

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Laboratory for Computer Science

PC/IP User's Guide

Network programs based on the DoD Internet Protocol
for the IBM Personal Computer

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CONTENTS

General

- installation note
- overview
- other documentation
- changes in this release
- software installation
- hardware installation
- Ethernet etiquette
- host names and internet addresses
- debugging options
- dialup line file transfer

Command descriptions

- custom
- hostname
- iprint
- netwatch
- nickname
- offhook and onhook
- ping
- setclock
- telnet
- term
- tftp
- tftp server
- whois

Status of PC/IP network programs

- status
- project list

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CREDITS

The PC/IP packages are built on the work of many people in the TCP/IP community, both at M.I.T. and elsewhere. Following are some of the people who directly helped in the creation of the packages.

Network environment--John L. Romkey

Terminal emulator and customizer--David A. Bridgham

Initial TFTP--Karl D. Wright

Initial telnet--Louis J. Konopelski

Telnet model--David D. Clark

Tasking package--Larry W. Allen

Development system--Christopher J. Terman

Development environment--Wayne C. Gramlich

User Documentation--Jerome H. Saltzer

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Software installation

This section describes how to install the PC/IP commands and how to do initial customization.

The first step is to determine whether a serial line, an Ethernet, or a Pronet interface will be used for network attachment. One should obtain a diskette containing the proper versions of the set of PC/IP commands.

The distribution diskette is designed to be a read-only master copy, and it does not contain any parts of DOS. Thus you should start by copying the files you intend to use from the distribution diskette onto a formatted, DOS-containing working diskette or hard disk. You can then put the distribution diskette away in a safe place.

The next step is customization of the PCIP system for your environment. To do customization a few key facts about the environment must be collected for input to the customizer. If you are using an Ethernet or Pronet attachment:

- 1) Someone must assign an internet address for this PC.
- 2) If you plan to communicate with hosts not directly attached to the same physical net, you must know the internet address of a gateway that is attached to the Ethernet or Pronet.
- 3) If you are using an Ethernet and other hosts on your Ethernet do not use the proposed standard Ethernet-to-Internet address translation protocol, you must obtain a list of Ethernet-to-Internet address translations for the other hosts on your Ethernet.
- 4) Figure out which DMA channel and which interrupt vector will be used by your network interface. (See the hardware installation section for details.)

If you are using a serial line attachment, you do not need any of the above pieces of information. Instead, you must know the data rate of the serial line you plan to use.

That is the minimum repertoire of information needed for customization. In addition, you will probably want to make use of time, name, and printer services, so you should also obtain a list of names of up to five name servers and time servers, and one print server. The names are all you need if your local net is linked to the ARPANET; you will be able to use the IP/hostname command to discover the internet addresses of those services.

(more on next page)

The next step is to customize the network device, a file named "netdev.sys" on the working diskette or hard disk, using the minimum set of facts collected above. See the writeup of command PC/custom for details on how to customize "netdev.sys".

The customization of "netdev.sys" does not take effect until you install it as a DOS device driver. The reason is that "netdev.sys" is a file that describes a device driver rather than the device driver itself. Installation is automatic when DOS is bootloaded, that is either when the PC power is turned on or when control-alt-delete is typed. However, there is one detail: In order for the device driver to be installed automatically, the bootload diskette or disk must also contain a file named "config.sys" and that file must contain a line such as:

```
DEVICE=NETDEV.SYS
```

that names the file containing the device driver. If you already use a "config.sys" file you should make a copy of it and add this line, using a text editor. If you do not already have a "config.sys" file, you can use the one found on the distribution diskette. The DOS reference manual provides more information about the DEVICE command and about the file config.sys.

You should now have a "config.sys" file containing a "device" command that names "netdev.sys", you should have customized "netdev.sys" with the minimum information, and after you bootload DOS (type control-alt-delete) you will be ready to try a PC/IP command.

Try, for example, PC/ping, specifying the IP address of some host that you should be able to address, to see what happens. If customization is not correct, some error message should appear that may give a clue as to what is wrong.

The next step is to use PC/hostname (or the information in the section "other handy facts") to obtain the internet addresses of some time and name servers, add them to the customization, and reboot to check them out. PC/setclock can be used to verify that both time service and name service customization are working: if PC/setclock succeeds when invoked with no argument, at least one time service address is correct; if it can obtain the time from a named time service, at least one name service address is correct.

8 April 1985. This document is in file install.txt

```
* * * * *
*
*   PC/IP INSTALLATION NOTE:  DEVICE DRIVERS   *
*
* * * * *
```

The PC/IP programs use a DOS device driver that gets installed automatically every time you bootload the PC (that is, every time you turn the power on or press CTL-ALT-DEL.) But that installation is automatic only if you have set things up in the required way. If the following error message appears when you type a PC/IP command:

```
        Couldn't read in the custom structure, so you probably
        didn't install NETDEV.SYS correctly.
```

it means that when the PC was bootloaded the PC/IP device driver did not get automatically installed.

Device Driver Installation Checklist:

1. Locate the system disk that you used when you powered up the PC, or that was used when you last typed CTL-ALT-DEL.
2. Issue the command "DIR" for this disk. In the listing of the root directory there should be a file named "CONFIG.SYS".
3. There should also be a file named "NETDEV.SYS" in some directory.
4. Issue the command "TYPE CONFIG.SYS" The displayed listing of the contents of "CONFIG.SYS" should include the line

```
        DEVICE=filename
```

where "filename" is the full path name of the PCIP device driver file "NETDEV.SYS".

5. NETDEV.SYS should have been customized by running the PC/IP custom command. If NETDEV.SYS has been customized, its directory timestamp will generally be different from the directory timestamps of other PC/IP programs. If it has not been customized, it will probably be the same.

If any of these checks turn up something that is not as described, you should turn to the user's guide sections on "installation" and "customization" and follow the instructions found there.

Note that programs PC/custom, PC/offhook, PC/onhook, and PC/term do not require that the PC/IP device driver be installed. PC/custom, PC/offhook, and PC/onhook are not customizable, and PC/term is customized with the DOS debugger rather than with NETDEV.SYS.

9 April 1985. This document is in file instnot.txt

Overview of PC/IP network programs

The PC/IP network programs are a set of commands that operate under the DOS operating system for the IBM Personal Computer. They provide a set of facilities that make the PC a directly attachable network host rather than a simulated intelligent terminal.

The PC/IP programs have their origin in an M.I.T. research project on protocol effectiveness. In consequence, they incorporate several second- and third-generation protocol implementation techniques and algorithms. These techniques and algorithms:

- reduce the processing load on the computer,
- maximize opportunities for parallel operation of the network and the computer,
- minimize unnecessary retransmission of data,
- eliminate certain pathological situations in which two technically compatible machines communicate very inefficiently.

One result of application of these techniques is that a complete host implementation can operate with high effectiveness in a machine as small as the PC.

