rsd0a/0 1536000
pseudo-one Any;2-2 tcp/realone.somewhere.com/57

RECOMMENDATIONS

The default retry time and backoff (i.e. Any;10-3600) are appropriate for use with dialup connections where the PPP connection must be reestablished as quickly as possible after an interruption but where it is not desirable to continuously redial a host that may be down. A much shorter maximum would be appropriate for a dedicated line between two systems, or where call attempts cost nothing. Moderate call retry times, such as 60 seconds, work well on systems that can establish connections in either direction using dialup modems, to avoid deadlocks waiting for telephone busy signals from each calling the other at the same time. Because of the difference between the behaviors of originating and answering modems, the 60-second clocks will usually start ticking at different times, allowing one side to call the other without interference. Alternatively, different call retry times may be specified at either end of a link to help keep the two systems from calling each other simultaneously.

If you specify host names, be sure that their addresses are available locally, even with the connection down. If you find that you must bring up a connection to resolve a domain name, consider using that host's IP address (decimal numbers separated by periods) in both **Filter** and **Systems** instead.

Automatic failover recovery can be arranged between systems that each have multiple modems, or multiple connection methods. If two systems are connected via a dedicated line (sync or async), that entry should be first in **Systems**, followed by another entry describing an on-demand dial-up connection. See the Morning Star PPP User Guide for more details.

SECURITY CONCERNS

The file **/etc/ppp/Systems** should be mode 600.

SEE ALSO

tun(4), ppp.Auth(5), ppp.Sevices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), pppd(8), RFC 1548, RFC 1332, RFC 1144, RFC 1055.

Morning Star PPP 1.4.1 Aug 12 1994 33

COPYRIGHT INFORMATION

PPP.SYSTEMS(5) Morning Star Technologies PPP.SYSTEMS(5)

COPYRIGHT INFORMATION

Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc.;
all rights reserved.

34 Aug 12 1994 Morning Star PPP 1.4.1

NAME

pppd – PPP daemon

SYNOPSIS

pppd [options...]

DESCRIPTION

Pppd is a daemon process used in UNIX systems to manage connections to other hosts using PPP, the Point to Point Protocol, or SLIP, the Serial Line Internet Protocol. It uses the UNIX host's native serial ports or the Morning Star SnapLink SCSI-attached high speed serial interface. It communicates with the UNIX kernel's own TCP/IP implementation via the Morning Star IP tunnel driver. (see *tun*(4))

DAEMON MANAGEMENT OPTIONS

auto Start in 'autocall' mode and detach from the controlling terminal to run as a daemon. Initiate a connection in response to a packet specified in the 'bringup' category in filter-file. Requires the remote address.

up When used with **auto**, bring the link up immediately rather than waiting for traffic. If the link goes down, attempt to restart it (after the call retry delay timer expires) without waiting for an outbound packet.

dedicated Treat the connection as a dedicated line rather than a demand-dial connection. This option tells *pppd* to never give up on the connection; that is, if the peer tries to shut down the link, go ahead and do so, but then immediately try to reestablish the connection. Similarly, when first trying to connect, *pppd* will not give up after sending a fixed number of Configure-Request messages. Hangup events (LQM failures, loss of Carrier Detect) will still cause the device to be closed, just as with dial-up connections, and the **Systems** file will then be checked for alternate entries. If none are available, the connection will be reestablished after the call retry delay timer

PPPD(8) Morning Star Technologies PPPD(8)

NAME

pppd – PPP daemon

SYNOPSIS

pppd [options...]

DESCRIPTION

Pppd is a daemon process used in UNIX systems to manage connections to other hosts using PPP, the Point to Point Protocol, or SLIP, the Serial Line Internet Protocol. It uses the UNIX host's native serial ports or the Morning Star SnapLink SCSI-attached high speed serial interface. It communicates with the UNIX kernel's own TCP/IP implementation via the Morning Star IP tunnel driver. (see tun(4))

DAEMON MANAGEMENT OPTIONS

auto Start in 'autocall' mode and detach from the controlling terminal to run as a daemon. Initiate a connection in response to a packet specified in the 'bringup' category in filter-file. Requires the remote address.

up When used with auto, bring the link up immediately rather than waiting for traffic. If the link goes down, attempt to restart it (after the call retry delay timer expires) without waiting for an outbound packet.

dedicated Treat the connection as a dedicated line rather than a demand-dial connection. This option tells pppd to never give up on the connection; that is, if the peer tries to shut down the link, go ahead and do so, but then immediately try to reestablish the connection. Similarly, when first trying to connect, pppd will not give up after sending a fixed number of Configure-Request messages. Hangup events (LQM failures, loss of Carrier Detect) will still cause the device to be closed, just as with dial-up connections, and the Systems file will then be checked for alternate entries. If none are available, the connection will be reestablished after the call retry delay timer

Morning Star PPP 1.4.1 Aug 12 1994 35

expires. Use a short call retry delay timer on dedicated circuits; something like **Any;5-30** should work well. Implies **up**.

nodetach Don't detach from the controlling terminal in 'autocall' mode. When used with **log -**, this can be useful for watching the progress of the PPP session.

log log-file Append logging messages to log-file (default: **/usr/adm/pppd.log**).

acct acct-file Append session accounting messages to acct-file. If acct-file is the same as log-file, the session accounting messages will be interleaved with other logging information.

filter filter-file Look in filter-file for packet filtering and link management information (default: **/etc/ppp/Filter** or **/usr/lib/ppp/Filter** on SCO systems)

debug debug-level Set the log file verbosity to debug-level, chosen from the following table:

0 Daemon start messages

1 Link status messages, calling attempts (the default)

2 Chat script processing, input framing errors

3 LCP, IPCP, PAP and CHAP negotiation

4 LQM status summaries

5 IP interface changes

6 IP message summaries

7 Full LQM reports

8 All PPP messages (without framing)

9 Characters read or written

10 Procedure call messages

11

Internal timers the lower-numbered levels.

PPPD(8) Morning Star Technologies PPPD(8)

expires. Use a short call retry delay timer on dedicated circuits; something like **Any;5-30** should work well. Implies **up**.

nodetach Don't detach from the controlling terminal in 'autocall' mode. When used with **log -**, this can be useful for watching the progress of the PPP session.

log log-file Append logging messages to log-file (default: **/usr/adm/pppd.log**).

acct acct-file Append session accounting messages to acct-file. If acct-file is the same as log-file, the session accounting messages will be interleaved with other logging information.

filter filter-file Look in filter-file for packet filtering and link management information (default: **/etc/ppp/Filter** or **/usr/lib/ppp/Filter** on SCO systems)

debug debug-level Set the log file verbosity to debug-level, chosen from the following table:

0 Daemon start messages

1 Link status messages, calling attempts (the default)

2 Chat script processing, input framing errors

3 LCP, IPCP, PAP and CHAP negotiation

4 LQM status summaries

5 IP interface changes

6 IP message summaries

7 Full LQM reports

8 All PPP messages (without framing)

9 Characters read or written

10 Procedure call messages

11

Internal timers the lower-numbered levels.

36 Aug 12 1994 Morning Star PPP 1.4.1

exec exec-cmd
: Run 'exec-cmd **up** addr args' when the link comes up, and 'exec-cmd **down** addr args' when it goes down. *Addr* is the IP address of the peer, and *args* is the list of arguments given to pppd.

nopop
: On Sun systems, don't pop the *ldterm* and *ttcompat* STREAMS modules when opening **/dev/tty**. This is necessary when **/dev/tty** happens to serve as the console.

nonice
: Run at a normal user process priority, rather than using the nice() library routine to elevate *pppd*'s scheduling priority to -10.

COMMUNICATIONS OPTIONS

asyncmap async-map
: Set the desired Async Control Character Map to async-map, expressed in C-style hexadecimal notation (default 0xA0000).

noasyncmap
: Disable LCP Async Control Character Map negotiation.

escape odd-character
: In addition to those characters specified in the PPP Async Control Character Map (which can include only 0x00 through 0x1F), also apply the escaping algorithm when transmitting odd-character. The value of odd-character must be between 0x00 and 0xFF, and cannot be any of 0x5E, 0x7D or 0x7E.

  Odd-character can be specified as a decimal number, in C-style hexadecimal notation, or as an ASCII character with optional '^' control-character notation. For example, the XON character could be specified as 17, 0x11, or ^Q.

  If a character specified with the **escape** argument, when transformed into its escaped form, would be the same as a character contained in the peer's negotiated Async Control Character Map, a warning

PPPD(8) Morning Star Technologies PPPD(8)

exec exec-cmd
: Run 'exec-cmd **up** addr args' when the link comes up, and 'exec-cmd **down** addr args' when it goes down. *Addr* is the IP address of the peer, and *args* is the list of arguments given to pppd.

nopop
: On Sun systems, don't pop the *ldterm* and *ttcompat* STREAMS modules when opening **/dev/tty**. This is necessary when **/dev/tty** happens to serve as the console.

nonice
: Run at a normal user process priority, rather than using the nice() library routine to elevate *pppd*'s scheduling priority to -10.

COMMUNICATIONS OPTIONS

asyncmap async-map
: Set the desired Async Control Character Map to async-map, expressed in C-style hexadecimal notation (default 0xA0000).

noasyncmap
: Disable LCP Async Control Character Map negotiation.

escape odd-character
: In addition to those characters specified in the PPP Async Control Character Map (which can include only 0x00 through 0x1F), also apply the escaping algorithm when transmitting odd-character. The value of odd-character must be between 0x00 and 0xFF, and cannot be any of 0x5E, 0x7D or 0x7E.

  Odd-character can be specified as a decimal number, in C-style hexadecimal notation, or as an ASCII character with optional '^' control-character notation. For example, the XON character could be specified as 17, 0x11, or ^Q.

  If a character specified with the **escape** argument, when transformed into its escaped form, would be the same as a character contained in the peer's negotiated Async Control Character Map, a warning

will be printed in the log file and the character specified on the command line will not be escaped.

If a character specified with the **escape** argument, when transformed into its escaped form, would be the same as a character specified in another **escape** argument on the daemon's command line, *pppd* will print an error message and exit.

device — Communicate over the named device (default /dev/tty).

comm-speed — Set communications rate to comm-speed bits per second.

poll poll-rate — Set SnapLink polling frequency, in polls per second. Recommend values are 20, 50, or 100 (default 50). **internal-clocking** The SnapLink will provide the synchronous clock signal (TXCLK and RXCLK). By default, it expects the modem, CSU/DSU or modem eliminator to provide the clock signal. Internal-clocking cannot be used with RS-232 cables on the SnapLink.

ignore-cd — Ignore the state of the CD (Carrier Detect, also called DCD, Data Carrier Detect) signal. This is useful for systems that don't support CD but want to run PPP over a dedicated line.

rtscts — Set the line to use out-of-band EIA RS-232-D 'hardware' (RTS/CTS) flow control. (The default is to use no flow control.) For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line. This option is not available on all systems. On NeXT systems, enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. On Silicon Graphics systems, use **/dev/ttyf2** for a modem with hardware flow control instead (see *serial*(7)). On SCO systems, **rtscts**

PPPD(8) Morning Star Technologies PPPD(8)

will be printed in the log file and the character specified on the command line will not be escaped.

If a character specified with the **escape** argument, when transformed into its escaped form, would be the same as a character specified in another **escape** argument on the daemon's command line, *pppd* will print an error message and exit.

device — Communicate over the named device (default /dev/tty).

comm-speed — Set communications rate to comm-speed bits per second.

poll poll-rate — Set SnapLink polling frequency, in polls per second. Recommend values are 20, 50, or 100 (default 50). **internal-clocking** The SnapLink will provide the synchronous clock signal (TXCLK and RXCLK). By default, it expects the modem, CSU/DSU or modem eliminator to provide the clock signal. Internal-clocking cannot be used with RS-232 cables on the SnapLink.

ignore-cd — Ignore the state of the CD (Carrier Detect, also called DCD, Data Carrier Detect) signal. This is useful for systems that don't support CD but want to run PPP over a dedicated line.

rtscts — Set the line to use out-of-band EIA RS-232-D 'hardware' (RTS/CTS) flow control. (The default is to use no flow control.) For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line. This option is not available on all systems. On NeXT systems, enable **ttydfa** or **ttydfb** in **/etc/ttys** instead. On Silicon Graphics systems, use **/dev/ttyf2** for a modem with hardware flow control instead (see *serial*(7)). On SCO systems, **rtscts**

38 Aug 12 1994 Morning Star PPP 1.4.1

cannot be used with either **rtscts-rtsflow** or **rtscts-crtsfl**.

crtscts A synonym for **rtscts**.

rtscts-rtsflow As above in **rtscts**, but sets both CTSFLOW and RTSFLOW. (SCO UNIX systems only, and cannot be used with either **rtscts** or **rtscts-crtsfl**).

crtscts-rtsflow A synonym for **rtscts-rtsflow**.

rtscts-crtsfl As above in **rtscts**, but sets CRTSFL and clears both CTSFLOW and RTSFLOW. (SCO UNIX systems only, and cannot be used with either **rtscts** or **rtscts-rtsflow**).

crtscts-crtsfl A synonym for **rtscts-crtsfl**.

xonxoff Set the line to use in-band ('software') flow control, using the characters DC3 (^S, XOFF, ASCII 0x13) to stop the flow and DC1 (^Q, XON, ASCII 0x11) to resume. (The default is to use no flow control.) For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line.

telnet When used on an answering pppd command line, negotiate the telnet binary option and understand telnet escape processing. Not for use with **device** or **auto**.

LINK MANAGEMENT OPTIONS

nooptions Disable all LCP and IPCP options.

noaccomp Disable HDLC Address and Control Field compression.

noprotcomp Disable LCP Protocol Field Compression.

slip Use RFC 1055 SLIP packet framing rather than PPP packet framing. Disables all option negotiation, and implies **noasyncmap**, **noipaddress**, **vjslots 16**, **novjcid**, **nomagic**, **nomru**, and **mru 1006**. Implies **vjcomp** if peer sends a header-compressed TCP packet.

PPPD(8) Morning Star Technologies PPPD(8)

cannot be used with either **rtscts-rtsflow** or **rtscts-crtsfl**.

crtscts A synonym for **rtscts**.

rtscts-rtsflow As above in **rtscts**, but sets both CTSFLOW and RTSFLOW. (SCO UNIX systems only, and cannot be used with either **rtscts** or **rtscts-crtsfl**).

crtscts-rtsflow A synonym for **rtscts-rtsflow**.

rtscts-crtsfl As above in **rtscts**, but sets CRTSFL and clears both CTSFLOW and RTSFLOW. (SCO UNIX systems only, and cannot be used with either **rtscts** or **rtscts-rtsflow**).

crtscts-crtsfl A synonym for **rtscts-crtsfl**.

xonxoff Set the line to use in-band ('software') flow control, using the characters DC3 (^S, XOFF, ASCII 0x13) to stop the flow and DC1 (^Q, XON, ASCII 0x11) to resume. (The default is to use no flow control.) For an outbound connection, this may be specified either in **Devices** or on the *pppd* command line.

telnet When used on an answering pppd command line, negotiate the telnet binary option and understand telnet escape processing. Not for use with **device** or **auto**.

LINK MANAGEMENT OPTIONS

nooptions Disable all LCP and IPCP options.

noaccomp Disable HDLC Address and Control Field compression.

noprotcomp Disable LCP Protocol Field Compression.

slip Use RFC 1055 SLIP packet framing rather than PPP packet framing. Disables all option negotiation, and implies **noasyncmap**, **noipaddress**, **vjslots 16**, **novjcid**, **nomagic**, **nomru**, and **mru 1006**. Implies **vjcomp** if peer sends a header-compressed TCP packet.

Morning Star PPP 1.4.1 Aug 12 1994 39

extra-slip-end When running in SLIP mode, prepend a SLIP packet framing character (0xC0) to each frame before transmission, even if this frame immediately follows the previous frame. By default, *pppd* transmits only one framing character between adjacent SLIP frames.

nomagic Disable LCP Magic Number negotiation.

mru mru-size Set LCP Maximum Receive Unit value to mru-size for negotiation. The default is 1500 for PPP (256 on Sun-3) and 1006 for SLIP.

nomru Disable LCP Maximum Receive Unit negotiation, and use 1500 (256 on Sun-3) for our interface.

active Begin LCP parameter negotiation immediately (the default).

passive Do not send our first LCP packet until we receive an LCP packet from the peer.

timeout restart-time Set the LCP, IPCP, CCP, PAP, and CHAP option negotiation restart timers to restart-time (default 3 seconds).

lqrinterval time Send Link-Quality-Reports or Echo-Requests every *time* seconds (default 10 seconds). If the peer responds with a Protocol-Reject, send LCP Echo-Requests every *time* seconds instead, and use the received LCP Echo-Replies for link status policy decisions.

lqthreshold min/per Set a minimum standard for link quality by considering the connection to have failed if fewer than *min* out of the last *per* LQRs we sent have been responded to by the peer (default 1/5).

echolqm Use LCP Echo-Requests rather than standard Link-Quality-Report messages for link quality assessment and policy

PPPD(8) Morning Star Technologies PPPD(8)

extra-slip-end When running in SLIP mode, prepend a SLIP packet framing character (0xC0) to each frame before transmission, even if this frame immediately follows the previous frame. By default, *pppd* transmits only one framing character between adjacent SLIP frames.

nomagic Disable LCP Magic Number negotiation.

mru mru-size Set LCP Maximum Receive Unit value to mru-size for negotiation. The default is 1500 for PPP (256 on Sun-3) and 1006 for SLIP.

nomru Disable LCP Maximum Receive Unit negotiation, and use 1500 (256 on Sun-3) for our interface.

active Begin LCP parameter negotiation immediately (the default).

passive Do not send our first LCP packet until we receive an LCP packet from the peer.

timeout restart-time Set the LCP, IPCP, CCP, PAP, and CHAP option negotiation restart timers to restart-time (default 3 seconds).

lqrinterval time Send Link-Quality-Reports or Echo-Requests every *time* seconds (default 10 seconds). If the peer responds with a Protocol-Reject, send LCP Echo-Requests every *time* seconds instead, and use the received LCP Echo-Replies for link status policy decisions.

lqthreshold min/per Set a minimum standard for link quality by considering the connection to have failed if fewer than *min* out of the last *per* LQRs we sent have been responded to by the peer (default 1/5).

echolqm Use LCP Echo-Requests rather than standard Link-Quality-Report messages for link quality assessment and policy

40 Aug 12 1994 Morning Star PPP 1.4.1

decisions. The peer can override this if it actively tries to configure Link Quality Monitoring unless the **nolqm** parameter is also specified.

nolqm Don't send or recognize Link-Quality-Report messages. If **echolqm** is also specified, Echo-Request messages will be used to detect link failures.

idle idle-time Shut down the link when idle-time seconds pass without receiving or transmitting a packet specified in the 'keepup' category in the filter file (default is to never shut down).

max-configure tries Set the PPP Max-Configure counter (the maximum number of Configure-Requests sent without a response) to **tries**.

max-terminate tries Set the PPP Max-Terminate counter (the maximum number of Terminate-Requests sent without a response) to **tries**.

max-failure tries Set the PPP Max-Failure counter (the maximum number of Configure-Naks sent without a positive response) to **tries**.

IP OPTIONS

local**:**remote The address of this machine, followed by the expected address for the remote machine. Can be specified either as symbolic names or as literal IP addresses, if their addresses cannot be discovered locally without using the PPP link.

Both addresses are optional, but a colon by itself is not valid, and the remote address is required when running as a daemon in 'autocall' mode. If only 'local:' is specified when receiving an incoming call, the remote address will be discovered during IPCP IP-Address negotiations.

If either address is followed by a tilde character ('~'), or if the tilde appears alone, *pppd*

PPPD(8) Morning Star Technologies PPPD(8)

decisions. The peer can override this if it actively tries to configure Link Quality Monitoring unless the **nolqm** parameter is also specified.

nolqm Don't send or recognize Link-Quality-Report messages. If **echolqm** is also specified, Echo-Request messages will be used to detect link failures.

idle idle-time Shut down the link when idle-time seconds pass without receiving or transmitting a packet specified in the 'keepup' category in the filter file (default is to never shut down).

max-configure tries Set the PPP Max-Configure counter (the maximum number of Configure-Requests sent without a response) to **tries**.

max-terminate tries Set the PPP Max-Terminate counter (the maximum number of Terminate-Requests sent without a response) to **tries**.

max-failure tries Set the PPP Max-Failure counter (the maximum number of Configure-Naks sent without a positive response) to **tries**.

IP OPTIONS

local**:**remote The address of this machine, followed by the expected address for the remote machine. Can be specified either as symbolic names or as literal IP addresses, if their addresses cannot be discovered locally without using the PPP link.

Both addresses are optional, but a colon by itself is not valid, and the remote address is required when running as a daemon in 'autocall' mode. If only 'local:' is specified when receiving an incoming call, the remote address will be discovered during IPCP IP-Address negotiations.

If either address is followed by a tilde character ('~'), or if the tilde appears alone, *pppd*

Morning Star PPP 1.4.1 Aug 12 1994 41

accepts the IP address given by the peer during IPCP negotiations, whether for the local end or the peer's end of the link. (not available in SLIP mode)

Because SLIP cannot perform option negotiations, including IPCP, both addresses should normally be specified, and the tilde option is unavailable. To obtain a similar "feature", the peer must provide the IP address textually during the login process, and a new value must be obtained using the Systems file '\A' chat script feature (see **ppp.Systems(5)**).

netmask subnet-mask — Set the subnet mask of the interface to subnet-mask, expressed either in C-style hexadecimal (e.g. 0xffffff00) or in decimal dotted-quad notation (e.g. 255.255.255.0). The default subnet mask will be appropriate for the network (class A, B, or C), assuming no subnetting.

noipaddress — Disable IPCP IP-Address negotiation.

vjcomp — Enable RFC 1144 'VJ' Van Jacobson TCP header compression negotiation with 16 slots and slot ID compression (this is the default with PPP framing). 'VJ' compression is enabled by default for async connections, and disabled by default for sync connections.

novjcomp — Disable RFC 1144 'VJ' Van Jacobson TCP header compression (this is the default with SLIP framing, until the peer sends a header-compressed TCP packet).

vjslots vj-slots — Set the number of VJ compression slots (min 3, max 256, default 16).

novjcid — Disable VJ compression slot ID compression (enabled by default).

rfc1172-vj — Backwards compatibility with older PPP implementations (4-byte VJ configuration

PPPD(8) Morning Star Technologies PPPD(8)

accepts the IP address given by the peer during IPCP negotiations, whether for the local end or the peer's end of the link. (not available in SLIP mode)

Because SLIP cannot perform option negotiations, including IPCP, both addresses should normally be specified, and the tilde option is unavailable. To obtain a similar "feature", the peer must provide the IP address textually during the login process, and a new value must be obtained using the Systems file '\A' chat script feature (see **ppp.Systems(5)**).

netmask subnet-mask — Set the subnet mask of the interface to subnet-mask, expressed either in C-style hexadecimal (e.g. 0xffffff00) or in decimal dotted-quad notation (e.g. 255.255.255.0). The default subnet mask will be appropriate for the network (class A, B, or C), assuming no subnetting.

noipaddress — Disable IPCP IP-Address negotiation.

vjcomp — Enable RFC 1144 'VJ' Van Jacobson TCP header compression negotiation with 16 slots and slot ID compression (this is the default with PPP framing). 'VJ' compression is enabled by default for async connections, and disabled by default for sync connections.

novjcomp — Disable RFC 1144 'VJ' Van Jacobson TCP header compression (this is the default with SLIP framing, until the peer sends a header-compressed TCP packet).

vjslots vj-slots — Set the number of VJ compression slots (min 3, max 256, default 16).

novjcid — Disable VJ compression slot ID compression (enabled by default).

rfc1172-vj — Backwards compatibility with older PPP implementations (4-byte VJ configuration

42 Aug 12 1994 Morning Star PPP 1.4.1

option), but with the correct option negotiation value of 0x002d.

rfc1172-typo-vj Backwards compatibility with older PPP implementations (4-byte VJ configuration option) that conform to the typographical error in RFC 1172 section 5.2 (Compression-Type value 0x0037).

rfc1172-addresses Backwards compatibility with older PPP implementations that conform to RFC 1172 section 5.1 (IP-Addresses, IPCP configuration option 1) and not with the newer RFC 1332 (IP-Address, IPCP configuration option 3), but that respond with something besides a Configure-Reject when they receive an IPCP Configure-Request containing an option 3.

AUTHENTICATION OPTIONS

nopap Don't allow PAP authentication (default: allow PAP but don't require it).

nochap Don't allow CHAP authentication (default: allow CHAP but don't require it).

requireauth Require either PAP or CHAP authentication.

requirechap Require CHAP authentication as described in RFC 1334.

rechap interval Demand that the peer re-authenticate itself (using CHAP) every interval seconds. If the peer fails the new challenge, the link is terminated.

oldchap Interoperate with CHAP implementations (e.g. Morning Star PPP version 1.3) that conform with certain draft versions of the CHAP protocol specification.

olderchap Interoperate with CHAP implementations that conform with certain older draft versions of the CHAP protocol specification.

PPPD(8) Morning Star Technologies PPPD(8)

option), but with the correct option negotiation value of 0x002d.

rfc1172-typo-vj Backwards compatibility with older PPP implementations (4-byte VJ configuration option) that conform to the typographical error in RFC 1172 section 5.2 (Compression-Type value 0x0037).

rfc1172-addresses Backwards compatibility with older PPP implementations that conform to RFC 1172 section 5.1 (IP-Addresses, IPCP configuration option 1) and not with the newer RFC 1332 (IP-Address, IPCP configuration option 3), but that respond with something besides a Configure-Reject when they receive an IPCP Configure-Request containing an option 3.

AUTHENTICATION OPTIONS

nopap Don't allow PAP authentication (default: allow PAP but don't require it).

nochap Don't allow CHAP authentication (default: allow CHAP but don't require it).

requireauth Require either PAP or CHAP authentication.

requirechap Require CHAP authentication as described in RFC 1334.

rechap interval Demand that the peer re-authenticate itself (using CHAP) every interval seconds. If the peer fails the new challenge, the link is terminated.

oldchap Interoperate with CHAP implementations (e.g. Morning Star PPP version 1.3) that conform with certain draft versions of the CHAP protocol specification.

olderchap Interoperate with CHAP implementations that conform with certain older draft versions of the CHAP protocol specification.

Morning Star PPP 1.4.1 Aug 12 1994 43

name identifier — Provide the identifier used during PAP or CHAP negotiation. This option is necessary if the PPP peer requires authentication. The default value is the value returned by the *gethostname*(2) system call or the *hostname*(1) command.

ENCRYPTION OPTIONS

Encryption is not available in software exported from the USA.

gw-crypt keys-file — Encrypt traffic between the pairs of hosts or networks specified in the designated keys file (see *ppp.Keys*(5)).

LINK COMPRESSION OPTIONS

compress — Offer all supported link compression types (currently only Predictor-1) when negotiating. The default is to propose and accept no link compression type.

compress-pred1 — Accept any supported compression type, but prefer Predictor type 1 compression.

nopred1 — Never use Predictor-1 compression.

LOG FILE

Status information is recorded in the log file (**/usr/adm/pppd.log** by default) by each copy of *pppd* running on a single machine. Each line in the file consists of a message preceded by the date, the time, and the process ID number of the daemon writing the message. The quantity and verbosity of messages are controlled with the **debug** option and with the **log** filter (see *ppp.Filter*(5)).

Each packet that brings up the link (at debug level 1 or more), each packet that matches the **log** filter (at any debug level), or any packet when the debug level is 7 or more writes a one-line description of the packet to the log file. The first item of the message is the protocol (**tcp**, **udp**, **icmp**, or a numeric protocol value). For ICMP packets, the keyword **icmp** is followed by the ICMP message type and sub code, separated by slashes. After the protocol comes an IP address and optionally a TCP or UDP port number, followed by an arrow indicating whether the packet was sent (**–>**) or received (**<–**), followed by another address and port number, followed by the length of the packet in bytes before VJ TCP header compression, followed by zero or more keywords. For transmitted packets,

PPPD(8) Morning Star Technologies PPPD(8)

name identifier — Provide the identifier used during PAP or CHAP negotiation. This option is necessary if the PPP peer requires authentication. The default value is the value returned by the *gethostname*(2) system call or the *hostname*(1) command.

ENCRYPTION OPTIONS

Encryption is not available in software exported from the USA.

gw-crypt keys-file — Encrypt traffic between the pairs of hosts or networks specified in the designated keys file (see *ppp.Keys*(5)).

LINK COMPRESSION OPTIONS

compress — Offer all supported link compression types (currently only Predictor-1) when negotiating. The default is to propose and accept no link compression type.

compress-pred1 — Accept any supported compression type, but prefer Predictor type 1 compression.

nopred1 — Never use Predictor-1 compression.

LOG FILE

Status information is recorded in the log file (**/usr/adm/pppd.log** by default) by each copy of *pppd* running on a single machine. Each line in the file consists of a message preceded by the date, the time, and the process ID number of the daemon writing the message. The quantity and verbosity of messages are controlled with the **debug** option and with the **log** filter (see *ppp.Filter*(5)).

Each packet that brings up the link (at debug level 1 or more), each packet that matches the **log** filter (at any debug level), or any packet when the debug level is 7 or more writes a one-line description of the packet to the log file. The first item of the message is the protocol (**tcp**, **udp**, **icmp**, or a numeric protocol value). For ICMP packets, the keyword **icmp** is followed by the ICMP message type and sub code, separated by slashes. After the protocol comes an IP address and optionally a TCP or UDP port number, followed by an arrow indicating whether the packet was sent (**–>**) or received (**<–**), followed by another address and port number, followed by the length of the packet in bytes before VJ TCP header compression, followed by zero or more keywords. For transmitted packets,

44 Aug 12 1994 Morning Star PPP 1.4.1

the first IP address is the source address, while for received packets, the first IP address is the destination address. Well known TCP and UDP port numbers will be replaced by the name returned by the *getservbyport()* library function. The keywords and their meanings are:

frag the packet is a middle or later part of a fragmented IP frame

syn the packet has the TCP SYN bit set

fin the packet has the TCP FIN bit set

bringup the transmitted packet matches the **bringup** filter and is bringing up the link

!keepup the packet has been rejected by the **keepup** filter

!pass the packet has been rejected by the **pass** filter

dial failed the packet was dropped because *pppd* is waiting for the call retry timer to expire

(c) the received packet is VJ TCP header compressed

(u) the received packet is VJ TCP header uncompressed

For example, the following log file line

```
9/6-14:06:26-83 tcp 63.1.6.3/1050 -> 8.1.1.9/smtp 44 syn
```

indicates that at 2:06:26 PM on September 6, process ID 83 sent a 44-byte TCP packet with the SYN bit set from port 1050 on 63.1.6.3 to the SMTP port on 8.1.1.9.

SIGNALS

Upon reception of the following signals, *pppd* closes and reopens the log file, re-reads the filter and key files, then takes the indicated actions:

SIGKILL Don't use this. Never, never use this. Since *pppd* won't be able to shut down gracefully, it will leave your serial interfaces (whether **/dev/tty** or a SnapLink) and your IP tunnel driver in some unknown state. Use SIGTERM instead, so *pppd* will shut down cleanly, and leave the system in a well-defined state.