Software environment

The PC/IP programs are a set of commands that operate under IBM DOS versions 2.0 and 3.0. A device driver must be installed, but no changes are required to the operating system. Ethernet versions of the PC/IP programs have been verified to work under TopView.

These programs all use the ARPANET standard end-to-end Internet Protocol, IP, and can be used to communicate with any other host that also uses that protocol. Individual commands use various higher-level ARPANET standard protocols from the IP family, as appropriate:

- TCP for reliable byte stream transmission
- UDP for datagram service
- Telnet for remote login
- ICMP for control messages
- SMTP for mail transfer
- TFTP for file transfer
- name lookup service protocol
- error and event logging protocol
- time-of-day and calendar service protocol

Thus these programs are directly useful only in a network environment where there are other hosts that implement one or more IP-family protocols [Thus the programs are not useful on a network where all other hosts implement only the SNA LU6.2, A.I. Laboratory CHAOS or Xerox NS protocol families.]

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There is one limitation in the PC/IP protocol implementation that may affect usage in some environments: reassembly of fragmented packets is not supported. If one anticipates communications with a host that is accessible only via networks that require small packets, this limitation may be a problem.

In addition to the protocols mentioned above, PC/IP network programs make use, if available, of several network services commonly found in IP network environments. These services include:

- name-to-host-address translation service
- IP gateways to other IP networks
- time-of-day and calendar services
- error logging service
- printer service

If any of these services is not available, it is still possible to use the PC/IP network programs, though with loss of certain convenience features.

Hardware environment

The PC/IP programs operate on a standard IBM PC, PC/XT, or PC/AT. They have also been reported to work on a COMPAQ IBM-compatible PC. They require 128 kbytes of memory, one disk drive, 80-column display (either monochrome or color) and any of three kinds of hardware network attachment: RS-232 port, Ethernet[1], or proNET[2].

When an RS-232 port is used, the other end of the line can go (either by dialup or by direct wiring) to another PC or a gateway that forwards packets to and from a local area network. The link-level protocol used is a non-standard one designed to allow flow control, buffer management, and packet-to-packet redundancy compression on a full-duplex line. To simplify forwarding of packets destined for an RS-232 attached PC, the gateway assigns the internet host address of the PC. The PC asks the gateway for its assigned address using another non-standard protocol. The port may be used at any standard data rate from 300 bits/sec. to 19.2 kbits/sec. Note, however, that highly interactive services, such as character-at-a-time remote echoing, are not every effective at data rates below 9.6 kbits/sec. The RS-232 port does not work under TopView at speeds of 9.6 kbits/sec. and higher.

The Ethernet versions of the PC/IP programs provide a driver for the 3COM Etherlink[3] interface. (Note: The PC/IP Ethernet driver does not use the 3COM software or device driver, and it does not require that hardware switches be set to simulate availability of four disk drives. However, if the environment contains the 3COM software or switch settings, the PC/IP Ethernet driver will still operate correctly.) Since Ethernet addresses do not map directly into internet host addresses, the Ethernet driver uses a proposed IP standard Ethernet-to-Internet address translation protocol. If this protocol is not implemented by other hosts, it is possible, by use of a customization option, to supply manually a limited number of Ethernet-to-Internet address bindings.

(continued on next page)

The proNET versions of the PC/IP programs provide a driver for the Proteon, Inc., proNET ring interface.

There are three versions of each PC/IP command, one version for each of the three kinds of networks.

Customization

A customization program, named "custom", sets certain parameters in a DOS device driver that is used by each PC/IP network program. Some of these parameters, such as serial line speed, cannot otherwise be discovered by the software. Others, such as the preferred modes of operation of the remote login program, depend on characteristics of the distant host most often used. Still others, such as the internet addresses of name servers, are site-dependent. Details of which parameters may be set for each program are found in the descriptions of the individual programs and in the description of custom.

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- [1] "Ethernet" is a registered trademark of the Xerox Corporation.
 - [2] "proNET" is a registered trademark of Proteon, Inc.
 - [3] "Etherlink" is a registered trademark of 3COM Corporation.

8 April 1985. This document is in file overview.txt

Other documentation

This section provides an annotated list of other documents that describe or pertain to PC/IP.

- 1) Saltzer, J.H., et al., "The Desktop Computer as a Network Participant," to be published in IEEE Selected Areas in Communications, May, 1985.

Discussion of the implementation may be found in:

- 2) Romkey, John L., "IBM PC/IP Network Programmer's Manual"

The following undergraduate thesis describes the first implementation of a file transfer protocol package. Although that package has been superseded, there are still several points of design strategy that carry over into various PC/IP packages.

- 3) Wright, Karl D., "A file Transfer Program for a Personal Computer," S. B. Thesis, M.I.T. Department of Electrical Engineering and Computer Science, April, 1982. Also available as M.I.T. L.C.S. Technical Memorandum TM-217.

The following undergraduate thesis describes the TCP/Telnet package. This package is still in use, though the thesis describes an early implementation.

- 4) Konopelski, Louis J., "Implementing Internet Remote Login on a Personal Computer," S. B. Thesis, M.I.T. Department of Electrical Engineering and Computer Science, December, 1982. Also available as M.I.T. L.C.S. Technical Memorandum TM-233.

Much of the PC/IP implementation was influenced by the ideas of David D. Clark documented in the "Internet Protocol Implementation Guide," August, 1982, SRI International, Menlo Park, California. Five parts of this document are of particular interest:

- 5) Window and Acknowledgement Strategy in TCP (RFC 813)
- 6) Names, Addresses, Ports and Routes (RFC 814)
- 7) IP Datagram Reassembly Algorithms (RFC 815)
- 8) Fault Isolation and Recovery (RFC 816)
- 9) Modularity and Efficiency in Protocol Implementation (RFC 817)

The protocols used in the PC/IP packages are specified in the "Internet Protocol Transition Workbook", March, 1982, available from SRI international. The particular protocol documents are:

- 10) Internet Protocol (RFC-791)
- 11) Internet Control Message Protocol (RFC-792)
- 12) User Datagram Protocol (RFC-768)
- 13) Transmission Control Protocol (RFC-793)
- 14) Telnet Protocol (RFC-764)
- 15) Trivial File Transfer Protocol (RFC-783)
- 16) Name Server Protocol (IEN-116)
- 17) Time Server Protocol (RFC-868)
- 18) Nicname/Whois server (RFC-812)
- 19) Echo Protocol (RFC-862)

(continued on next page)

One other protocol is described in the ARPANET Protocol handbook of January, 1978:

20) Finger protocol (NIC-42758 or RFC-742)

The protocol used to send files to the Imagen print server is described in:

21) Imprint-10 Programmer's Manual, Imagen Corp. April, 1984.

The following document describes a transcription of PC/IP into Pascal, for use on the Apple Macintosh computer and Applebus:

22) Sherman, Mark, "A Network Package for the Macintosh using DoD Internet Protocols," Department of Mathematics and Computer Science, Dartmouth College, New Hampshire.

8 April 1985. This document is in file docs.txt

Changes in this release

This section describes changes since the February 1, 1984, release of the PC/IP packages.

WARNING

A major structural change in the installed device driver appears in this release. As a result, a single PC must run either all old release programs or else all new release programs. Users of the old release who want to switch to this new release must perform the installation and customization procedures just as if they had never before used these programs. Note, however, that if one PC runs the old release and another PC runs the new release on the same network they can communicate.

I. Changes that affect all packages

- 1) Name user upgraded to check responses to make sure they are for the current request rather than for an earlier one.
- 2) Improved error messages throughout system.
- 3) The sources of PCIP were modified to compile and assemble with the latest release of the microcomputer development C compiler, which now handles identifiers of longer than 8 characters correctly. In addition, a new C library is now in use. (Neither of these changes should cause any user-visible effects.)
- 4) An error in initialization that caused some programs to crash when run on machines with more than 512K of memory was fixed.
- 5) Class B and Class C internet addresses now print properly.
- 6) All commands now return an error code to DOS as they terminate, so that the DOS ERRORLEVEL feature can be used.
- 7) An error in the NETDEV device driver that prevented operation under TopView was fixed.
- 8) The Ethernet device driver is now substantially more reliable, and it works with the PC/AT.

II. Changes to protocol implementations

A) ICMP

- 1) Time-exceeded debugging messages now include information about the packet that got in trouble.

(more on next page)

B) IP

1) A bug in interpretation of bit fields in the IP header that caused the "do-not-fragment" bit to act as the "this is a fragment" bit was fixed.

C) UDP

1) An error in length interpretation was fixed, which eliminates some bogus checksum errors.

D) TCP

1) TCP now provides an entry that allows an aborting command to reset a connection before exiting.

III. Changes in specific packages

A) PC/telnet

1) The escape sequences F10-u and F10-U enable and disable the 25th line clock.

2) A new feature allows the user to specify that the tftp server of telnet should not ask the user for permission to do file transfers.

3) The escape sequence F10-A (which turned on tracing of TCP activity) is now invoked by F10-P.

4) An experimental feature allows the user to call a command interpreter while running telnet.

B) terminal emulator (used in pc/term and pc/telnet)

1) Certain escape sequences are not emulated; the emulator simply discards them. Formerly, the emulator discarded only the escape sequence but not its following arguments. Now, the arguments are discarded also.

2) In certain scrolling situations, the wrong attribute byte was used at the end of newly scrolled lines. The bug affected only color displays, where text near the bottom of the screen was filled to the right with light blue background. Screen filling is now done correctly.

C) PC/whois

1) Replaced messages using the old command name "finger" with the name "whois".

2) The user can now abort the command by typing "q".

(more on next page)

D) PC/tftp

1) An error in PC/tftp sometimes caused outgoing packets to contain a header with a zero-length field. Although the resulting packet was, according to protocol, strictly legal, a bug in BSD4.2 UNIX caused UNIX to go into a loop in the kernel whenever it received such a packet. The error in PC/tftp was fixed.

2) An error in server tftp caused one packet buffer to be lost each time it was used to send a file from the PC. In addition, the error caused the wrong data packet to be resent when a timeout occurred, thereby assuring failure of that transfer. The error was fixed. (This error affects both PC/tftp and PC/telnet.)

3) A bug in calculating the length of error packets was fixed. Other hosts should no longer receive error packets with extraneous junk at the end.

E) Ethernet driver

1) The 3COM Etherlink card for the PC locks up when it receives successive runt packets. It remains locked up until either the card is reset or the PC tries to send a packet. The effect is to disable any program (such as ping, tftp, or netwatch) that acts as a server. The Ethernet driver program was modified to watch for this condition and reset the Etherlink card if necessary.

2) An (apparently) hardware bug causes the 3COM Etherlink card to occasionally fail to respond to DMA requests on the PC/AT. The Ethernet driver program now loops in a busy wait to insure that DMA is completed, rather than depending on an interrupt. It now initiates DMA with a sequence that works on PC's with an expansion chassis.

3) Zero-length packets (a common occurrence) are no longer reported as protocol errors.

4) The software can now be configured to use any DMA channel and I/O base address that the 3COM Etherlink card can be configured to use. (But PC/custom does not yet allow setting DMA channel.)

5) Lost interrupts are now picked up by a timer. This addition improves reliability on Ethernets that have a large traffic load.

F) PC/custom

1) Upgraded to allow flexible choice of I/O base address for Ethernet interface. Also allows setting of user name, office location, telephone number, and printer service address. Ability to set inverse video mode in display removed.

(more on next page)

G) PC/netwatch

1) A new "symbolic" format option displays IP, CHAOS, and Ethernet ARP interpretation of received packets, as an alternative to simple hexadecimal contents.

2) Packet buffer area reduced from 1000 to 512 undisplayed packets.

H) PC/hostname

1) Built-in table of name servers brought up to date.

I) PC/ping

1) Ethernet version now gives intelligible error messages when pinging a non-responding host on the same local net.

H) New packages

1) PC/nickname: A command to send requests to the ARPANET Network Information Center name server.

2) PC/iprint: A command to send files to an Imagen printer service.

18 January 1985. This document is in file novchg.txt

Handy facts when using PC/IP network programs.

Library containing PC/IP programs on MIT-BORAX: /usr/ibm
Loaded command files, ready to TFTP: /usr/ibm/obj/name.com
Naming conventions: sname.com serial line version
 ename.com Ethernet version
 pname.com Pronet version

prefix "o" (as in osname.com) is attached to old, reliable versions.
prefix "x" (as in xename.com) is attached to new, experimental versions.
"term" and "onhook" do not have "e", "s", or "p" prefixes.
telnet is named "tn" "netdev.sys" is found there, too.

Documentation: /usr/ibm/doc/man/name.txt
Source: /usr/ibm/srccmd and /usr/ibm/srclib are directories that
contain one directory per command and one directory per protocol.

Report bugs to: PC-IP-request @@ MIT-XX

Telephone numbers:

CSR-UNIX 1200 baud modems 258-6646/7 only two working lines
PC-Concentrator 1200 baud 258-8192 only one line connected
MIT-Multics 1200 baud modems 258-8331 lots of lines

M.I.T. time servers:

MIT-Multics 12,0,0,6

Non-M.I.T. time servers:

DCN1 200,4,0,1 (synchronized to WWV)
BBNA 12,3,0,5
BBNG 12,1,0,5
ISIB 12,3,0,64
ISID 12,0,0,33
ISIF 12,2,0,64

Imagen Print Server 22,32,0,1

M.I.T. name servers:

MIT-Multics 12,0,0,6 Full ARPANET host table
MIT-XX 12,0,0,54 Full ARPANET host table
MIT-spooler 22,2,0,200 M.I.T. local names only

Non-M.I.T. name servers:

NIC 12,0,0,63
Purdue 12,0,0,45
DCN1 200,4,0,1
BBNA 12,3,0,5
BBNF 12,0,0,5
BBNG 12,1,0,5
ISIF 12,2,0,64

(There are other name and time servers available on MILNET.)