SIGINT Disconnect gracefully from an active session. If in 'autocall' mode, reset the call retry delay timer and call retry backoff interval. If **up** was specified, attempt

PPPD(8) Morning Star Technologies PPPD(8)

the first IP address is the source address, while for received packets, the first IP address is the destination address. Well known TCP and UDP port numbers will be replaced by the name returned by the *getservbyport()* library function. The keywords and their meanings are:

frag the packet is a middle or later part of a fragmented IP frame

syn the packet has the TCP SYN bit set

fin the packet has the TCP FIN bit set

bringup the transmitted packet matches the **bringup** filter and is bringing up the link

!keepup the packet has been rejected by the **keepup** filter

!pass the packet has been rejected by the **pass** filter

dial failed the packet was dropped because *pppd* is waiting for the call retry timer to expire

(c) the received packet is VJ TCP header compressed

(u) the received packet is VJ TCP header uncompressed

For example, the following log file line

```
9/6-14:06:26-83 tcp 63.1.6.3/1050 -> 8.1.1.9/smtp 44 syn
```

indicates that at 2:06:26 PM on September 6, process ID 83 sent a 44-byte TCP packet with the SYN bit set from port 1050 on 63.1.6.3 to the SMTP port on 8.1.1.9.

SIGNALS

Upon reception of the following signals, *pppd* closes and reopens the log file, re-reads the filter and key files, then takes the indicated actions:

SIGKILL Don't use this. Never, never use this. Since *pppd* won't be able to shut down gracefully, it will leave your serial interfaces (whether **/dev/tty** or a SnapLink) and your IP tunnel driver in some unknown state. Use SIGTERM instead, so *pppd* will shut down cleanly, and leave the system in a well-defined state.

SIGINT Disconnect gracefully from an active session. If in 'autocall' mode, reset the call retry delay timer and call retry backoff interval. If **up** was specified, attempt

to re-establish the link. Exit if not in 'autocall' mode.

SIGHUP Disconnect abruptly from an active session. If **up** was specified, attempt to re-establish the link. Exit if not in 'autocall' mode.

SIGTERM Disconnect gracefully from an active session, clean up the state of any serial and IP interfaces that are open, then exit.

SIGUSR1 Increment the verbosity level for debugging information written to the log file.

SIGUSR2 Reset the debugging verbosity level to the base value (1 unless **debug 0** was supplied on the command line).

SIGALRM Take no action except to re-read the filter and key files.

EXAMPLE

To run a pair of daemons on 'oursystem', one maintaining a constant link with 'backbonesystem' and the other prepared to initiate outbound calls to a neighboring machine named 'theirsystem', add the following to **/etc/rc.local**:

```
if [ -f /etc/ppp/Startup ]; then
     /etc/ppp/Startup
fi
```

Then make **/etc/ppp/Startup** look like this:

```
#!/bin/sh

PATH=/usr/etc:/bin:/usr/bin

if [ -f /usr/adm/pppd.log ]; then
        mv /usr/adm/pppd.log /usr/adm/OLDpppd.log
fi

echo -n "Starting PPP daemons:"        >/dev/console

pppd oursystem:backbonesystem auto up
        (echo -n ' backbonesystem')    >/dev/console
pppd oursystem:theirsystem auto idle 120
        (echo -n ' theirsystem')       >/dev/console

echo '.'                               >/dev/console
```

To allow a PPP implementation running on 'theirsystem' to dial

PPPD(8) Morning Star Technologies PPPD(8)

to re-establish the link. Exit if not in 'autocall' mode.

SIGHUP Disconnect abruptly from an active session. If **up** was specified, attempt to re-establish the link. Exit if not in 'autocall' mode.

SIGTERM Disconnect gracefully from an active session, clean up the state of any serial and IP interfaces that are open, then exit.

SIGUSR1 Increment the verbosity level for debugging information written to the log file.

SIGUSR2 Reset the debugging verbosity level to the base value (1 unless **debug 0** was supplied on the command line).

SIGALRM Take no action except to re-read the filter and key files.

EXAMPLE

To run a pair of daemons on 'oursystem', one maintaining a constant link with 'backbonesystem' and the other prepared to initiate outbound calls to a neighboring machine named 'theirsystem', add the following to **/etc/rc.local**:

```
if [ -f /etc/ppp/Startup ]; then
     /etc/ppp/Startup
fi
```

Then make **/etc/ppp/Startup** look like this:

```
#!/bin/sh

PATH=/usr/etc:/bin:/usr/bin

if [ -f /usr/adm/pppd.log ]; then
        mv /usr/adm/pppd.log /usr/adm/OLDpppd.log
fi

echo -n "Starting PPP daemons:"        >/dev/console

pppd oursystem:backbonesystem auto up
        (echo -n ' backbonesystem')    >/dev/console
pppd oursystem:theirsystem auto idle 120
        (echo -n ' theirsystem')       >/dev/console

echo '.'                               >/dev/console
```

To allow a PPP implementation running on 'theirsystem' to dial

46 Aug 12 1994 Morning Star PPP 1.4.1

into 'oursystem', insert the following into /etc/passwd on 'oursystem':

```
Pthem:?:105:20:Their PPP:/etc/ppp:/etc/ppp/Login
```

where group 20 is the gid of the ppp group which owns /usr/etc/pppd, and **/etc/ppp/Login** is an executable shell script that looks something like

```
#!/bin/sh
PATH=/usr/bin:/usr/etc:/bin
mesg n
stty -tostop
exec pppd `hostname`:
```

RECOMMENDATIONS

Use host names when running **/etc/ppp/Startup** from **/etc/rc.local** only if they are known locally. If a PPP connection to a DNS server would be required to resolve a host name, use its literal IP address instead.

ENVIRONMENT

The environment variable **PPPHOME**, if present, specifies the directory in which *pppd* looks for its configuration files (**Filter** and **Auth** for all connections, along with **Systems**, **Devices**, and **Dialers** if the connection is 'outbound'). You can specify **PPPHOME** either in the **Startup** script or in an incoming connection's **Login** script. If **PPPHOME** is not present, *pppd* will expect to find its configuration files in **/etc/ppp/***.

SECURITY CONCERNS

Pppd should be mode 4750, owned by root, and executable only by the members of the group containing all the incoming PPP login 'users'.

STANDARDS CONFORMANCE

Morning Star PPP implements the IETF Proposed Standard Point-to-Point Protocol and many of its options and extensions, in conformance with RFCs 1548, 1549, 1332, 1333, 1334, and 1144. It can be configured to be conformant with earlier specifications of the PPP protocol, as described in RFCs 1134, 1171, and 1172. It implements the nonstandard SLIP protocol as described in RFCs 1055 and 1144.

PPPD(8) Morning Star Technologies PPPD(8)

into 'oursystem', insert the following into /etc/passwd on 'oursystem':

Pthem:?:105:20:Their PPP:/etc/ppp:/etc/ppp/Login

where group 20 is the gid of the ppp group which owns /usr/etc/pppd, and **/etc/ppp/Login** is an executable shell script that looks something like

#!/bin/sh
PATH=/usr/bin:/usr/etc:/bin
mesg n
stty -tostop
exec pppd `hostname`:

RECOMMENDATIONS

Use host names when running **/etc/ppp/Startup** from **/etc/rc.local** only if they are known locally. If a PPP connection to a DNS server would be required to resolve a host name, use its literal IP address instead.

ENVIRONMENT

The environment variable **PPPHOME**, if present, specifies the directory in which *pppd* looks for its configuration files (**Filter** and **Auth** for all connections, along with **Systems**, **Devices**, and **Dialers** if the connection is 'outbound'). You can specify **PPPHOME** either in the **Startup** script or in an incoming connection's **Login** script. If **PPPHOME** is not present, *pppd* will expect to find its configuration files in **/etc/ppp/***.

SECURITY CONCERNS

Pppd should be mode 4750, owned by root, and executable only by the members of the group containing all the incoming PPP login 'users'.

STANDARDS CONFORMANCE

Morning Star PPP implements the IETF Proposed Standard Point-to-Point Protocol and many of its options and extensions, in conformance with RFCs 1548, 1549, 1332, 1333, 1334, and 1144. It can be configured to be conformant with earlier specifications of the PPP protocol, as described in RFCs 1134, 1171, and 1172. It implements the nonstandard SLIP protocol as described in RFCs 1055 and 1144.

Morning Star PPP 1.4.1 Aug 12 1994 47

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), RFC 1548, RFC 1549, RFC 1332, RFC 1333, RFC 1334, RFC 1172, RFC 1144, RFC 1055, ds.internic.net:/internet-drafts/draft-ietf-pppext-compression-04.txt.

CREDITS

Parts of the protocol engine are derived from code written by Drew D. Perkins <perkins+@cmu.edu>. The TCP header compression feature is derived from code written by Van Jacobson <van@helios.ee.lbl.gov>. The CHAP feature uses the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

COPYRIGHT INFORMATION

PPPD(8) Morning Star Technologies PPPD(8)

SEE ALSO

tun(4), ppp.Auth(5), ppp.Devices(5), ppp.Dialers(5), ppp.Filter(5), ppp.Keys(5), ppp.Systems(5), RFC 1548, RFC 1549, RFC 1332, RFC 1333, RFC 1334, RFC 1172, RFC 1144, RFC 1055, ds.internic.net:/internet-drafts/draft-ietf-pppext-compression-04.txt.

CREDITS

Parts of the protocol engine are derived from code written by Drew D. Perkins <perkins+@cmu.edu>. The TCP header compression feature is derived from code written by Van Jacobson <van@helios.ee.lbl.gov>. The CHAP feature uses the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

COPYRIGHT INFORMATION

This software and associated documentation is Copyright © 1991, 1992, 1993, 1994 Morning Star Technologies Inc., all rights reserved.

This daemon contains code that is Copyright © 1989 Carnegie Mellon University, all rights reserved; it also contains code that is Copyright © 1989 Regents of the University of California, all rights reserved; it also contains code that is Copyright © 1990, RSA Data Security, Inc., all rights reserved.

48 Aug 12 1994 Morning Star PPP 1.4.1

Troubleshooting Guide

This Troubleshooting Guide suggests solutions to common problems users experience with Morning Star PPP.

Scenario: *Pppd* dials, the modems connect, the modem data lights flash briefly, and then the log file shows 'Hangup' or 'SIGHUP'.

Solution: Increase *pppd*'s debug level to 2 (chat script processing) to see if any error messages are printed by the peer at startup. 'Login incorrect' indicates that the login and/or password in the calling machine's **Systems** file don't match those in the answering machine's **passwd** file. '/etc/ppp/Login: Permission denied' indicates a file protection problem with the login shell script. '/usr/etc/pppd: Permission denied' indicates that the PPP user account cannot execute the daemon, probably because the user account is not in the 'ppp' group that owns the daemon, while the daemon is mode 4750 for security reasons.

Scenario: *Pppd* dials out, the modems connect, the log file says 'Call succeeded', but *ps* shows *pppd*'s state to be 'connecting' until the modems disconnect about a minute later.

Solution: Check the log file for messages indicating negotiation problems.

Increase *pppd*'s debugging level to 2 (input framing errors). Look in the **pppd.log** file for warnings indicating damaged received messages such as 'Bad FCS received', 'Frame too long', or 'Missed ALLSTATIONS'.

Increase *pppd*'s debugging level to 9 (show all characters read or written) to see if the peer is sending anything at all. PPP messages should initially look like 7E FF 7D 23 ... 7E. Look for corrupted characters (e.g. 7F instead of FF) or other parity bit problems.

Scenario: PPP connects, and I can ping the other end, but I can't use telnet, rlogin, or ftp.

Solution: Check the log file for any messages indicating negotiation problems.

Increase *pppd*'s debugging level to 2 (input framing errors). Look in the **pppd.log** file for warnings from ppp indicating

Troubleshooting Guide

This Troubleshooting Guide suggests solutions to common problems users experience with Morning Star PPP.

Scenario: *Pppd* dials, the modems connect, the modem data lights flash briefly, and then the log file shows 'Hangup' or 'SIGHUP'.

Solution: Increase *pppd*'s debug level to 2 (chat script processing) to see if any error messages are printed by the peer at startup. 'Login incorrect' indicates that the login and/or password in the calling machine's **Systems** file don't match those in the answering machine's **passwd** file. '/etc/ppp/Login: Permission denied' indicates a file protection problem with the login shell script. '/usr/etc/pppd: Permission denied' indicates that the PPP user account cannot execute the daemon, probably because the user account is not in the 'ppp' group that owns the daemon, while the daemon is mode 4750 for security reasons.

Scenario: *Pppd* dials out, the modems connect, the log file says 'Call succeeded', but *ps* shows *pppd*'s state to be 'connecting' until the modems disconnect about a minute later.

Solution: Check the log file for messages indicating negotiation problems.

Increase *pppd*'s debugging level to 2 (input framing errors). Look in the **pppd.log** file for warnings indicating damaged received messages such as 'Bad FCS received', 'Frame too long', or 'Missed ALLSTATIONS'.

Increase *pppd*'s debugging level to 9 (show all characters read or written) to see if the peer is sending anything at all. PPP messages should initially look like 7E FF 7D 23 ... 7E. Look for corrupted characters (e.g. 7F instead of FF) or other parity bit problems.

Scenario: PPP connects, and I can ping the other end, but I can't use telnet, rlogin, or ftp.

Solution: Check the log file for any messages indicating negotiation problems.

Increase *pppd*'s debugging level to 2 (input framing errors). Look in the **pppd.log** file for warnings from ppp indicating

damaged messages such as 'Bad FCS received', 'Frame too long', 'Missed ALLSTATIONS', 'Bad protocol', or 'Short frame received'.

Increase *pppd*'s debugging level to 6 (IP message summary). When telnet is started, make sure a tcp packet is sent. A tcp packet should be received in response.

Restart *pppd* with the **novjcomp** option. If this fixes the problem, then the peer may be using a buggy IPCP option negotiation algorithm. Try running *pppd* with the **rfc1172-vj** or the **rfc1172-typo-vj** option. If they don't work, go back to **novjcomp** and complain to the vendor of the peer's implementation of PPP.

Scenario: PPP connects and everything works, but it is slow and erratic.

Solution: Is your Telebit modem using the PEP protocol? PPP over PEP is normally slow and erratic.

Increase *pppd*'s debugging level to 2 (input framing errors). Make sure that received frames are arriving undamaged and that you aren't getting an excessive number of FCS errors.

Make sure that the telephone lines are relatively clean. Noisy phone lines can cause FCS or other transmission errors, or can cause V.42 or MNP error correcting protocols to retransmit excessively, or can cause the modems to retrain frequently, slowing the connection.

Make sure the serial port is not running faster than your computer can comfortably handle.

Make sure that flow control is set up properly on the modem and on the serial port it is connected to. If you are using hardware flow control, make sure the cable connects RTS and CTS (RS-232 pins 4 and 5).

Scenario: When I use telnet, ping or some other program to attempt a connection, the modem doesn't start dialing and nothing is written to the log.

Solution: Increase *pppd*'s debugging level to 6 (IP message summary). If it now shows the packets, but says 'dial failed', then PPP is waiting after a failed call attempt until the call retry delay timer expires. Use SIGINT to tell *pppd* to reset the timer,

Morning Star PPP version 1.4.1

damaged messages such as 'Bad FCS received', 'Frame too long', 'Missed ALLSTATIONS', 'Bad protocol', or 'Short frame received'.

Increase *pppd*'s debugging level to 6 (IP message summary). When telnet is started, make sure a tcp packet is sent. A tcp packet should be received in response.

Restart *pppd* with the **novjcomp** option. If this fixes the problem, then the peer may be using a buggy IPCP option negotiation algorithm. Try running *pppd* with the **rfc1172-vj** or the **rfc1172-typo-vj** option. If they don't work, go back to **novjcomp** and complain to the vendor of the peer's implementation of PPP.

Scenario: PPP connects and everything works, but it is slow and erratic.

Solution: Is your Telebit modem using the PEP protocol? PPP over PEP is normally slow and erratic.

Increase *pppd*'s debugging level to 2 (input framing errors). Make sure that received frames are arriving undamaged and that you aren't getting an excessive number of FCS errors.

Make sure that the telephone lines are relatively clean. Noisy phone lines can cause FCS or other transmission errors, or can cause V.42 or MNP error correcting protocols to retransmit excessively, or can cause the modems to retrain frequently, slowing the connection.

Make sure the serial port is not running faster than your computer can comfortably handle.

Make sure that flow control is set up properly on the modem and on the serial port it is connected to. If you are using hardware flow control, make sure the cable connects RTS and CTS (RS-232 pins 4 and 5).

Scenario: When I use telnet, ping or some other program to attempt a connection, the modem doesn't start dialing and nothing is written to the log.