CSNET directory service: telnet to CSNET-SH, login as "ns"

25 October 1984. This document is in file facts.txt

Hardware installation

This section describes problems that may arise in the use of local area network hardware in the IBM PC.

Memory expansion card flaw

Some IBM 64K/256K memory expansion cards have a design flaw that causes trouble when an I/O device uses DMA channel 1. (The PC/IP software usually uses DMA channel 1 for the Ethernet or the Pronet.) The symptom of this design flaw when running PC/IP software is a catastrophic crash with the screen displaying the message "PARITY CHECK 2". The crash usually occurs within the first hundred or so packets transmitted to or from the network.

If this problem appears, one should check the memory expansion card to see whether or not it has this design flaw, and whether or not it has been field-upgraded. Flawed cards have a connection between pins nine and ten of chip U49. (The connection is a very small printed circuit stripe on the underside of the card.) Repaired cards have had that connection severed, and two new wires added, from chip U33 pin eight to chip U33 pin eleven, and from chip U33 pin ten to chip U49 pin nine. Note that making changes such as these must be done with care to avoid damaging the card, and may void any warranties. If you have a flawed card it may be appropriate to inquire of your dealer what action should be taken. Alternatively, the network can be operated using DMA channel 3 if that channel is not already in use for some other device such as a hard disk.

Ethernet jumper selection

There are several jumper-selectable hardware options on the 3COM Etherlink Ethernet card. The cards come in two forms. The first, older form, is identifiable by the label "Rev. A" or "Rev. x.y" where x and y are integers. The second, newer form, is identifiable by the label "Rev. B" and by the presence of a humongous, 64-pin chip in the upper left corner of the card (when held with the chips visible and the bus connector pointing down.) The two kinds of cards have completely different labels for their option setting jumpers, and the newer cards have a few additional settings. The option set at the top of the next page is known to work with the PC/IP Ethernet packages.

The choice of which DMA channel and which interrupt vector to use depends on what other I/O equipment is attached to the PC. For example, on an IBM PC/XT the hard disk, floppy disk, and printer are configured to use interrupt vector positions five, six, and seven, leaving two, three, and four for other attached devices. The Ethernet commonly uses interrupt vector position three.

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3COM Etherlink card option settings:

Rev. B label	Rev. A label	suggested jumper position
DMA REQ	jp1	channel 1 (must match software)
DMA ACK	jp2	Must match DMA REQ or jp1
Interrupt	jp3	vector 3 (must match software)
I/O address bit 9	n/a	right (1)
I/O address bit 8	jp4	right (1)
I/O address bit 7	jp5	left (0)
I/O address bit 6	jp6	left (0)
I/O address bit 5	jp7	left (0)
I/O address bit 4	jp8	left (0)
Memory address bit 19	n/a	right (1)
Memory address bit 18	jp9	right (1)
Memory address bit 17	jp10	right (1)
Memory address bit 16	n/a	left (0)
Memory address bit 15	n/a	right (1)
Memory address bit 14	jp11	right (1)
Memory address bit 13	jp12	left (0)
Memory address bit 12	jp13	left (0)
Memory enable	jp14	right (disable)
n/a	sw1	Left for onboard transceiver, right for external transceiver
U11/U10	n/a	Plug goes in socket U10 for onboard, socket U11 for external transceiver

(Note that older Etherlink cards can be set only to interrupt vector positions three and five, and therefore must use position three in an XT.) Similarly, the PC/XT uses DMA channel three for the hard disk and DMA channel two for its floppy disk, so the Ethernet must use DMA channel one. (Note that in recent shipments the 3COM Ethernet card has been configured at the factory with exactly these two settings.)

Ethernet external transceiver incompatibility

Certain combinations of 3COM Etherlink cards with 3COM external transceivers generate improper Ethernet waveforms. These improper waveforms can be decoded without trouble by any 3COM interface, but some Ethernet interfaces from other manufacturers cannot decode these improper signals. This problem may be the cause when a PC can communicate with some, but not other, hosts on the same Ethernet. If switching the 3COM Etherlink card to use the internal transceiver clears up the difficulty, then the transceiver incompatibility problem is almost certainly the cause. Contact a 3COM sales representative for information on an engineering change that corrects the problem.

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Pronet jumper selection

There are both switch-settable and jumper-selectable options on the proNet p1300 ring interface. Section three of the "Operation and Maintenance Manual" should be consulted for details.

a) Switches.

The node address switch (S39) must be set to an address different from every other station on your ring network, and that address is the same as the value in the last field of the internet address that your machine has been assigned (see step one under software installation.) Note that the node address switch uses the "on" position to denote the binary value "0" and the "off" position to denote the binary value "1". The board/rom address switch (S22) should be set to all zeros (all "on".)

b) Jumpers.

The interrupt vector jumper and the two DMA jumpers (one for input, one for output) must agree with the configuration that the software will assume, and must not conflict with other installed I/O devices. The card can be set to use any of interrupt vector positions 2, 3, or 4, and any of DMA channels 1, 2, and 3. The PC/IP software requires that the two DMA jumpers be configured to use the same DMA channel. The card is usually shipped with the jumpers set for a configuration that will work with a standard PC or PC/XT, using interrupt vector 2 and DMA channel 1 for both input and output.

9 April 1985. This document is in file hardware.txt

Ethernet etiquette

The Ethernet is a shared communication system, and certain actions can unintentionally disrupt it. This section describes practices and procedures that can minimize troubles seen by other users of the same Ethernet.

- 1) Most PC's are attached using "thin Ethernet," which means that the Ethernet wire comes down to the back of the PC where it connects to the PC with a T-connector. The continuity of the Ethernet (and of service to other users) depends on the integrity of the connection through the T-connector. If you disconnect your PC from the Ethernet, you should:
 - a) make certain that the continuity of the thin Ethernet through the T-connector is maintained.
 - b) Make certain that the T-connector is not touching anything metallic or conductive.
 - c) If the disconnection will be for more than a few minutes, replace the T-connector with a barrel connector. (Unterminated T-connectors provide an opportunity for noise, radiation, and echoes; one such opportunity won't necessarily bring down an Ethernet, but a large number of them can.)
- 2) If you are at one end of an Ethernet segment, you will find that one side of your T-connector has the Ethernet coming in, while the other side has a terminator attached. Continuity from the Ethernet to the terminator is just as important as continuity from one section of cable to the next, so if you disconnect your PC from the Ethernet, you should make certain that the Ethernet continues to be terminated, using either the T-connector or a barrel connector.
- 3) The Internet address used for your PC when it is attached to the Ethernet must be unique, and it must be manually assigned. Thus some care is needed to insure that two PC's don't accidentally try to operate using the same Internet address. Each PC/IP command has this Internet address embedded in it (as part of customization). You should not change the internet address that your PC uses without coordinating the change with the central registry of addresses of other PC's. Also, if you exchange diskettes containing network programs with other PC/IP users be sure that you recustomize the internet address before using the programs.