Solution: Increase *pppd*'s debugging level to 6 (IP message summary). If it now shows the packets, but says 'dial failed', then PPP is waiting after a failed call attempt until the call retry delay timer expires. Use SIGINT to tell *pppd* to reset the timer,

50

change the Systems file entry if it is set to use too long a delay, or wait until the timer expires.

Scenario: *Pppd* installs a route when it starts (as shown by *netstat -r*), but after a while it disappears.

Solution: Are you running *in.routed*? *Routed* is sometimes ill-suited to use with point-to-point connections; its RIP protocol can't adequately describe them to other *routed*'s, and it gets confused about intermittent connections, over which it sometimes can't hear from another *routed* to reassure itself that the link is still up, and therefore deserving of a route. Make 'passive' entries in **/etc/gateways**, similar to those in **Examples/gateways.ex** (see **routed(8)**), to persuade *routed* not to gratuitously remove routes it thinks aren't active any more.

If *routed* can't solve your routing topology problems, we suggest running *gated* instead, available via anonymous FTP from gated.cornell.edu or via anonymous PPP/FTP from Morning Star Technologies.

If both *routed* and *gated* are too cumbersome, and your network is simple enough, don't run either routing daemon. Use static routes instead.

Scenario: To avoid using a separate subnet, you have set up your network as described in the section entitled 'Connecting a Host to a LAN: ARP table manipulation'. The remote workstations can exchange packets with everything on that LAN, but not with any hosts or networks that are reachable through a particular router.

Solution: Some routers implement a security feature that causes them to not believe the second IP address that is claimed to be associated with a particular Ethernet address. If your remote workstation can exchange packets with all the hosts on your LAN but not with any that are reachable only through a particular router, then that router is probably skeptical of your ARP entry. Luckily, this router security feature is usually configurable. If not, you must put the remote workstations on their own subnet as described in the section entitled 'Connecting a Host to a LAN: Separate Network', and configure the router so that it knows that your office hub is the gateway to that subnet.

Troubleshooting Guide

change the Systems file entry if it is set to use too long a delay, or wait until the timer expires.

Scenario: *Pppd* installs a route when it starts (as shown by *netstat -r*), but after a while it disappears.

Solution: Are you running *in.routed*? *Routed* is sometimes ill-suited to use with point-to-point connections; its RIP protocol can't adequately describe them to other *routed*'s, and it gets confused about intermittent connections, over which it sometimes can't hear from another *routed* to reassure itself that the link is still up, and therefore deserving of a route. Make 'passive' entries in **/etc/gateways**, similar to those in **Examples/gateways.ex** (see **routed(8)**), to persuade *routed* not to gratuitously remove routes it thinks aren't active any more.

If *routed* can't solve your routing topology problems, we suggest running *gated* instead, available via anonymous FTP from gated.cornell.edu or via anonymous PPP/FTP from Morning Star Technologies.

If both *routed* and *gated* are too cumbersome, and your network is simple enough, don't run either routing daemon. Use static routes instead.

Scenario: To avoid using a separate subnet, you have set up your network as described in the section entitled 'Connecting a Host to a LAN: ARP table manipulation'. The remote workstations can exchange packets with everything on that LAN, but not with any hosts or networks that are reachable through a particular router.

Solution: Some routers implement a security feature that causes them to not believe the second IP address that is claimed to be associated with a particular Ethernet address. If your remote workstation can exchange packets with all the hosts on your LAN but not with any that are reachable only through a particular router, then that router is probably skeptical of your ARP entry. Luckily, this router security feature is usually configurable. If not, you must put the remote workstations on their own subnet as described in the section entitled 'Connecting a Host to a LAN: Separate Network', and configure the router so that it knows that your office hub is the gateway to that subnet.

Scenario: PPP won't connect and the log file shows 'IPCP: Received bad Configure-Reject'

Solution: Restart *pppd* with the **novjcomp** option. If this fixes the problem, then the peer may be using a buggy IPCP option negotiation algorithm. Try running *pppd* with the **rfc1172-vj** or the **rfc1172-typo-vj** option. If they don't work, go back to **novjcomp** and complain to the vendor of the peer's implementation of PPP.

Scenario: PPP won't come up, and the peer complains that it is has received a request for IPCP configuration option 3.

Solution: Restart *pppd* with the **rfc1172-addresses** option, and report a bug to the vendor of the peer's implementation of PPP. If the peer doesn't recognize IPCP configuration option 3, it should respond with an IPCP Configure-Reject rather than exiting altogether.

Scenario: The PPP link comes up and carries IP traffic, but a minute later the log file shows 'LQM: LQRs: 0/5', then 'LQM: Too many Link-Quality-Reports lost', then *pppd* closes the connection.

Solution: Restart *pppd* with either the **echolqm** or the **nolqm** option, and report a bug to the vendor of the peer's implementation of PPP.

If the peer doesn't support Link Quality Monitoring, it should issue a Configure-Reject during LCP negotiations. If, even after sending a LCP Configure-Ack in response to MST PPP's LCP Configure-Request containing LQM, the peer doesn't recognize a Link Quality Report, it should respond with a Protocol-Reject rather than not responding at all. When *pppd* sees the Protocol-Reject, it will fall back to using LCP Echo-Requests for its link status monitoring functions.

A LQM failure one minute after connection startup, particularly during successful user data transfers, indicates that the peer neither properly Configure-Rejected LQM during LCP negotiations, nor properly Protocol-Rejected MST PPP's first LQR.

Scenario: When the modem abruptly gets hung up, *pppd* doesn't notice.

Solution: Make sure that the modem drops the Carrier Detect (CD, also called DCD, Data Carrier Detect) signal when carrier is lost. On a Telebit T1600, set '&C1'.

Morning Star PPP version 1.4.1

Scenario: PPP won't connect and the log file shows 'IPCP: Received bad Configure-Reject'

Solution: Restart *pppd* with the **novjcomp** option. If this fixes the problem, then the peer may be using a buggy IPCP option negotiation algorithm. Try running *pppd* with the **rfc1172-vj** or the **rfc1172-typo-vj** option. If they don't work, go back to **novjcomp** and complain to the vendor of the peer's implementation of PPP.

Scenario: PPP won't come up, and the peer complains that it is has received a request for IPCP configuration option 3.

Solution: Restart *pppd* with the **rfc1172-addresses** option, and report a bug to the vendor of the peer's implementation of PPP. If the peer doesn't recognize IPCP configuration option 3, it should respond with an IPCP Configure-Reject rather than exiting altogether.

Scenario: The PPP link comes up and carries IP traffic, but a minute later the log file shows 'LQM: LQRs: 0/5', then 'LQM: Too many Link-Quality-Reports lost', then *pppd* closes the connection.

Solution: Restart *pppd* with either the **echolqm** or the **nolqm** option, and report a bug to the vendor of the peer's implementation of PPP.

If the peer doesn't support Link Quality Monitoring, it should issue a Configure-Reject during LCP negotiations. If, even after sending a LCP Configure-Ack in response to MST PPP's LCP Configure-Request containing LQM, the peer doesn't recognize a Link Quality Report, it should respond with a Protocol-Reject rather than not responding at all. When *pppd* sees the Protocol-Reject, it will fall back to using LCP Echo-Requests for its link status monitoring functions.

A LQM failure one minute after connection startup, particularly during successful user data transfers, indicates that the peer neither properly Configure-Rejected LQM during LCP negotiations, nor properly Protocol-Rejected MST PPP's first LQR.

Scenario: When the modem abruptly gets hung up, *pppd* doesn't notice.

Solution: Make sure that the modem drops the Carrier Detect (CD, also called DCD, Data Carrier Detect) signal when carrier is lost. On a Telebit T1600, set '&C1'.

52

Make sure that the cable properly connects CD (RS-232 pin 8) from the modem through to the serial port, and that the *pppd* command line doesn't include the **ignore-cd** option.

Scenario: Shortly after the Systems chat script completes, the log file records a SIGHUP and the connection drops. But the remote modem didn't actually hang up the connection, and *tip* works correctly.

Solution: Make sure that the modem asserts Carrier Detect (CD, also called DCD, Data Carrier Detect) signal when it is actually talking to a remote modem. On a Telebit T1600, set '&C1'.

Make sure that the cable properly connects CD (RS-232 pin 8) from the modem through to the serial port. *pppd* doesn't check the state of DCD until after the Systems chat script completes, about the time that PPP negotiations begin. If the modem isn't asserting DCD, or if the cable isn't delivering the signal to the serial port, *pppd* won't be able to tell that the modem is connected. To test this, or to work around a defective cable, start *pppd* with the **ignore-cd** option.

Scenario: *Pppd* won't hang up the phone, even though it was started with **idle 300**.

Solution: Increase *pppd*'s debugging level to 6 (IP frame summary) and watch for logged frames that *don't* say '!keepup'. If you don't want those messages to keep your line active, put them in the 'keepup' filter in the **Filter** file (**$PPPHOME/Filter** by default).

Scenario: *Pppd* dies with a 'Fatal error: ...' or 'Fatal system error: ...' message.

Solution: That's probably a bug. Send e-mail to support@MorningStar.Com containing relevant portions of **pppd.log** and your configuration files (edit out the passwords and phone number first) and we'll fix it.

Scenario: When you telnet to test if the answering PPP account is set up correctly, you will be greeted with what looks like line noise. This is the PPP Link Control Protocol Configure-Request packet, but it takes a long time for *pppd* to give up and go away.

Solution: The easy way to instruct the answering *pppd* to exit and close the connection is to type the four-character sequence of a tilde

Troubleshooting Guide

Make sure that the cable properly connects CD (RS-232 pin 8) from the modem through to the serial port, and that the *pppd* command line doesn't include the **ignore-cd** option.

Scenario: Shortly after the Systems chat script completes, the log file records a SIGHUP and the connection drops. But the remote modem didn't actually hang up the connection, and *tip* works correctly.

Solution: Make sure that the modem asserts Carrier Detect (CD, also called DCD, Data Carrier Detect) signal when it is actually talking to a remote modem. On a Telebit T1600, set '&C1'.

Make sure that the cable properly connects CD (RS-232 pin 8) from the modem through to the serial port. *pppd* doesn't check the state of DCD until after the Systems chat script completes, about the time that PPP negotiations begin. If the modem isn't asserting DCD, or if the cable isn't delivering the signal to the serial port, *pppd* won't be able to tell that the modem is connected. To test this, or to work around a defective cable, start *pppd* with the **ignore-cd** option.

Scenario: *Pppd* won't hang up the phone, even though it was started with **idle 300**.

Solution: Increase *pppd*'s debugging level to 6 (IP frame summary) and watch for logged frames that *don't* say '!keepup'. If you don't want those messages to keep your line active, put them in the 'keepup' filter in the **Filter** file (**$PPPHOME/Filter** by default).

Scenario: *Pppd* dies with a 'Fatal error: ...' or 'Fatal system error: ...' message.

Solution: That's probably a bug. Send e-mail to support@MorningStar.Com containing relevant portions of **pppd.log** and your configuration files (edit out the passwords and phone number first) and we'll fix it.

Scenario: When you telnet to test if the answering PPP account is set up correctly, you will be greeted with what looks like line noise. This is the PPP Link Control Protocol Configure-Request packet, but it takes a long time for *pppd* to give up and go away.

Solution: The easy way to instruct the answering *pppd* to exit and close the connection is to type the four-character sequence of a tilde

('~', ASCII 0x7E) followed by three control-Cs (^C, ASCII 0x03). If the *pppd* is running on a Sun where the *pppframe* module is loaded, you'll also need to type another tilde after the three control-Cs to flush the ^C characters through the STREAMS.

The '~^C^C^C' sequence only works in PPP mode, not in SLIP mode. And in PPP mode, if you specified 'passive' on the command line, '~^C^C^C' only works after receipt of a good PPP packet.

Scenario: *Pppd* won't dial out; the log file says 'Device is locked'.

Solution: *Pppd* uses lock files compatible with other programs to avoid using a device already in use by another program, and to keep other programs from interfering with devices in use by *pppd*. If the **pppd.log** file says 'Device is locked', look for a lock file such as LCK..cua in /usr/spool/locks, /usr/spool/uucp, /usr/spool/uucp/LCK, /var/spool/locks, or wherever your system keeps tty lock files. Each lock file should contain the process id of the owner process. If the lock file is 4 bytes long, the process id is a 32-bit binary number. If the lock file is 11 bytes long, the process id is printed in ASCII. Look in the lock file for the owner pid (use *od -d* for binary files and *cat* for ASCII lock files), and then use *ps* to look for the owner.

The University of Toronto SLIP implementation for SunOS 4.1 uses lock files that are name-compatible with those used by HDB UUCP and Morning Star PPP. That is, they're in /usr/spool/locks named LCK..cua or LCK..ttyb or whatever is appropriate. Unfortunately, UTSLIP's lock files are of zero length, which makes it impossible to determine the pid of the owner process. Later instances of *uucico* or *pppd* will examine the contents of any lock files they find, to see whether the creating process is still running, or whether it perhaps died ungracefully and didn't clean up its lock files. If the latter, *uucico* and *pppd* know that they can usurp the claimed but expired lock on that interface.

When *pppd* finds a lock file of zero length, it has no way of knowing the pid of the process that created it, so to be safe, it gives up trying to open the associated tty.

Scenario: Even though UUCP is using the modem, *pppd* tries to use it to place an outbound call. And when *pppd* has an active link,

Morning Star PPP version 1.4.1

('~', ASCII 0x7E) followed by three control-Cs (^C, ASCII 0x03). If the *pppd* is running on a Sun where the *pppframe* module is loaded, you'll also need to type another tilde after the three control-Cs to flush the ^C characters through the STREAMS.

The '~^C^C^C' sequence only works in PPP mode, not in SLIP mode. And in PPP mode, if you specified 'passive' on the command line, '~^C^C^C' only works after receipt of a good PPP packet.

Scenario: *Pppd* won't dial out; the log file says 'Device is locked'.

Solution: *Pppd* uses lock files compatible with other programs to avoid using a device already in use by another program, and to keep other programs from interfering with devices in use by *pppd*. If the **pppd.log** file says 'Device is locked', look for a lock file such as LCK..cua in /usr/spool/locks, /usr/spool/uucp, /usr/spool/uucp/LCK, /var/spool/locks, or wherever your system keeps tty lock files. Each lock file should contain the process id of the owner process. If the lock file is 4 bytes long, the process id is a 32-bit binary number. If the lock file is 11 bytes long, the process id is printed in ASCII. Look in the lock file for the owner pid (use *od -d* for binary files and *cat* for ASCII lock files), and then use *ps* to look for the owner.

The University of Toronto SLIP implementation for SunOS 4.1 uses lock files that are name-compatible with those used by HDB UUCP and Morning Star PPP. That is, they're in /usr/spool/locks named LCK..cua or LCK..ttyb or whatever is appropriate. Unfortunately, UTSLIP's lock files are of zero length, which makes it impossible to determine the pid of the owner process. Later instances of *uucico* or *pppd* will examine the contents of any lock files they find, to see whether the creating process is still running, or whether it perhaps died ungracefully and didn't clean up its lock files. If the latter, *uucico* and *pppd* know that they can usurp the claimed but expired lock on that interface.

When *pppd* finds a lock file of zero length, it has no way of knowing the pid of the process that created it, so to be safe, it gives up trying to open the associated tty.

Scenario: Even though UUCP is using the modem, *pppd* tries to use it to place an outbound call. And when *pppd* has an active link,

54

UUCP tries to make an outbound call.

Solution: The outbound 'Auto Call Unit' ('ACU') names used in PPP's **Devices** must match the names used for similar purposes in UUCP's **Devices** file. For example, if your UUCP configuration knows it as **cua0** but PPP knows it as **cua**, each facility will be unable to discover the lock file indicating that the other is active.

Scenario: With the debugging verbosity level set to 2 or more, I get messages in the log file like 'Bad FCS received', 'Bad protocol (even), flushing frame', 'Short frame received (3 bytes)', 'Frame too long, flushing frame', 'Missed ALLSTATIONS, flushing frame', or 'Missed UI, flushing frame'.

Solution: Some of the incoming messages are getting damaged in transit. If your throughput is erratic or lower than you expect, then refer to the section above starting with 'PPP connects and everything works, but it is slow and erratic'.

If you see 'Missed ALLSTATIONS' while the link is coming up, after 'Chat script succeeded' but before the first 'Received LCP Configure-Request', don't worry about it. The calling daemon is scanning the characters it sees coming from the answering system, looking for the start of a PPP frame that signifies the beginning of option negotiations. While the contents of the answering machine's **/etc/motd** scrolls by, it's likely that the calling daemon will flush several of what it had thought to be frames, but that turned out to be more text.

If the messages happen while the link is active, but only rarely, then don't worry about them. The errors may be due to intermittent line noise in the phone lines, or your computer may occasionally lose incoming characters. Suspect this last possibility if the errors tend to occur when receiving large amounts of data.

Scenario: My NeXT system can't run Morning Star PPP, but it has always run Marble Teleconnect just fine. Whenever the MST PPP daemon starts, the it complains in the log file about problems using **du0**.

Solution: Remove Marble Teleconnect and reboot your NeXT system. Its use of the device name **du0** collides with MST PPP's use of the name, and there's nothing Marble can do that MST PPP can't

Troubleshooting Guide

UUCP tries to make an outbound call.

Solution: The outbound 'Auto Call Unit' ('ACU') names used in PPP's **Devices** must match the names used for similar purposes in UUCP's **Devices** file. For example, if your UUCP configuration knows it as **cua0** but PPP knows it as **cua**, each facility will be unable to discover the lock file indicating that the other is active.

Scenario: With the debugging verbosity level set to 2 or more, I get messages in the log file like 'Bad FCS received', 'Bad protocol (even), flushing frame', 'Short frame received (3 bytes)', 'Frame too long, flushing frame', 'Missed ALLSTATIONS, flushing frame', or 'Missed UI, flushing frame'.

Solution: Some of the incoming messages are getting damaged in transit. If your throughput is erratic or lower than you expect, then refer to the section above starting with 'PPP connects and everything works, but it is slow and erratic'.

If you see 'Missed ALLSTATIONS' while the link is coming up, after 'Chat script succeeded' but before the first 'Received LCP Configure-Request', don't worry about it. The calling daemon is scanning the characters it sees coming from the answering system, looking for the start of a PPP frame that signifies the beginning of option negotiations. While the contents of the answering machine's **/etc/motd** scrolls by, it's likely that the calling daemon will flush several of what it had thought to be frames, but that turned out to be more text.

If the messages happen while the link is active, but only rarely, then don't worry about them. The errors may be due to intermittent line noise in the phone lines, or your computer may occasionally lose incoming characters. Suspect this last possibility if the errors tend to occur when receiving large amounts of data.

Scenario: My NeXT system can't run Morning Star PPP, but it has always run Marble Teleconnect just fine. Whenever the MST PPP daemon starts, the it complains in the log file about problems using **du0**.

Solution: Remove Marble Teleconnect and reboot your NeXT system. Its use of the device name **du0** collides with MST PPP's use of the name, and there's nothing Marble can do that MST PPP can't

do.

Scenario: **/etc/resolv.conf** points at a name server out on the Internet somewhere, across the PPP link. When **/etc/resolv.conf** is in place and ppp connection is up, connectivity between internal host is fine. When **/etc/resolv.conf** is in place and the ppp connection is down, connectivity between internal host comes to a crawl. Once the **/etc/resolv.conf** is removed, connectivity returns to normal.

Solution: That's because local applications are trying to reverse-resolve incoming connection addresses (even on the local net) into names, whether for authentication (e.g. **/.rhosts** and **/etc/hosts.equiv**), or just normal operations (e.g. *telnetd* making entries into **/etc/utmp** and **/var/adm/wtmp**). When the DNS resolver routines can't reach the nameserver, they don't return a value meaning "I don't know" until some timeout interval has passed. This is probably happening on every connection attempt.

The fix is to run a local nameserver that's either SOA (Start of Authority) or an authoritative secondary NS (Name Server) for your name space (forward mapping) and your address space (reverse mapping). An authoritative secondary NS is one that's listed in the SOA's RR (Resource Record) for that domain.

Scenario: Using Morning Star PPP on SCO UNIX with SCO TCP 1.2, when attempting to start a new PPP or SLIP connection, **pppd.log** reports something like

```
/etc/pppd: Fatal system error:
     Error opening IP device '/dev/inet/ip':
     No such device or address
```

Solution: That probably means you've run out of STREAMS networking slots into which the STREAMS-based IP tunnel driver can attach itself. Edit /etc/conf/pack.d/ip/space.c and increase the values of IPCNT and IPPROVCNT from 8 and 16 to something like 32 and 64, respectively. Then 'cd /etc/conf/cf.d; ./link_unix' and reboot. If you need more than 8 peers, see **/usr/lib/ppp/Examples/README** for instructions.

Morning Star PPP version 1.4.1

do.

Scenario: **/etc/resolv.conf** points at a name server out on the Internet somewhere, across the PPP link. When **/etc/resolv.conf** is in place and ppp connection is up, connectivity between internal host is fine. When **/etc/resolv.conf** is in place and the ppp connection is down, connectivity between internal host comes to a crawl. Once the **/etc/resolv.conf** is removed, connectivity returns to normal.

Solution: That's because local applications are trying to reverse-resolve incoming connection addresses (even on the local net) into names, whether for authentication (e.g. **/.rhosts** and **/etc/hosts.equiv**), or just normal operations (e.g. *telnetd* making entries into **/etc/utmp** and **/var/adm/wtmp**). When the DNS resolver routines can't reach the nameserver, they don't return a value meaning "I don't know" until some timeout interval has passed. This is probably happening on every connection attempt.

The fix is to run a local nameserver that's either SOA (Start of Authority) or an authoritative secondary NS (Name Server) for your name space (forward mapping) and your address space (reverse mapping). An authoritative secondary NS is one that's listed in the SOA's RR (Resource Record) for that domain.

Scenario: Using Morning Star PPP on SCO UNIX with SCO TCP 1.2, when attempting to start a new PPP or SLIP connection, **pppd.log** reports something like

```
/etc/pppd: Fatal system error:
     Error opening IP device '/dev/inet/ip':
     No such device or address
```

Solution: That probably means you've run out of STREAMS networking slots into which the STREAMS-based IP tunnel driver can attach itself. Edit /etc/conf/pack.d/ip/space.c and increase the values of IPCNT and IPPROVCNT from 8 and 16 to something like 32 and 64, respectively. Then 'cd /etc/conf/cf.d; ./link_unix' and reboot. If you need more than 8 peers, see **/usr/lib/ppp/Examples/README** for instructions.

56

Scenario: Using Morning Star PPP on SCO UNIX, *pppd* dials the modem immediately after it's started, but before any user processes would be using the link. The **pppd.log** file shows a line (broken to fit on this page) like

```
9/23-18:48:34-83 udp 192.0.2.1/60000 ->
     192.0.2.2/60000 45 bringup
```

Solution: This is SCO's copy protection scheme, broadcasting the serial number of this system. If a SCO UNIX system ever receives a broadcast message containing a serial number identical to its own, it shuts down. To avoid bringing up the link for this sort of packet, append '!60000/udp' to the 'bringup' filter in the **Filter** file (**/usr/lib/ppp/Filter** by default).

Scenario: Using Morning Star PPP on a system or network where Frame (a WYSIAYG document production system) is installed, *pppd* dials the modem hourly even though no users are actively using it. The **pppd.log** file shows a line (broken to fit on this page) like

```
9/23-18:48:34-83 udp 192.0.2.1/3680 ->
     192.0.2.2/sunrpc 45 bringup
```

Solution: This is Frame's copy license manager probing for other license managers on the network. To avoid bringing up the link for this sort of packet, append '!sunrpc' to the 'bringup' filter in the **Filter** file.

Scenario: Using Morning Star PPP in its SLIP mode, the peer receives only alternating frames. Every other frame is discarded.

Solution: The peer's SLIP implements only the optional framing style suggested in the second paragraph in the PROTOCOL section on the second page of RFC 1055, and cannot receive adjacent frames separated by only one END character (0xC0). Add **extra-slip-end** to the *pppd* command line.

Scenario: Calling into a system running SCO UNIX or ODT or some other operating system derived from System V, the calling *pppd*'s **Systems** chat script sees the 'login:' prompt and sends the correct login string, but never sees a 'Password:' prompt.

Solution: The stock System V **getty** flushes its input buffers just after printing the 'login:' prompt. Since *pppd* progresses into the 'send' phase of the expect/send chat script immediately upon

Troubleshooting Guide

Scenario: Using Morning Star PPP on SCO UNIX, *pppd* dials the modem immediately after it's started, but before any user processes would be using the link. The **pppd.log** file shows a line (broken to fit on this page) like

```
9/23-18:48:34-83 udp 192.0.2.1/60000 ->
     192.0.2.2/60000 45 bringup
```

Solution: This is SCO's copy protection scheme, broadcasting the serial number of this system. If a SCO UNIX system ever receives a broadcast message containing a serial number identical to its own, it shuts down. To avoid bringing up the link for this sort of packet, append '!60000/udp' to the 'bringup' filter in the **Filter** file (**/usr/lib/ppp/Filter** by default).

Scenario: Using Morning Star PPP on a system or network where Frame (a WYSIAYG document production system) is installed, *pppd* dials the modem hourly even though no users are actively using it. The **pppd.log** file shows a line (broken to fit on this page) like

```
9/23-18:48:34-83 udp 192.0.2.1/3680 ->
     192.0.2.2/sunrpc 45 bringup
```

Solution: This is Frame's copy license manager probing for other license managers on the network. To avoid bringing up the link for this sort of packet, append '!sunrpc' to the 'bringup' filter in the **Filter** file.

Scenario: Using Morning Star PPP in its SLIP mode, the peer receives only alternating frames. Every other frame is discarded.

Solution: The peer's SLIP implements only the optional framing style suggested in the second paragraph in the PROTOCOL section on the second page of RFC 1055, and cannot receive adjacent frames separated by only one END character (0xC0). Add **extra-slip-end** to the *pppd* command line.

Scenario: Calling into a system running SCO UNIX or ODT or some other operating system derived from System V, the calling *pppd*'s **Systems** chat script sees the 'login:' prompt and sends the correct login string, but never sees a 'Password:' prompt.

Solution: The stock System V **getty** flushes its input buffers just after printing the 'login:' prompt. Since *pppd* progresses into the 'send' phase of the expect/send chat script immediately upon

completion of the 'expect' phase, the calling *pppd* may be sending the login string before the answering **getty** is ready to listen for it. So the calling system's **Systems** entry should look something like

```
SysVbox Any ACU 38400 5551212 in:--in: \dProbin word: mypasswd
```

Scenario: With Sun patch ID 100513-04 installed on a SPARC system running SunOS 4.1.2, PPP link traffic flows well until the volume picks up and RTS/CTS flow control is needed. Then the line stalls, no more packets can cross.

Solution: Comment out the section of **/etc/ppp/Startup** that modloads the pppframe driver, then reboot your SPARC system.

Morning Star PPP version 1.4.1

completion of the 'expect' phase, the calling *pppd* may be sending the login string before the answering **getty** is ready to listen for it. So the calling system's **Systems** entry should look something like

```
SysVbox Any ACU 38400 5551212 in:--in: \dProbin word: mypas
```

Scenario: With Sun patch ID 100513-04 installed on a SPARC system running SunOS 4.1.2, PPP link traffic flows well until the volume picks up and RTS/CTS flow control is needed. Then the line stalls, no more packets can cross.

Solution: Comment out the section of **/etc/ppp/Startup** that modloads the pppframe driver, then reboot your SPARC system.

58

Active-Open — An event internal to the PPP configuration finite state machine that causes PPP to start sending Configure-Request messages to the peer.

bps — Bits per second.

CCITT — The French acronym of the International Telegraph and Telephone Consultative Committee, an organization that publishes international data communications standards.

Challenge Handshake Authentication Protocol — A challenge-response LCP authentication protocol resistant to playback attacks. CHAP runs after LCP negotiation is complete but before any NCPs are started.

CHAP — See *Challenge Handshake Authentication Protocol*.

DNS — See *Domain Name System*.

Domain Name System — The distributed host and network name database system used to translate between Internet addresses and their associated host and network names. RFC 1034, *Domain Names – Concepts and Facilities* is an introduction to the DNS. RFC 1035, *Domain Names – Implementation and Specification* describes the protocols and data types used.

FCS — See *Frame Check Sequence*.

Frame Check Sequence — The (usually) 16-bit field transmitted after all data in a frame but before the closing flag. Its value is computed using the data portion of the frame and a binary polynomial, and its purpose is to provide the receiver with a fairly reliable check against data corruption during transmission. An "FCS error" indicates that a frame was damaged in transit.

FTP — The internet File Transfer Protocol, described in RFC 959, is used to copy data files across TCP/IP networks.

hardware flow control — Out of band flow control defined in EIA RS-232-D that provides bidirectional flow control using the RTS (Request To Send) and CTS (Clear To Send) signals. The DTE (typically a computer) asserts RTS when it is able to accept input, and the DCE (typically a modem) asserts CTS when it is able to accept input.

HDLC — High-Level Data Link Control, defined in ISO 3309, is a bit-

Glossary

Active-Open — An event internal to the PPP configuration finite state machine that causes PPP to start sending Configure-Request messages to the peer.

bps — Bits per second.

CCITT — The French acronym of the International Telegraph and Telephone Consultative Committee, an organization that publishes international data communications standards.

Challenge Handshake Authentication Protocol — A challenge-response LCP authentication protocol resistant to playback attacks. CHAP runs after LCP negotiation is complete but before any NCPs are started.

CHAP — See Challenge Handshake Authentication Protocol.

DNS — See Domain Name System.

Domain Name System — The distributed host and network name database system used to translate between Internet addresses and their associated host and network names. RFC 1034, Domain Names – Concepts and Facilities is an introduction to the DNS. RFC 1035, Domain Names – Implementation and Specification describes the protocols and data types used.

FCS — See Frame Check Sequence.

Frame Check Sequence — The (usually) 16-bit field transmitted after all data in a frame but before the closing flag. Its value is computed using the data portion of the frame and a binary polynomial, and its purpose is to provide the receiver with a fairly reliable check against data corruption during transmission. An "FCS error" indicates that a frame was damaged in transit.

FTP — The internet File Transfer Protocol, described in RFC 959, is used to copy data files across TCP/IP networks.

hardware flow control — Out of band flow control defined in EIA RS-232-D that provides bidirectional flow control using the RTS (Request To Send) and CTS (Clear To Send) signals. The DTE (typically a computer) asserts RTS when it is able to accept input, and the DCE (typically a modem) asserts CTS when it is able to accept input.

HDLC — High-Level Data Link Control, defined in ISO 3309, is a bit-

oriented framing and addressing scheme which is used as the basis for most modern synchronous wide-area data communications protocols, including PPP, X.25, SNA, OSI, and Frame Relay.

Internet Protocol — The layer of the Internet family of protocols that is responsible for packet routing and datagram fragmentation and reassembly.

Internet Protocol — The NCP for IP, the Internet Protocol.

IP — See *Internet Protocol*.

IPCP — See *Internet Protocol Control Protocol*.

ISO — The International Standards Organization publishes a broad range of international standards for industry, including a large number that are identical or nearly identical to CCITT standards.

LCP — See *Link Control Protocol*.

Link Control Protocol — The protocol that establishes, configures, and tests the data link connection.

Link Quality Monitoring — A negotiable feature of LCP that allows a PPP implementation to determine when and how often the link is losing data. If both ends of a PPP link agree to perform LQM, they will periodically send Link-Quality-Report messages to their peer containing various sequence numbers, state variables, and byte and packet counts. This information is then used to measure how reliable the connection is, and can be used to decide when to shut the connection down and perhaps try again.

Link-Quality-Report — An LCP message sent after successfully negotiating the LQM option. The LQR contains various state variables, packet counts, and byte counts.