23 October 1983. This document is in file etiq.txt

M.I.T. Host Names

A list of names found in IP name table servers, of hosts on the M.I.T. campus that provide some IP protocol-based services. All integers in these tables are decimal.

Named IP-speaking hosts on the ARPANET (network 10.x.0.y)

name	aliases	x.0.y
MIT-GATEWAY	MIT-GW, GW	0.0.77
MIT-XX	XX	0.0.44
MIT-Multics	Multics, mult	0.0.6
MIT-Devmultics	cisl, devmultics	3.0.31
MIT-MC	MC	3.0.44
MIT-ML	ML	3.0.6
MIT-TAC		2.0.77
MIT-TST-GW	MIT-TST, TST, TST-GW	2.0.44

Named IP-speaking hosts on the Pronet ring (network 18.10.0.x)

name	aliases	x
AJAX	MIT-AJAX	64
BIG-BLUE	MIT-BIG-BLUE, BIGBLUE MIT-BIGBLUE	195
BLUE-DANUBE	MIT-BLUE-DANUBE, DANUBE	193
BLUE-LIGHT	MIT-BLUE-LIGHT	192
BOLD	MIT-BOLD	69
Borax	MIT-Borax	65
BRIDGE	MIT-BRIDGE, MIT-BR	5
CLS	MIT-CLS	76
Comet	MIT-Comet	66
CSR	MIT-CSR, printer, CSR2	8
Dash	MIT-Dash	73
Dutch	MIT-Dutch	67
DUZ	MIT-DUZ	72
FAB	MIT-FAB	70
FLA	MIT-FLA, NEWT, MIT-NEWTOWNE-VARIETY	75
GRAPE-NEHI	MIT-GRAPE-NEHI	77
Heineken	MIT-Heineken	78
Kirin	MIT-Kirin	81
MacEwan	MIT-MacEwan	80
Milo	MIT-Milo	86
Molson	MIT-Molson	82
DM	MIT-DM	129
MIT-GW-LCS		4
MIT-NMS		24
MrClean	MIT-MrClean	68
MOTHER	MIT-MOTHER	194
NMS		30
OA	MIT-OA	79
Opus	MIT-Opus	87

(continued on next page)

PCGW	MIT-PCGW, TIU	40
PRJ	MIT-PRJ	71
Rinso	MIT-Rinso	88
SLUDGE	MIT-SLUDGE, MIT-SL, SL	6
Tide	MIT-Tide	74
TST-V2	MIT-TST-V2	41

Named IP-speaking hosts on the 10 Mbit LCS Ethernet (network 18.26.0.x)

Name	Alias	x
BLUE-APOLLO	MIT-BLUE-APOLLO	136
BABY-BLUE	BABY, MIT-BABY-BLUE	24
BLUE-BAYOU	MIT-BLUE-BAYOU, BAYOU	26
BLUE-BLOOD	MIT-BLUE-BLOOD, BLOOD	31
BLUE-JEANS	MIT-BLUE-JEANS	30
BLUE-SUEDE-SHOES	MIT-BLUE-SUEDE-SHOES, BLUE-SUEDE	27
BLUE-THUNDER	MIT-BLUE-THUNDER, THUNDER	25
CAR-WASH	CAR-WASH-BLUES, MIT-CAR-WASH-BLUES	29
CHARMIN	MIT-CHARMIN	1
CJT	MIT-CJT	45
COKE	MIT-COKE	39
CUB	MIT-CUB	21
DR-PEPPER	MIT-DR-PEPPER, MIT-DP, DP	40
GUANO	MIT-GUANO	44
MELKOR	MIT-MELKOR	8
MISTY-BLUE	MIT-MISTY-BLUE, MISTY	28
PEPSI	MIT-PEPSI	41
PLUTO	MIT-PLUTO	35
SELTZER	MIT-SELTZER	42
VAX	MIT-VAX	95
VAXLET	MIT-VAXLET	64
WILD-BLUE-YONDER	MIT-WILD-BLUE-YONDER, WBY, MIT-WBY, WILD-BLUE	75
XBOOT	MIT-XBOOT	34
ZUD	MIT-ZUD	38

Named IP-speaking hosts at MIT Project Athena (network 18.x.0.y)

Name	Alias	x.0.y
APHRODITE	MIT-APHRODITE	58.0.12
APOLLO	MIT-APOLLO	58.0.10
ARES	MIT-ARES	58.0.5
ARTEMIS	MIT-ARTEMIS, ARTY	58.0.11
ATHENA	MIT-ATHENA	58.0.1
ATLAS	MIT-ATLAS	58.0.15
CHARON	MIT-CHARON, SIPBVAX	58.0.13
DEMETER	MIT-DEMETER	58.0.4
HERA	MIT-HERA	58.0.3
PERSEPHONE	MIT-PERSEPHONE, PHONE	58.0.8
POSEIDON	MIT-POSEIDON	58.0.6
PROMETHEUS	MIT-PROMETHEUS, PROM	58.0.14
ZEUS	MIT-ZEUS	58.0.2

(continued on next page)

Named IP-speaking hosts on the 3 Mbit experimental Ethernet
(network 18.2.0.x)

name	aliases	x
alto214b		56
alto502		130
alto503		100
alto508		96
alto509		18
alto510		20
alto511		72
alto520		170
alto524	Guttag	32
alto828	Medg	134
csg		15
MIT-spooler	spooler, spool, sp	128
MIT-SHELOB	SHELOB	127
muriel		80
NP-alto		129
OA-alto		56

IP-forwarding internetwork gateways:

Fifth floor bridge:

proNET ring:	(no name)	18.10.0.5
3 Mbit Ethernet:	MIT-BR-ETHERNET, MIT-BR	18.2.0.7

ARPANET gateway I:

proNET ring:	(no name)	18.10.0.4
ARPANET:	MIT-GATEWAY	10.0.0.77

PC Concentrator:

proNET ring:	MIT-PCGW	18.10.0.40
Serial line net:	(no name)	18.9.0.128

ARPANET gateway II:

proNET ring:	(no name)	18.10.0.41
ARPANET:	MIT-TST-GW	10.2.0.44

Ethernet gateway:

proNET ring:	MIT-SLUDGE	18.10.0.6
10 Mbit Ethernet:	(no name)	18.26.0.132

IP-to-CHAOS gateway:

proNET ring	MIT-GROSS	18.10.0.9
AI Ethernet		

Location of IP name tables in character format at M.I.T.:

```
MIT-XX PS:<terminet>auxiliary-host.table
MIT-AJAX /etc/net/Hostmap/hosts.txt
MIT-Multics invoke >lib>net>e>dsht [-all]
```

31 October 1984. This document is in file hosts.txt

Debugging options

This section explains the operation and usefulness of the debugging option switches that can be set using the customizer.