LQM — See *Link Quality Monitoring*.

LQR — See *Link-Quality-Report*.

Magic Number — A 32-bit random number, unique to each end of each PPP link, used to determine if the link is looped back. If a PPP implementation discovers that its peer has the same Magic Number, it will strongly suspect that it is talking to itself.

MNP — The Microcom Network Protocols include several error correction and data compression schemes for use in modems.

Morning Star PPP version 1.4.1

oriented framing and addressing scheme which is used as the basis for most modern synchronous wide-area data communications protocols, including PPP, X.25, SNA, OSI, and Frame Relay.

Internet Protocol — The layer of the Internet family of protocols that is responsible for packet routing and datagram fragmentation and reassembly.

Internet Protocol — The NCP for IP, the Internet Protocol.

IP — See *Internet Protocol*.

IPCP — See *Internet Protocol Control Protocol*.

ISO — The International Standards Organization publishes a broad range of international standards for industry, including a large number that are identical or nearly identical to CCITT standards.

LCP — See *Link Control Protocol*.

Link Control Protocol — The protocol that establishes, configures, and tests the data link connection.

Link Quality Monitoring — A negotiable feature of LCP that allows a PPP implementation to determine when and how often the link is losing data. If both ends of a PPP link agree to perform LQM, they will periodically send Link-Quality-Report messages to their peer containing various sequence numbers, state variables, and byte and packet counts. This information is then used to measure how reliable the connection is, and can be used to decide when to shut the connection down and perhaps try again.

Link-Quality-Report — An LCP message sent after successfully negotiating the LQM option. The LQR contains various state variables, packet counts, and byte counts.

LQM — See *Link Quality Monitoring*.

LQR — See *Link-Quality-Report*.

Magic Number — A 32-bit random number, unique to each end of each PPP link, used to determine if the link is looped back. If a PPP implementation discovers that its peer has the same Magic Number, it will strongly suspect that it is talking to itself.

MNP — The Microcom Network Protocols include several error correction and data compression schemes for use in modems.

Maximum Receive Unit — The size of the data field in the largest PPP message a PPP implementation can receive.

Maximum Transmission Unit — The size of the largest IP datagram an IP interface can send.

MRU — See *Maximum Receive Unit*.

MTU — See *Maximum Transmission Unit*.

NCP — See *Network Control Protocol*.

Network Control Protocol — Any of a group of protocols that run after LCP has successfully connected and whose purpose is to establish and configure a network-layer protocol.

Network-Layer Protocol — The member of any protocol family corresponding to Level 3 on the ISO protocol stack. One example is IP.

NFS — The Sun Network Filesystem protocol, described in RFC 1094, provides transparent remote access to shared files across networks using the Sun RPC protocol.

NNTP — The Network News Transfer Protocol, described in RFC 977, is used for transporting and reading network news articles across internet connections.

NTP — The Network Time Protocol, described in RFC 1129, is used to keep the clocks of internet-connected hosts synchronized.

PAP — See *Password Authentication Protocol*.

Passive-Open — An event internal to the PPP configuration finite state machine that causes PPP to move from the Closed state to the Listen state, where it awaits Configure-Request messages from the peer.

Password Authentication Protocol — A simple LCP authentication protocol that sends an identifying name and an associated password. PAP runs after LCP negotiation is complete but before any NCPs are started.

peer — The PPP implementation at the other (far) end of the link.

PEP — The Packetized Ensemble Protocol is a proprietary modulation and error correction technique used in some Telebit modems. It can achieve throughput of up to 16000 bps, and is able to establish and maintain connections over noisy lines better than V.32, but it is asymmetric, with slow line turnaround and latency.

Glossary

Maximum Receive Unit — The size of the data field in the largest PPP message a PPP implementation can receive.

Maximum Transmission Unit — The size of the largest IP datagram an IP interface can send.

MRU — See *Maximum Receive Unit*.

MTU — See *Maximum Transmission Unit*.

NCP — See *Network Control Protocol*.

Network Control Protocol — Any of a group of protocols that run after LCP has successfully connected and whose purpose is to establish and configure a network-layer protocol.

Network-Layer Protocol — The member of any protocol family corresponding to Level 3 on the ISO protocol stack. One example is IP.

NFS — The Sun Network Filesystem protocol, described in RFC 1094, provides transparent remote access to shared files across networks using the Sun RPC protocol.

NNTP — The Network News Transfer Protocol, described in RFC 977, is used for transporting and reading network news articles across internet connections.

NTP — The Network Time Protocol, described in RFC 1129, is used to keep the clocks of internet-connected hosts synchronized.

PAP — See *Password Authentication Protocol*.

Passive-Open — An event internal to the PPP configuration finite state machine that causes PPP to move from the Closed state to the Listen state, where it awaits Configure-Request messages from the peer.

Password Authentication Protocol — A simple LCP authentication protocol that sends an identifying name and an associated password. PAP runs after LCP negotiation is complete but before any NCPs are started.

peer — The PPP implementation at the other (far) end of the link.

PEP — The Packetized Ensemble Protocol is a proprietary modulation and error correction technique used in some Telebit modems. It can achieve throughput of up to 16000 bps, and is able to establish and maintain connections over noisy lines better than V.32, but it is asymmetric, with slow line turnaround and latency.

Point-to-Point Protocol — The Internet standards-track data-link protocol for carrying multi-protocol datagrams (including IP) over serial links.

PPP — See *Point-to-Point Protocol*.

Request For Comments — The Internet name for a standard.

RFC — See *Request For Comments*.

RPC — The Sun Remote Procedure Call protocol, described in RFC 1050, is used to distribute applications over multiple networked computers.

SCSI — The Small Computer System Interface is a standard for connecting high-speed intelligent peripherals, such as disk or tape drives, to computers.

Serial Line Internet Protocol — A simple protocol for carrying IP datagrams over serial links. No error detection or configuration negotiation is included.

SLIP — See *Serial Line Internet Protocol*.

SMTP — The Simple Mail Transfer Protocol, described in RFC 821, is used to deliver electronic mail messages across internet networks.

telnet — The protocol used to establish terminal sessions across internet networks. See RFC 854 for the protocol specification. There are many other related RFCs that describe various telnet options.

UUCP — The Unix-to-Unix Copy Program is used to transfer data files and electronic mail, usually across dial-up modem connections, between Unix systems.

V.32 — A 9600 bps full-duplex modem modulation scheme with fallback to 4800 bps.

V.32bis — A 14400 bps full-duplex modem modulation scheme with fallback to 12000, 9600, 7200, and 4800 bps.

V.42 — An error correction scheme used by many V.32 and V.32bis modems that carries asynchronous data using the LAPM protocol over a synchronous connection.

V.42bis — A data compression method used by many V.32 and V.32bis modems. V.42bis can only be used over V.42.

VJ — The initials of Van Jacobson, an engineer at Lawrence Berkeley Laboratories who has done lots of good things for the Internet protocols,

Morning Star PPP version 1.4.1

Point-to-Point Protocol — The Internet standards-track data-link protocol for carrying multi-protocol datagrams (including IP) over serial links.

PPP — See *Point-to-Point Protocol*.

Request For Comments — The Internet name for a standard.

RFC — See *Request For Comments*.

RPC — The Sun Remote Procedure Call protocol, described in RFC 1050, is used to distribute applications over multiple networked computers.

SCSI — The Small Computer System Interface is a standard for connecting high-speed intelligent peripherals, such as disk or tape drives, to computers.

Serial Line Internet Protocol — A simple protocol for carrying IP datagrams over serial links. No error detection or configuration negotiation is included.

SLIP — See *Serial Line Internet Protocol*.

SMTP — The Simple Mail Transfer Protocol, described in RFC 821, is used to deliver electronic mail messages across internet networks.

telnet — The protocol used to establish terminal sessions across internet networks. See RFC 854 for the protocol specification. There are many other related RFCs that describe various telnet options.

UUCP — The Unix-to-Unix Copy Program is used to transfer data files and electronic mail, usually across dial-up modem connections, between Unix systems.

V.32 — A 9600 bps full-duplex modem modulation scheme with fallback to 4800 bps.

V.32bis — A 14400 bps full-duplex modem modulation scheme with fallback to 12000, 9600, 7200, and 4800 bps.

V.42 — An error correction scheme used by many V.32 and V.32bis modems that carries asynchronous data using the LAPM protocol over a synchronous connection.

V.42bis — A data compression method used by many V.32 and V.32bis modems. V.42bis can only be used over V.42.

VJ — The initials of Van Jacobson, an engineer at Lawrence Berkeley Laboratories who has done lots of good things for the Internet protocols,

62

including inventing a TCP header compression method described in RFC 1144.

Glossary

including inventing a TCP header compression method described in RFC 1144.

63

Morning Star PPP version 1.4.1

64

Bibliography

We recommend that newly-connected Internet users and administrators become familiar with the contents of the following documents, some are themselves reading lists. You can get RFCs via anonymous FTP from nic.ddn.mil:/rfc* or from ftp.uu.net:/inet/rfc/*.

RFC-1180 — A TCP/IP Tutorial by T. Socolofsky and C. Kale (1991, 28 pps.)

An Introduction to the Internet Protocols — by Charles L. Hedrick (1987, 27 pps.) ftp.morningstar.com:pub/papers/hedrick-intro.Z

RFC-1206 — Answers to Commonly asked "New Internet User" Questions by G. Malkin and A. Marine (1991, 32 pps.)

RFC-1207 — Answers to Commonly asked "Experienced Internet User" Questions by G. Malkin, A. Marine, and J. Reynolds (1991, 15 pps.)

RFC-1208 — A Glossary of Networking Terms by O. Jacobsen and D. Lynch (1991, 18 pps.)

RFC-1173 — Responsibilities of host and network managers: A summary of the "oral tradition" of the Internet. by J. VanBokkelen (1990, 5 pps.)

Introduction to Administration of an Internet-based Local Network — by Charles L. Hedrick (1988, 46 pps.)

RFC-1118 — The Hitchhiker's Guide to the Internet by Ed Krol (1989, 24pps.)

RFC-1462 — What is the Internet? by E. Krol and E. Hoffman (1993, 11 pps.)

RFC-1463 — Introducing the Internet-- A Short Bibliography of Introductory Internetworking Readings for the Network Novice by E. Hoffman and L. Jackson (1993, 4 pps.)

Bibliography

We recommend that newly-connected Internet users and administrators become familiar with the contents of the following documents, some are themselves reading lists. You can get RFCs via anonymous FTP from nic.ddn.mil:/rfc* or from ftp.uu.net:/inet/rfc/*.

RFC-1180 — A TCP/IP Tutorial by T. Socolofsky and C. Kale (1991, 28 pps.)

An Introduction to the Internet Protocols — by Charles L. Hedrick (1987, 27 pps.) ftp.morningstar.com:pub/papers/hedrick-intro.Z

RFC-1206 — Answers to Commonly asked "New Internet User" Questions by G. Malkin and A. Marine (1991, 32 pps.)

RFC-1207 — Answers to Commonly asked "Experienced Internet User" Questions by G. Malkin, A. Marine, and J. Reynolds (1991, 15 pps.)

RFC-1208 — A Glossary of Networking Terms by O. Jacobsen and D. Lynch (1991, 18 pps.)

RFC-1173 — Responsibilities of host and network managers: A summary of the "oral tradition" of the Internet. by J. VanBokkelen (1990, 5 pps.)

Introduction to Administration of an Internet-based Local Network — by Charles L. Hedrick (1988, 46 pps.)

RFC-1118 — The Hitchhiker's Guide to the Internet by Ed Krol (1989, 24pps.)

RFC-1462 — What is the Internet? by E. Krol and E. Hoffman (1993, 11 pps.)

RFC-1463 — Introducing the Internet-- A Short Bibliography of Introductory Internetworking Readings for the Network Novice by E. Hoffman and L. Jackson (1993, 4 pps.)

RFC-1325 — Questions and Answers - Answers to Commonly asked "New Internet User" Questions by G. Malkin and A. Marine (1992, 42 pps.)

RFC-1175 — Where to start: A bibliography of internetworking information by K. Bowers, T. LaQuey Parker, J. Reynolds, K. Roubicek, M. Stahl, A. Yuan (1990, 42 pps.)

RFC-1392 — Internet Users' Glossary by G. Malkin and T. LaQuey Parker (1993, 53 pps.)

Internetworking with TCP/IP — Principles, Protocols, and Architecture — by Douglas Comer (1988, Prentice-Hall, 261 pps. plus 5 appendices, bibliography, and index; ISBN 0-13-470154-2)

The first three chapters of this textbook are of particular value to beginners. Comer should be available at any good technical bookstore. A second edition is rumored nearly ready for publication.

We also recommend that the following be kept available for convenient reference:

Improving The Security Of Your UNIX System — by David A. Curry (1990, 51 pps.)

RFC-Index — Citations for the Internet Requests For Comment. (continuously updated by the Network Information Center)

RFC-822 — Standard for the format of ARPA Internet text messages by David Crocker (1982, 47 pps.)

RFC-1035 — Domain Names — Implementation and Specification by Paul Mockapetris (1987, 55 pps.)

A Brief Tutorial on Sendmail Rules — attributed to Charles L. Hedrick (1985, 16Kb).

RFC-1036 — Standard for interchange of USENET messages by Mark Horton and Rick Adams (1987, 19 pps.)

Morning Star PPP version 1.4.1

RFC-1325 — Questions and Answers - Answers to Commonly asked "New Internet User" Questions by G. Malkin and A. Marine (1992, 42 pps.)

RFC-1175 — Where to start: A bibliography of internetworking information by K. Bowers, T. LaQuey Parker, J. Reynolds, K. Roubicek, M. Stahl, A. Yuan (1990, 42 pps.)

RFC-1392 — Internet Users' Glossary by G. Malkin and T. LaQuey Parker (1993, 53 pps.)

Internetworking with TCP/IP — Principles, Protocols, and Architecture — by Douglas Comer (1988, Prentice-Hall, 261 pps. plus 5 appendices, bibliography, and index; ISBN 0-13-470154-2)

The first three chapters of this textbook are of particular value to beginners. Comer should be available at any good technical bookstore. A second edition is rumored nearly ready for publication.

We also recommend that the following be kept available for convenient reference:

Improving The Security Of Your UNIX System — by David A. Curry (1990, 51 pps.)

RFC-Index — Citations for the Internet Requests For Comment. (continuously updated by the Network Information Center)

RFC-822 — Standard for the format of ARPA Internet text messages by David Crocker (1982, 47 pps.)

RFC-1035 — Domain Names — Implementation and Specification by Paul Mockapetris (1987, 55 pps.)

A Brief Tutorial on Sendmail Rules — attributed to Charles L. Hedrick (1985, 16Kb).

RFC-1036 — Standard for interchange of USENET messages by Mark Horton and Rick Adams (1987, 19 pps.)

66

RFC-977 — Network News Transfer Protocol by Brian Kantor and Phil Lapsley (1986, 27 pps.)

RFC-1129 — Internet time synchronization: The Network Time Protocol by Dave Mills (1989, 27 pps.)

RFC-1122 — Requirements for Internet Hosts — Communications Layers. (1989, 116 pps.)

RFC-1123 — Requirements for Internet Hosts — Application and Support. (1989, 98 pps.)

RFC-1200 — IAB Official Protocol Standards (1991, 31 pps.)

RFC-1087 — Ethics and the Internet. (1989, 2pps.)

RFC-1178 — Choosing a Name for Your Computer by D. Libes (1990, 8 pps.)

Inter-Network Mail Guide — by John J. Chew et al (1990 and 1991, 20 Kb)

USENET Software — History and Sources by Gene Spafford (1991, 15 Kb)

List of Active Newsgroups — by Gene Spafford (1991, 37 Kb)

Bibliography

RFC-977 — Network News Transfer Protocol by Brian Kantor and Phil Lapsley (1986, 27 pps.)

RFC-1129 — Internet time synchronization: The Network Time Protocol by Dave Mills (1989, 27 pps.)

RFC-1122 — Requirements for Internet Hosts — Communications Layers. (1989, 116 pps.)

RFC-1123 — Requirements for Internet Hosts — Application and Support. (1989, 98 pps.)

RFC-1200 — IAB Official Protocol Standards (1991, 31 pps.)

RFC-1087 — Ethics and the Internet. (1989, 2pps.)

RFC-1178 — Choosing a Name for Your Computer by D. Libes (1990, 8 pps.)

Inter-Network Mail Guide — by John J. Chew et al (1990 and 1991, 20 Kb)

USENET Software — History and Sources by Gene Spafford (1991, 15 Kb)

List of Active Newsgroups — by Gene Spafford (1991, 37 Kb)

Morning Star PPP version 1.4.1

68

Release Notes

This section describes the changes that have occurred in each successive release of Morning Star PPP.

Version 1.4.1.2 - August 8, 1994

Bugs Fixed

- Don't try to close and reopen the device on a dedicated line at SIGHUP time if *auto* is also specified.

Version 1.4.1.1 - August 6, 1994

Features Added

- Improve conformance with PPP RFCs, mostly improving MST PPP's interoperability with non-conformant peers
- When a running *pppd* finds an error while parsing a new *Filter*, it logs a warning message and continues running with the previous filter specification, rather than exiting

Bugs Fixed

- Fix a problem that caused excessive CPU use on HP 700's
- Silently ignore 0-byte tty reads on Solaris systems rather than interpreting it as EOF (which causes a hangup).
- Work around a bug in Solaris and Unixware that would cause *pppd* to get a segmentation violation on inbound TCP and TELNET connections.
- Modify Unixware tunnel driver to account for a discrepency between the printed Unixware documentation and the example source in the SDK. This fixes the problem of unixware not allowing more than one simultaneous incoming SLIP or PPP session.
- Count ifInOctets, ifOutOctets and ifOutUniPackets on SLIP links.
- Don't display LQM throughput percentages in the command line if LCP isn't up.
- Work around meaningless but distracting 'IFF_POINTTOPOINT not set' console message on Solaris.

Release Notes

This section describes the changes that have occurred in each successive release of Morning Star PPP.

Version 1.4.1.2 - August 8, 1994

Bugs Fixed

- Don't try to close and reopen the device on a dedicated line at SIGHUP time if *auto* is also specified.

Version 1.4.1.1 - August 6, 1994

Features Added

- Improve conformance with PPP RFCs, mostly improving MST PPP's interoperability with non-conformant peers
- When a running *pppd* finds an error while parsing a new *Filter*, it logs a warning message and continues running with the previous filter specification, rather than exiting

Bugs Fixed

- Fix a problem that caused excessive CPU use on HP 700's
- Silently ignore 0-byte tty reads on Solaris systems rather than interpreting it as EOF (which causes a hangup).
- Work around a bug in Solaris and Unixware that would cause *pppd* to get a segmentation violation on inbound TCP and TELNET connections.
- Modify Unixware tunnel driver to account for a discrepency between the printed Unixware documentation and the example source in the SDK. This fixes the problem of unixware not allowing more than one simultaneous incoming SLIP or PPP session.
- Count ifInOctets, ifOutOctets and ifOutUniPackets on SLIP links.
- Don't display LQM throughput percentages in the command line if LCP isn't up.
- Work around meaningless but distracting 'IFF_POINTTOPOINT not set' console message on Solaris.

- Fix bug on x86 systems (and other little-endian machines) that sent ICMP Unreachables (*Filter* **/unreach=xxx**) with reversed source IP address.
- Fix a bug in the NeXT tunnel driver that would cause an incoming *pppd* call to set the MTU to zero at disconnect time if an auto *pppd* were sleeping in the background.

Version 1.4.1 - May 27, 1994

Features Added

- Support for NeXTStep 3.2, BSDI BSD/386 1.1, HP-UX 9.0 on 9000/800, Unixware 1.1, AIX 3.2.5, Solaris 2.1 on Intel
- Support for synchronous PPP over the native serial ports on SPARCstations running SunOS 4.1.* and Solaris 2.3.
- Allow **internal-clocking** on the *pppd* command line as well as in the **Devices** file
- Allow **ignore-cd** in the **Devices** file as well as on the *pppd* command line
- When *pppd* checks software keys in **Licenses**, hostname and serial "number" comparisons are now case-insensitive, and trailing domain names are ignored
- Change *Filter* file **default** semantics so that the parser keeps on scanning for its desired address after reading the default entry, allowing **default** entry to supply values for others
- Add **nonice** command-line option
- Negotiate the use of LQM, rather than depending upon the peer to correctly Protocol-Reject our first LQR
- Add Predictor-1 data compression
- Add the ability (**rechap**) to periodically re-authenticate the peer
- Chat scripts automatically shift parity to match incoming "expect" strings
- The **pppframe** performance enhancement for incoming traffic is now available on SPARC (both SunOS and Solaris 2), Sun-3, Solaris/Intel, and Unixware.

Bugs Fixed

- Work around problem in NeXTStep 3.1 and 3.2 ttys, to allow inbound connections

Morning Star PPP version 1.4.1

- Fix bug on x86 systems (and other little-endian machines) that sent ICMP Unreachables (*Filter* **/unreach=xxx**) with reversed source IP address.
- Fix a bug in the NeXT tunnel driver that would cause an incoming *pppd* call to set the MTU to zero at disconnect time if an auto *pppd* were sleeping in the background.

Version 1.4.1 - May 27, 1994

Features Added

- Support for NeXTStep 3.2, BSDI BSD/386 1.1, HP-UX 9.0 on 9000/800, Unixware 1.1, AIX 3.2.5, Solaris 2.1 on Intel
- Support for synchronous PPP over the native serial ports on SPARCstations running SunOS 4.1.* and Solaris 2.3.
- Allow **internal-clocking** on the *pppd* command line as well as in the **Devices** file
- Allow **ignore-cd** in the **Devices** file as well as on the *pppd* command line
- When *pppd* checks software keys in **Licenses**, hostname and serial "number" comparisons are now case-insensitive, and trailing domain names are ignored
- Change *Filter* file **default** semantics so that the parser keeps on scanning for its desired address after reading the default entry, allowing **default** entry to supply values for others
- Add **nonice** command-line option
- Negotiate the use of LQM, rather than depending upon the peer to correctly Protocol-Reject our first LQR
- Add Predictor-1 data compression
- Add the ability (**rechap**) to periodically re-authenticate the peer
- Chat scripts automatically shift parity to match incoming "expect" strings
- The **pppframe** performance enhancement for incoming traffic is now available on SPARC (both SunOS and Solaris 2), Sun-3, Solaris/Intel, and Unixware.

Bugs Fixed

- Work around problem in NeXTStep 3.1 and 3.2 ttys, to allow inbound connections

- Fix a problem that could cause VJ TCP header compression not to work correctly on some systems
- Fix various problems with the way *pppd* deals with errors on dedicated lines
- Work around a bug in Solaris 2.* and AIX that led to duplicate routes
- Fix a bug in LQR statistics computation that occasionally led to 100% CPU consumption
- Fix for NeXTStep's improper route removal when *pppd* is killed
- Don't process received IP packets if IPCP isn't up, and don't
- Fix a bug that would cause us to get the wrong filter by matching on the wrong address.
- Correct the way *pppd* deals with loss of CD and other errors on dedicated lines
- Don't process received IP packets if IPCP isn't up, nor if a SLIP frame was already discovered to be damaged
- Fix "Can't set destination address" bug when **dedicated** is used and a device and remote address are specified
- Fix a bug that would cause us to get the wrong filter by matching on the wrong address
- Add **max-configure**, **max-terminate**, and **max-failure** for full compliance with RFC 1548 section 4.8
- Fix chat script timeouts on Silicon Graphics systems
- Handle transient IP interface congestion more gracefully
- Little-endian BSD-style systems (BSDI and NeXT-Intel) now handle interactive priority packet queueing correctly
- Don't confuse AIX tty devices (such as /dev/tty15/0) with SnapLink devices.
- Fix chat script external "backquote" command processing - it didn't close all the file descriptors

Version 1.4 - November 3, 1993

Features Added

- Support for SCO TCP 1.2, NeXTStep 3, NeXTStep for Intel, Solaris 2.* on SPARC, HP-UX 9.0 on 9000/700, SCO Xenix V.2.3.4, Interactive UNIX 3.2v3.0, BSDI BSD/386 1.0

Release Notes

- Fix a problem that could cause VJ TCP header compression not to work correctly on some systems
- Fix various problems with the way *pppd* deals with errors on dedicated lines
- Work around a bug in Solaris 2.* and AIX that led to duplicate routes
- Fix a bug in LQR statistics computation that occasionally led to 100% CPU consumption
- Fix for NeXTStep's improper route removal when *pppd* is killed
- Don't process received IP packets if IPCP isn't up, and don't
- Fix a bug that would cause us to get the wrong filter by matching on the wrong address.
- Correct the way *pppd* deals with loss of CD and other errors on dedicated lines
- Don't process received IP packets if IPCP isn't up, nor if a SLIP frame was already discovered to be damaged
- Fix "Can't set destination address" bug when **dedicated** is used and a device and remote address are specified
- Fix a bug that would cause us to get the wrong filter by matching on the wrong address
- Add **max-configure**, **max-terminate**, and **max-failure** for full compliance with RFC 1548 section 4.8
- Fix chat script timeouts on Silicon Graphics systems
- Handle transient IP interface congestion more gracefully
- Little-endian BSD-style systems (BSDI and NeXT-Intel) now handle interactive priority packet queueing correctly
- Don't confuse AIX tty devices (such as /dev/tty15/0) with SnapLink devices.
- Fix chat script external "backquote" command processing - it didn't close all the file descriptors

Version 1.4 - November 3, 1993

Features Added

- Support for SCO TCP 1.2, NeXTStep 3, NeXTStep for Intel, Solaris 2.* on SPARC, HP-UX 9.0 on 9000/700, SCO Xenix V.2.3.4, Interactive UNIX 3.2v3.0, BSDI BSD/386 1.0

71

- Renumber debugging verbosity levels, and re-order their meanings, for greater troubleshooting convenience
- License keys lock software to particular hosts, and optionally for particular time periods, for demo/eval convenience
- Can send ICMP Destination Unreachable messages when the **pass** filter blocks a packet
- Can collect per-connection accounting information
- Can ignore SIGHUPs during chat scripts, to work with dial-back modems
- Can perform selective gateway encryption using DES (not available in software exported from the USA)
- Can filter packets based on IP options
- Can interact with the user during chat scripts, such as when the remote host is protected by a timecard-based security system
- Allow less adamant insistence upon what we think the link's ends' IP addresses should be
- Allow "tunneling" connections across TCP and Telnet through existing IP network infrastructures
- Support for RFC 1334 standard CHAP, with configuration options to work with older draft-spec CHAP implementations
- Can now specify arbitrary characters in chat scripts
- Can now configure a dial delay timer to keep two systems from colliding with each other's BUSY signals.
- Added SNMP support on some systems
- Can now filter on packet source and destination address; can now log TCP FIN packets and all packets that were rejected
- Added support for incoming calls on switched synchronous and ISDN interfaces on SnapLink ports
- Made the Speed and Phone Number fields in Systems optional, since they aren't always needed
- Add NIT support to the tunnel driver on SunOS for etherfind, tcpdump, etc.

Bugs Fixed

- Fixed a subtle bug in "VJ" TCP header decompression

Morning Star PPP version 1.4.1

- Renumber debugging verbosity levels, and re-order their meanings, for greater troubleshooting convenience
- License keys lock software to particular hosts, and optionally for particular time periods, for demo/eval convenience
- Can send ICMP Destination Unreachable messages when the **pass** filter blocks a packet
- Can collect per-connection accounting information
- Can ignore SIGHUPs during chat scripts, to work with dial-back modems
- Can perform selective gateway encryption using DES (not available in software exported from the USA)
- Can filter packets based on IP options
- Can interact with the user during chat scripts, such as when the remote host is protected by a timecard-based security system
- Allow less adamant insistence upon what we think the link's ends' IP addresses should be
- Allow "tunneling" connections across TCP and Telnet through existing IP network infrastructures
- Support for RFC 1334 standard CHAP, with configuration options to work with older draft-spec CHAP implementations
- Can now specify arbitrary characters in chat scripts
- Can now configure a dial delay timer to keep two systems from colliding with each other's BUSY signals.
- Added SNMP support on some systems
- Can now filter on packet source and destination address; can now log TCP FIN packets and all packets that were rejected
- Added support for incoming calls on switched synchronous and ISDN interfaces on SnapLink ports
- Made the Speed and Phone Number fields in Systems optional, since they aren't always needed
- Add NIT support to the tunnel driver on SunOS for etherfind, tcpdump, etc.

Bugs Fixed

- Fixed a subtle bug in "VJ" TCP header decompression

- Count incoming packets correctly on AIX
- Fixed host vs. network byte ordering problem, thus squashing bugs in address-based packet filtering and netmasks on little-endian machines
- Correct 'when' field matching in Systems for ranges that span midnight
- Fix controlling-tty and process-group problems on SCO and AIX
- Allow PAP in both directions
- Improve error messages for **Filter** file errors
- Delete route on exit when in *auto* mode, even if the local address is 0.0.0.0
- The idle timer is now unaffected by sudden time changes, as sometimes happens on oddball PC hardware
- Fixed a bug when processing \A when the address was immediately followed by a "."
- Change NeXT tunnel driver device major number from 17 to 28, to avoid conflicts with NetWare Manager app
- Fix some packet filtering problems related to byte-ordering and packet fragments
- Fix doubled-backslash handling in chat scripts

Version 1.3 - June 5, 1992

Features Added

- Support for IBM RS6000 under AIX 3.2, Silicon Graphics Indigo and Personal Iris under IRIX 4.*
- Tunnel driver support for multiprocessor Suns under SunOS 4.1.2
- Speedier daemon startup
- More useful logging messages
- Improved performance and responsiveness on Suns
- Allow interoperation with old CHAP implementations
- Allow better interoperation with old (but buggy) IPCP implementations
- LQM updated to February 1992 draft

Release Notes

- Count incoming packets correctly on AIX
- Fixed host vs. network byte ordering problem, thus squashing bugs in address-based packet filtering and netmasks on little-endian machines
- Correct 'when' field matching in Systems for ranges that span midnight
- Fix controlling-tty and process-group problems on SCO and AIX
- Allow PAP in both directions
- Improve error messages for **Filter** file errors
- Delete route on exit when in *auto* mode, even if the local address is 0.0.0.0
- The idle timer is now unaffected by sudden time changes, as sometimes happens on oddball PC hardware
- Fixed a bug when processing \A when the address was immediately followed by a "."
- Change NeXT tunnel driver device major number from 17 to 28, to avoid conflicts with NetWare Manager app
- Fix some packet filtering problems related to byte-ordering and packet fragments
- Fix doubled-backslash handling in chat scripts

Version 1.3 - June 5, 1992

Features Added

- Support for IBM RS6000 under AIX 3.2, Silicon Graphics Indigo and Personal Iris under IRIX 4.*
- Tunnel driver support for multiprocessor Suns under SunOS 4.1.2
- Speedier daemon startup
- More useful logging messages
- Improved performance and responsiveness on Suns
- Allow interoperation with old CHAP implementations
- Allow better interoperation with old (but buggy) IPCP implementations
- LQM updated to February 1992 draft

- CHAP updated to April MD5 draft
- Finite state machine updated to December 1991 draft
- Address discovery in SLIP dialups to cisco terminal servers (e.g. PSI Host-DCS)
- Use **PPPHOME** environment variable to specify config file directory
- Synchronous lines pay attention to Carrier Detect signal
- Support for external dialer programs
- *Exec* script receives peer's IP address as second argument
- Increase max MTU size from 1500 to 2048
- Better interoperation with buggy peers