The PC/IP packages have built in as part of their design a large number of error and progress report messages, but these messages do not appear on the display screen unless specifically requested. The debugging option switches control which messages the packages display. When troubles appear in the use of network programs, it is often not immediately apparent whether the cause is a problem in the local computer system, in some distant server, or in some network in between. The tracing that is controlled by the debugging switches has as its primary value that it can allow fairly rapid trouble isolation in such circumstances.

The arrangement of the debugging option switches in the PC/IP packages has evolved as the requirements for tracing have become better understood; this evolution is incomplete and there are quite a number of cases where different packages and different levels of network protocol do not yet follow consistent conventions.

The debugging switches can be set ON or OFF as customization options. The usual technique is to customize the debugging options to the ON position in the "netcust:" device so that they apply only to the current session. However, as is described below some users may find it helpful or interesting to customize the first few of the switches permanently ON (in the file "netdev.sys") to allow monitoring of network status and problems. Each debugging option switch is described here and in the customizer by a symbolic name.

Here are the message categories controlled by each debugging switch:

NETERR Reports all recoverable errors detected by the local network (Ethernet, proNET, or serial line) driver. Can be left ON during normal operation to monitor appearance of network troubles.

PROTERR Reports all packets received that seem to be inappropriate for the protocol being used, or that represent some other trouble at the protocol level. Primarily useful for debugging other implementations or discovering incompatibilities between implementations on different computer systems. Can be left ON during normal operation to serve as a warning that one has contacted a host that isn't following protocol in the expected way.

TIMEOUT Reports all timeouts waiting for the other end of a connection to respond. Can be left ON during normal operation to monitor frequency of timeout-triggered retries.

(More on next page)

APTRACE (Currently named ROUTE in the customizer) Provides a trace of the activities of the application level protocol. For example, in PC/tftp, APTRACE produces a one-line message for each file block that is sent or received. Can be left on during normal operation if progress reports are important or useful, but tends to fill the screen with tracing messages.

The following debugging options are primarily useful for finding bugs in the PC/IP programs themselves. They generally produce so much output that they are best left off unless they are really needed.

TCTRACE (Currently synonymous with TRACE in the customizer) Provides a trace of the activities of the transport level protocol, such as UDP or TCP. Produces a one-line message for each packet that is sent or received at the transport level.

INTRACE (Currently synonymous with TRACE in the customizer) Provides a trace of the activities of the internet protocol level, IP or ICMP. Produces a one-line message for each packet that is sent or received by the internet level.

NETRACE (Currently synonymous with TRACE in the customizer.) Provides a trace of the activities of the local network driver. Produces a one-line message for each packet that is sent or received on the local network.

DUMP Whenever an incoming packet seems to have something wrong with it, this switch causes its contents to be displayed in hexadecimal format.

INFOMSG Triggers a long list of informational and progress report messages. Used primarily to find out how far a PC/IP package got before it crashed.

BUGHLT Displays a message whenever the network level code of PC/IP detects a gross application error of some kind. (Not actually used very much.)

The PC/telnet command has a special tracing feature that is useful for tracking interactions with a remote time-sharing host. The PC/telnet escape F10/P toggles the APTRACE debugging switch described above. When APTRACE is ON, PC/telnet displays on line 25 a cryptic progress report (updated once per second) on the connection to the other host. This report appears as follows:

```
Sent: N1(N2)N3 Rcvd: N4(N5)N6 Window: N7
```

with the following interpretation:

N1	Number of bytes sent by the PC to the other host.
N2	Number of sent bytes not yet acknowledged by the other host.

(More on next page)

- N3 Number of packets resent to the other host in hope
 of eliciting an acknowledgement.
- N4 Number of bytes received from the other host.
- N5 Number of received bytes not yet acknowledged to
 the other host.
- N6 Number of packets rereceived (that is, duplicates)
 from the other host.
- N7 Number of bytes that PC/IP has authorized the other
 host to send. (TCP window size.)

Note that while ON, APTRACE also triggers a one-line-per-block message from the tftp server if it used from within PC/telnet.

PC/Telnet also can be asked to display other internal variables with the following F10 escapes:

- N local net and internet statistics
- S TCP and Telnet statistics
- + tasking package statistics

26 October 1984. This document is in file debug.txt.

Dialup line file transfer

One use of the PC/IP commands is to transfer files to and from some network-attached system over a dial-in line. Two scenarios for that use are described here. For either scenario, the description of commands PC/onhook and PC/tftp should be read before proceeding. These scenarios require that the serial line version of PC/tftp be used.

A) Scenario with manually-controlled dialling:

- 1) Type the command "offhook".
- 2) Dial the telephone number of the PC concentrator. When it answers, switch the modem to data.
- 3) (Optional, but recommended) Type the command "setclock" to verify that the network connection is operational and also to set the PC clock so that the date and time attached to newly transferred files will be correct.
- 4) Issue the "tftp" command to get or put the file wanted.
- 5) Repeat step 4 until all files are transferred.
- 6) Type the command "onhook".
- 7) Switch the modem to voice and disconnect it from the telephone line.

B) Scenario for use with a terminal-controlled dialling modem:

- 1) Type the command "term".
- 2) Using the terminal emulator, instruct the modem to dial as desired.
- 3) Continue with step three, above.

27 November 1983. This document is in file dialup.txt

PC/custom, version 2.0

A command to customize the PC/IP environment, allowing setting of parameters that describe the network environment and preferred option settings.

Usage:

```
custom netdev [model]
```

begins customization of the device description found in the file named "netdev.sys". When finished customizing, custom rewrites the file netdev.sys with the new parameters in place. The customizer is menu-driven and self-explanatory. If a second argument is given, custom reads the values of the customization parameters of the command found in the file "model.sys" and uses them as initial values. It then enters the usual starting menu so that the user can review the result.

For simplicity and uniformity, the one device driver contains the customization parameters for all network levels and all commands. For example, one can set serial line parameters even though the PC/IP commands to be used contain an Ethernet driver. It is not necessary to specify values for customization parameters that will not be used. For example, if the command PC/setclock will not be used, one need not specify the internet addresses of time servers.

Note that customizing the file netdev.sys will have no effect until the next time DOS is bootloaded. See the writeup entitled "software installation" for more details.

Standard customization parameters:

There are several customization parameters that are applicable to all or several different PCIP commands. Customization parameters that apply to just one command are described in the writeup of that command.