Bugs Fixed

- Fixed netmask handling at shutdown time
- Fixed IPCP address negotiation bug
- Fixed SIGSEGV when daemon is started with no environment
- Handle Protocol-Rejects properly
- Fix SLIP 'dial failed' problem
- Fix SLIP VJ handling when we receive a compressed frame
- Improved SnapLink buffer flow control
- Fix handling of Configure-NAKs with large MRUs
- Fix SunOS panic problem when we receive 'ping -lR'
- Fix transmitted frame when A/C compression is off but protocol compression is on
- Fix handling of IPCP Configure-Rejects that don't reject the address
- CHAP left **Auth** file open
- Fix SCO dialer exit status problem added with 'exec' option
- Fix some panic-inducing race conditions
- Fix PAP negotiation bug when requireauth and nochap are both specified
- Document some previously-undocumented SnapLink-specific **Devices** options
- Fix frame fragmenting problem when *pppd* generates its own frame (e.g. LQR) in the midst of sending user data frame

Morning Star PPP version 1.4.1

- CHAP updated to April MD5 draft
- Finite state machine updated to December 1991 draft
- Address discovery in SLIP dialups to cisco terminal servers (e.g. PSI Host-DCS)
- Use **PPPHOME** environment variable to specify config file directory
- Synchronous lines pay attention to Carrier Detect signal
- Support for external dialer programs
- *Exec* script receives peer's IP address as second argument
- Increase max MTU size from 1500 to 2048
- Better interoperation with buggy peers

Bugs Fixed

- Fixed netmask handling at shutdown time
- Fixed IPCP address negotiation bug
- Fixed SIGSEGV when daemon is started with no environment
- Handle Protocol-Rejects properly
- Fix SLIP 'dial failed' problem
- Fix SLIP VJ handling when we receive a compressed frame
- Improved SnapLink buffer flow control
- Fix handling of Configure-NAKs with large MRUs
- Fix SunOS panic problem when we receive 'ping -lR'
- Fix transmitted frame when A/C compression is off but protocol compression is on
- Fix handling of IPCP Configure-Rejects that don't reject the address
- CHAP left **Auth** file open
- Fix SCO dialer exit status problem added with 'exec' option
- Fix some panic-inducing race conditions
- Fix PAP negotiation bug when requireauth and nochap are both specified
- Document some previously-undocumented SnapLink-specific **Devices** options
- Fix frame fragmenting problem when *pppd* generates its own frame (e.g. LQR) in the midst of sending user data frame

74

- Fix nooptions overzealousness
- Fix NeXT SnapLink crashing problem
- Fix EINTR handling in chat script processing
- Fix IPCP Compression-Protocol negotiation bug; it was parsing the vjslots and vjcid fields incorrectly in received frames
- More SCO modem and flow control handling improvements, to work better with various 3rd party serial boards and drivers
- Fix SCSI read and write block sizes on SCO and NeXT
- Make SunOS 4.0.3 a separate distribution (for both Sun-3 and SPARC) because it lacks tcdrain()
- Delete host route when a SLIP connection shuts down
- Add **nopop** option to avoid scrogging the tty STREAMS stack of consoles of headless Suns

Version 1.2.1 - February 5, 1992

Features Added

- Dynamically loadable tunnel driver on Sun-3
- Hardware flow control support on SCO UNIX
- Ability to run an arbitrary program or shell script when the connection comes up or goes down
- CHAP upgraded to December 1991 draft
- IPCP address negotiation upgraded to December 1991 draft
- Support for yet more dialer types
- More useful logging messages

Bugs Fixed

- Avoid dividing by zero in LQM throughput calculations
- Handle CRC errors correctly when using VJ TCP header compression
- Slight performance improvements on Suns
- Don't continuously send LCP Echo-Requests during or after link shutdown
- More reliable chat script processing

Release Notes

- Fix nooptions overzealousness
- Fix NeXT SnapLink crashing problem
- Fix EINTR handling in chat script processing
- Fix IPCP Compression-Protocol negotiation bug; it was parsing the vjslots and vjcid fields incorrectly in received frames
- More SCO modem and flow control handling improvements, to work better with various 3rd party serial boards and drivers
- Fix SCSI read and write block sizes on SCO and NeXT
- Make SunOS 4.0.3 a separate distribution (for both Sun-3 and SPARC) because it lacks tcdrain()
- Delete host route when a SLIP connection shuts down
- Add **nopop** option to avoid scrogging the tty STREAMS stack of consoles of headless Suns

Version 1.2.1 - February 5, 1992

Features Added

- Dynamically loadable tunnel driver on Sun-3
- Hardware flow control support on SCO UNIX
- Ability to run an arbitrary program or shell script when the connection comes up or goes down
- CHAP upgraded to December 1991 draft
- IPCP address negotiation upgraded to December 1991 draft
- Support for yet more dialer types
- More useful logging messages

Bugs Fixed

- Avoid dividing by zero in LQM throughput calculations
- Handle CRC errors correctly when using VJ TCP header compression
- Slight performance improvements on Suns
- Don't continuously send LCP Echo-Requests during or after link shutdown
- More reliable chat script processing

Version 1.2 - December 27, 1991

Features Added

- Support for SCO 386 UNIX (V.3.2), Sun-3/SunOS4.1, and DECstation/Ultrix 4.2
- Dynamically loadable tunnel driver on SPARC
- Failover between multiple connection methods
- Added ability to ‘escape’ arbitrary character values
- Improve ability to work over dedicated lines
- Authentication now supports address restrictions
- Detect line failures with Link Quality Monitoring, with LCP Echo-Requests
- CHAP code conforms to October 1991 draft
- Configuration files contained in their own directory
- Documentation improved with table of contents, index
- Chat scripts can be continued over multiple lines
- Can work on serial interfaces that don’t provide Carrier Detect signal
- Better information in log file during connection establishment

Bugs Fixed

- Fixed SLIP SIGHUP "Bad file descriptor" bug
- Fixed filter file "log tcp/syn" bug
- Fixed NeXT hangup bug
- Same daemon supports SPARC from SunOS 4.0.3 forward
- Finite state machine begins with Active-Open in all cases
- Fix SLIP VJ-uncompression bug that excites the ‘panic: mclput’ bug in SunOS 4.1 and 4.1.1
- Fix route deletion when using dialins but not dialouts
- Negotiated behavior is now asymmetrical
- Tunnel driver now supports more than ten peers
- Better Ultrix serial port support
- Close stdin, stdout, stderr after forking for autodial

Morning Star PPP version 1.4.1

Version 1.2 - December 27, 1991

Features Added

- Support for SCO 386 UNIX (V.3.2), Sun-3/SunOS4.1, and DECstation/Ultrix 4.2
- Dynamically loadable tunnel driver on SPARC
- Failover between multiple connection methods
- Added ability to ‘escape’ arbitrary character values
- Improve ability to work over dedicated lines
- Authentication now supports address restrictions
- Detect line failures with Link Quality Monitoring, with LCP Echo-Requests
- CHAP code conforms to October 1991 draft
- Configuration files contained in their own directory
- Documentation improved with table of contents, index
- Chat scripts can be continued over multiple lines
- Can work on serial interfaces that don’t provide Carrier Detect signal
- Better information in log file during connection establishment

Bugs Fixed

- Fixed SLIP SIGHUP "Bad file descriptor" bug
- Fixed filter file "log tcp/syn" bug
- Fixed NeXT hangup bug
- Same daemon supports SPARC from SunOS 4.0.3 forward
- Finite state machine begins with Active-Open in all cases
- Fix SLIP VJ-uncompression bug that excites the ‘panic: mclput’ bug in SunOS 4.1 and 4.1.1
- Fix route deletion when using dialins but not dialouts
- Negotiated behavior is now asymmetrical
- Tunnel driver now supports more than ten peers
- Better Ultrix serial port support
- Close stdin, stdout, stderr after forking for autodial

76

Version 1.1 - October 8, 1991

Features Added

- Add pause and break to chat scripts
- Work with more UUCP port-locking mechanisms
- Allow peer to assign an IP address
- Synchronous support on SnapLink up to T1
- Synchronous support on Sun-4c and NeXT serial ports
- Allow ranges of ports in filter specs
- Support for draft (6-byte) VJ negotiation
- Add SLIP support
- Upgrade finite state machine to new draft specs
- Authentication with CHAP

Bugs Fixed

- Lock file is removed if error occurs part way through opening a device
- Packets transmitted with correct PPP Address/Control and Protocol field compression
- More useful messages about various failures

Version 1.0 - August 22, 1991

Original release on Sun-4 and Solbourne

Release Notes

Version 1.1 - October 8, 1991

Features Added

- Add pause and break to chat scripts
- Work with more UUCP port-locking mechanisms
- Allow peer to assign an IP address
- Synchronous support on SnapLink up to T1
- Synchronous support on Sun-4c and NeXT serial ports
- Allow ranges of ports in filter specs
- Support for draft (6-byte) VJ negotiation
- Add SLIP support
- Upgrade finite state machine to new draft specs
- Authentication with CHAP

Bugs Fixed

- Lock file is removed if error occurs part way through opening a device
- Packets transmitted with correct PPP Address/Control and Protocol field compression
- More useful messages about various failures

Version 1.0 - August 22, 1991

Original release on Sun-4 and Solbourne

77

Morning Star PPP version 1.4.1

78

Index

Index

~, 25, 41
ABORT, 13, 30, 43
accounting, 36
acct, 36
active, 15
Active-Open, 59
address assignment, 25
ange-ftp, 45
Annex, 59
argv, 35
ARP table, 39, 51
asyncmap, 17, 37
Auth, 5
authentication, 5, 29
bandwidth, 44-45
bps, 59
bringup, 43
Brixton Systems, 58
BrxPPP, 58
cables, 46
call, retry, 35
call retry delay timer, 21
carrier detect, 9, 38, 52-54
CCITT, 59
CD, 9, 38, 52-54
CHAP, 3, 5, 29, 43, 59
chat script, 12, 29-30, 36
compression, 22, 44
  address and control field, 2, 23, 39
  modem, 22, 51
  Predictor-1, 24, 44
  protocol field, 2, 23, 39
  slots, 42
  Van Jacobson TCP header, 2, 23, 42
crtscts, 9, 39
crtscts-crtsfl, 39
crtscts-rtsflow, 39
CTS, 8, 49-50, 53-54
DCD, 9, 38, 52-54
debug, 36
debugging, 29, 35-36
dedicated, 19, 21, 33, 35
Devices, 8, 12, 29, 50
dial failed, 29, 50
dial-back, 27
Dialers, 8, 12, 29, 36, 52
Direct, 8, 29
DNS, 21, 23, 47, 59
domain name system, 21, 23, 47, 59
DOS, 57
echolqm, 20, 40, 52, 58
emacs, 45
encryption, 25, 34, 44
/etc/gettytab, 55
/etc/group, 7
/etc/passwd, 10
/etc/rc.local, 9, 38, 40, 46-47, 55
/etc/ttys, 11, 50
/etc/ttytab, 56
exec, 16, 37
failover, 19, 33
fatal error, 53
FCS, 3, 9, 59
Filter, 13, 16
filter, 29
Filter, 33, 36
  bringup, 17
  default, 16
  dst, 18
  fin, 18
  IP options, 19
  ip-opt, 19
  keepup, 17
  log, 17
  pass, 17
  recv, 18

Morning Star PPP version 1.4.1

rejected, 18
send, 18
src, 18
syn, 18
trace, 18
unreach, 18
flow control, 49-51, 53-54
hardware, 8, 11, 49-51, 53-54, 59
mismatch, 50
none, 50
software, 39, 50
frame check sequence, 59
FTP, 59
FTP Software, 54, 57
gated, 37
getty, 56
gettytab, 55
GNU Emacs, 45
group, 7, 47
gw-crypt, 44
hangup, 49, 52-53
hardware, cables, 46
flow control, 8, 11, 49-51, 53-54, 59
installation, 3
troubleshooting, 49
HDLC, 17-18, 59
help, 60
Hewlett-Packard, 47
host names, 23, 33
hostname, 5, 44
HP LanProbe, 60
ICMP, 21
idle, 15, 21, 41, 53, 58
ignore-cd, 9, 38
Install, 7
installation, 7
hardware, 3
internet protocol, 60
control protocol, 60
IP, 60
routing, 14, 37
IPCP, 51-52, 60
ISO, 60
KA9Q, 60
keepup, 41
keys, 25
LCP, 60
link control protocol, 60
link quality monitoring, 19, 40, 60
Link-Quality-Report, 60
Livingston, 59
lock files, 54
log, 14, 35-36
Login, 10, 47, 56
LQM, 3, 19, 35, 40, 52, 60
LQR, 60
lqrinterval, 20, 40
lqthreshold, 20, 40
magic number, 60
max-configure, 41
max-failure, 41
maximum, receive unit, 61
transmission unit, 61
max-terminate, 41
MNP, 51, 60
modem, 47, 50, 54
null, 47
parameters, 49
QBlazer, 53
T1600, 52
T3000, 53
MRU, 17, 39-40, 61
MTU, 17, 61
NAT, 59
NCP, 61
NetBlazer, 54-56
netmask, 42
network, control protocol, 61
interface, 2
layer protocol, 61
Network Application Technology,

Index

59
NFS, 23, 44-45, 61
NIS, 7
NNTP, 61
nolqm, 20, 41, 52, 58
nonice, 37
nopop, 37
Novell, 58
novjcomp, 42
NTP, 21, 23, 61
null modem, 47
p8 (8 bits, no parity), 55
packet mode enabled, 56
PAP, 3, 5, 29, 43, 61
parity, 13, 31, 56
passive, 10, 15, 40, 58
Passive-Open, 61
passwd, 10, 47
password authentication protocol, 61
PC/TCP, 54, 57
peer, 61
PEP, 61
point of presence, 42
point-to-point protocol, 62
POP, 42
Portmaster, 59
PPP, 62
pppd.log, 14, 29, 35-36
Proteon, 59
proxy ARP, 39
pseudo-device, 2
QBlazer, 53
rc.local, 9, 38, 40, 46-47, 55
rdist, 44
request for comments, 62
retry delay, 29
RFC, 62
RIP, 13, 37
route, 38, 40
  disappearing, 51
routing, 14, 37
RPC, 62
RS-232, 9, 38, 46
RTS, 8, 49-50, 53-54
rtscts, 8, 11, 38, 49
rtscts-crtsfl, 39
rtscts-rtsflow, 39
SCO PPP, 58
SCSI, 62
SecureID, 27
security, authentication, 5, 29
  dial-back, 27
  encryption, 25, 34
  getty, 28
  packet filtering, 16, 29
  SecureID, 27
  time-to-call, 26
  tunneling, 32
serial, line, 17, 39, 55
serial line internet protocol, 62
services, 17, 23
SIGALRM, 46
SIGHUP, 46
SIGINT, 45
SIGKILL, 45
signals, 45
SIGTERM, 46
SIGUSR1, 46
SIGUSR2, 46
silo overflow, 50
SLIP, 17, 39-40, 55, 62
SMTP, 62
SnapLink, 1, 9, 18, 38
software, flow control, 39, 50-51
  installing, 7
  removing, 7
  troubleshooting, 49
Startup, 9, 38, 40, 55
subnet, 38
  mask, 37, 42
support, 60

Morning Star PPP version 1.4.1

synchronous, 18
Systems, 8, 12, 28, 33, 36, 55
T1600, 52
T3000, 53
tar, 6
telnet, 39, 62
throughput, 44
tilde, 25, 41
TIMEOUT, 13, 30, 43
time-to-call, 26
troubleshooting, 49
  argv, 35
  ARP table, 51
  debugging verbosity levels, 36
  disappearing routes, 51
  fatal error, 53
  flow control mismatch, 50
  getting pppd to exit, 53
  hangups, 49, 52-53
  IPCP, 51-52
  lock files, 54
  LQM, 52
  modem won't dial, 50
  negotiation failure, 49
  SIGUSR1, 46
  SIGUSR2, 46
  speed problems, 50
  TCP doesn't work, 49
  VJ compression doesn't work, 49
  won't idle out, 53
ttys, 11, 50
ttytab, 56
tun, 2, 35
tunneling, 29-30, 32-33
updates, 61
UUCP, 10, 52, 62
V.32, 44, 62
V.32bis, 44, 62
V.42, 44, 51, 62
V.42bis, 22, 44, 51, 62
VJ, 62
xonxoff, 9, 39, 50-51
Xylogics, 59
Xyplex, 59
yellow pages, 7
YP, 7

82