Site customization to match network hardware options, switch settings, and parameters:

- 1) Serial line speed. Can be set to any baud rate from 110 to 19,200. (Needs to be set only for serial line use.)
- 2) Interrupt vector for network interface. Should be set to correspond to the interrupt vector number that the hardware interface will use. If not set, the PC/IP Ethernet and Pronet drivers will use interrupt vector number five as a default, and the PC/IP serial line driver will use interrupt vector number four as a default.
- 3) DMA channel for network interface. Should be set to correspond to the DMA channel that the hardware interface will use. If not set, the PC/IP network drivers will use DMA channel one as a default. (Need not be set for serial line use.) [Note: the current version of PC/custom has no provision for changing this parameter.]

(more on next page)

- 4) Network interface I/O address. Should be set to match the I/O base address used by the network hardware. Default is 0300 (Hex).
- 5) Ethernet address. One can customize the Ethernet in one of three ways:
 - a) to the Ethernet address found on the network interface card,
 - b) to an Ethernet address derived from the internet address by concatenating 16 leading zero bits,
 - c) to an arbitrary Ethernet address specified to the customizer.

One should normally use the first option; the others are available to deal with non-standard Ethernet environments.
- 6) Number of network interfaces. This parameter is currently not used; it is provided for future implementation of multi-network attachment.

Site customization of network level parameters:

- 1) Internet address of this computer. (Not needed for serial line use.)
- 2) Internet address of default IP gateway. (Not needed for serial line use.)
- 3) Internet addresses of up to five IP name servers.
- 4) Internet addresses of up to five time servers. The servers are polled at two second intervals in the order they were set by the customizer, so one may place preferred services nearer the head of the list. (Needed only by IP/setclock.)
- 5) Internet address of a print server. (Needed only by PC/iprint.)
- 6) Internet address of an IP log server. If this address is non-zero, some PC/IP commands send error-logging or statistics-gathering packets to this address. For privacy, the address may be set to 0,0,0,0, in which case all logging is suppressed.
- 7) Up to three initial values for Ethernet-to-Internet address cache. (Needs to be set only for Ethernet use and when the environment does not provide the proper protocol.) IP addresses are entered in standard octal or decimal form. Ethernet addresses are entered as 6 octal byte values (each between 0 and 377) separated by commas.

(more on next page)

- 8) TCP window size and low window level. These two parameters affect the performance and smoothness of flow of data in commands such as Telnet. The window size is the count, in bytes, of the maximum amount of data that another host should send to the PC without waiting for authorization to send more. If not customized, its default value is 1000 bytes. One might make this value smaller if there is a gateway with limited buffering ability in the pathway between the PC and a commonly-used host. The low window level is the trigger point at which the PC sends authorization to send more data to the other host. If not customized, its default value is 200 bytes. If there is a long round-trip delay to a commonly-used host, one might adjust this value so as to just fill up the pipeline from that host. The low window level must be less than the window size, and the window size must be less than 2000 bytes.
- 9) Telnet transmission trigger. Can be set to send every character as it is typed (necessary if using a character-based remote echo system) or to send a batch of typed characters only when a newline character is typed (less demanding on the remote system.)
- 10) First RVD drive. This parameter is provided for a future feature.
- 11) Number of subnet bits. This parameter determines how many bits, following the network part of an IP address, are used to identify the attached subnetwork. PC/custom displays on octal "subnet mask" that is derived from the IP address and the number of subnet bits. This feature is used in a simple way, as follows: when an IP packet is to be sent from the PC, its IP destination address is masked with the subnet mask. The part of the destination address that is revealed by the subnet mask is then compared with the corresponding part of the PC's own IP address. If the revealed section of the two addresses are different, the destination is assumed to be on another subnetwork, and the routing layer sends the packet to the default gateway. If the revealed sections are the same, the destination is assumed to be on the same local area network as the PC itself, and the concealed portion of the destination address is used by the network layer to construct the proper physical address (perhaps using an Address Resolution Protocol). If subnetwork routing is not in use, an extent of zero is appropriate. At M.I.T. the subnetwork routing scheme uses 8 bits for subnetwork identification.

Personal customization of terminal emulation options:

- 1) Action on lines too long to fit on screen. Discard mode places all excess characters in column 80. Wraparound mode places excess characters on next line.
- 2) Swap interpretation of backspace with control-backspace. (See telnet description of emulation conventions for further information.)

(more on next page)

Other parameters:

- 1) User's name, office number, and telephone number. Character strings that are included in error logging messages and are placed in headers of files sent to a print server. May be set to (or left) blank.
- 2) Debug options. There are several options that turn on various degrees of progress reports, tracing, and otherwise suppressed error messages. These options are of interest primarily to system programmers. One normally sets them to "all off".
- 3) Local standard time offset, in minutes before GMT. West of GMT the value is positive, east of GMT the value is negative. For EST the value is +300. For SET the value is -60 in the winter.
- 4) Local standard time designation string. Three letters, such as EST, EDT, or SET.

On-the-fly error correction:

Errors in typing names and addresses can be corrected with the following common editing conventions: The backspace key discards the last character typed, while Control-U discards the entire name or address typed so far, allowing one to start over.

Temporary customization:

The command

```
custom netcust
```

will recustomize the currently active device driver, which is named "netcust:". Customization of netcust takes effect immediately, rather than at next bootload, and is lost when the next bootload takes place. Temporary customization of the active device driver is sometimes useful in debugging, for example to turn on a tracing option for a while. Note that for temporary customization to work there must be an already-present active device driver, previously loaded by DOS.

8 April 1985. This document is in file custom.txt

PC/hostname, version 5.0

A package to look up the internet address that corresponds to a host's character string name, using the UDP/ICMP name server protocol.

Usage:

```
hostname name  
or  
hostname name nameserver
```

Where "name" is the character string host name to be resolved. If no nameserver is specified, hostname sends an inquiry to every known name server, and displays all responses.

"nameserver" is an optional argument that, if provided, identifies a specific name server that is to be invoked to resolve the name "name". "nameserver" may be either a character string name (in which case it is resolved using the customized name servers) or an internet address in standard form.

The section on hostnames and internet addresses provides more information on the resolution of host names. This command is primarily useful for trouble isolation when one suspects that name tables may be inconsistent or incorrect.

Customization:

PC/hostname has no special customization parameters of its own. The names and internet addresses of several ARPANET name servers are built in to PC/hostname, and are changeable only by recompiling or patching the program. Name server addresses provided by customization are used only for resolution of name server names. See the description of custom for explanation of these parameters.

26 October 1984. This document is in file hostname.txt

PC/iprint, version 1.0

A program to send a text file to an Imagen print server.

Usage

```
    iprint filename  
or  
    iprint -n filename  
or  
    iprint -q filename
```

sends the file "filename" to the default print server, using the standard protocol for the Imagen family of print servers. PC/iprint specifies a default format that simulates an 80-character, 10-pitch line printer. It arranges for a header line containing the name of the file and the current date and time to appear at the top of each page, and it attaches a cover sheet containing the user's name and office number. If the option "-n" is given, the header line is omitted. If the option "-q" is given, the iprint command displays no messages unless it encounters an error.

Customization:

The following parameters of iprint can be customized with the PC/custom command.

- 1) Internet address of the Imagen print server.
- 2) Name and office number of the user, for the cover sheet.

Notes:

All PCIP packages follow the DOS convention of returning an ERRORLEVEL value when they exit. For use in batch files, PC/iprint returns ERRORLEVEL=0 if the printer service accepts the file, and ERRORLEVEL=1 otherwise.

23 November 1984. This document is in file pciprint.txt

PC/netwatch, version 5.0

A program to monitor the attached local network. It is useful primarily for debugging network operations on a broadcast network.

Usage:

netwatch

No arguments are required. PC/netwatch listens to the attached local broadcast network and displays one line of information for every packet that goes by. This information consists of the "to" and "from" local network addresses, the packet length, the value of the protocol type field, and 8 selected contiguous bytes of the packet contents. While netwatch is running one may type control instructions to it. The control instructions it recognizes are:

- a - Display packets whatever their source or destination.
(This is the starting mode of operation.)
- m - Display only packets coming from a given local net address.
(Address is input as 12 hex digits.)
- d - Display only packets going to a given local net address.
(Address is input as 12 hex digits.)
- t - Display only packets of a given protocol type.
(Type is input as up to 4 hex digits.)
- < - Display only packets larger than a given length.
(Length is input as up to 3 decimal digits.)
- o - First byte of packet contents to be displayed.
(Input as a zero-origin decimal number. Default is 14.)
- S - Display statistics of network driver.
- l - Clear screen.
- r - Reset packet count at bottom of screen.
- p - Send Address Resolution ARP broadcast packet.
- q - Exit from the monitor program.
- n - display packets in hexadecimal form.
- s - display packets in symbolic form, if recognizable as an IP, CHAOS, or Ethernet ARP packet. (This is the starting mode of operation.)
- A - display only ARP packets.
- C - display only CHAOS protocol packets.
- I - display only IP protocol packets.
- ? - Display the list of requests.

Performance

The limitations of the monitor in high-traffic situations should be understood. The monitor can handle a burst rate of about 200 packets per second. Packets arriving faster than that are missed (but counted in the statistics of the network driver). In addition, the display rate is about 25 packets per second and there is a buffer that can hold 512 undisplayed packets. If packets arrive faster than the display rate for a long enough time to fill up the buffer, the monitor discards overflow packets.

Note: When the proNET version of netwatch is used, a jumper must be set in the hardware to permit the interface to accept all packets.

8 April 1985. This document is in file netwatch.txt

PC/nickname, version 2.0

A program to invoke the ARPANET Network Information Center name directory service.

Usage:

nickname name

sends a request to the ARPANET Network Information Center (assumed to be located at IP address 12,0,0,63) name resolution service, inquiring about "name". The NIC normally responds with a text string, which nickname then displays on the screen of the PC.

If name is "-help" nickname displays some hints on how to use it. If name is "help", nickname forwards the request to the NIC, which responds to that name with a screenful of information on making more sophisticated inquiries.

If the Network Information Center is not forthcoming with a response, PC/nickname will give up after about 20 seconds. Typing the letter "q" will cause PC/nickname to abort the operation immediately. This feature is useful if one discovers that the output from the NIC is more extensive than anticipated.

4 December 1984. This document is in file nickname.txt

Host names and internet addresses

A brief description of the syntax of host names and internet addresses, and the method by which host names are resolved.

When PC/IP network programs accept a hostname argument it may be in either of two standard forms:

- 1) Internet address. An internet address is four octal integers separated by commas, for example:
22,11,0,127
or four decimal integers separated by periods, for example:
18.9.0.87
Each integer represents one byte of a 32-bit standard internet address, in the order "network," "subnet," etc. When the user supplies an internet address the PC/IP network program uses it as is, depending on nothing else for name resolution.
- 2) Host name. When a PC/IP network program encounters a string that does not appear to be an internet address, it interprets the string as a host name and it attempts to resolve the name by appeal to one or more name servers via the network. The program sends inquiries to as many as five name servers, whose internet addresses are embedded in the command program. (The user may change the number of name servers and their internet addresses by use of the PC/IP program "custom".)

When the user supplies a host name, there can be three outcomes, since name servers may reply with an internet address, reply with a "host name unknown" response, or may not reply at all. To increase availability several name servers are polled, and the following rules merge the resulting replies:

- 1) If one or more name servers respond with an internet address, the program uses the first such response received and ignores all later responses.
- 2) If one or more name servers respond, but all the responses are "host name unknown," the program displays that error message and exits.
- 3) If no response arrives from any name server within five seconds, the program gives up, displays the error message "name servers not responding," and exits.

Note that if different name servers give different responses to the same inquiry, the user may see erratic results depending on which name servers are up and which respond more quickly. If one suspects that name servers are not responding or are not in agreement, the command "hostname" may help isolate the trouble.

23 May 1983. This document is in file nameres.txt

The original source file for this page has not been located. The version here has been reconstructed by scan and OCR from a paper file.

PC/offhook PC/onhook

Programs to connect or disconnect (in telephone jargon, "place off-hook or on-hook" and in common parlance, "pick up or hang up") the telephone line attached to a serial port on the PC.

Usage:

offhook
onhook

These commands are provided for the scenario in which several different PC/IP commands are to be used in a single session, via a dial-up serial line. The offhook command instructs the attached modem that the computer is prepared to use the serial line (by turning on the signal "data terminal ready" in the modem interface.) By convention, PC/IP commands that use the serial line always restore the on-hook/offhook status of that serial line as they exit. At the completion of the session, the user may issue an onhook command to disconnect the telephone line.

Note that the terminal emulator command, PC/term, is also useful in management of on-hook and off-hook status, especially in the case where either the modem or the computer at the other end of the serial line is controlled by sending ASCII characters. Rather than starting a session with the offhook command one starts with term, using the emulator to tell the modem and switches how to connect things up. Then, the user exits term with F10/q, which leaves the serial port in off-hook status. At the completion of the session, the user issues the onhook command as usual.

The commands PC/onhook and PC/offhook operate on serial port number one, known in PC documentation as "COM1:".

23 October 1983. This document is in file onhook.txt

PC/ping, version 5.0

A program to send an echo request to another host and watch for a response, using the ICMP/IP protocol. Used primarily to isolate trouble in an internetwork environment.

Usage:

```
ping hostname
```

Where "hostname" is either a character-string name of the target or an internet address in standard form. (See the section on hostnames in the network overview for more details.) The hostname "me" will send an echo request addressed to the computer on which the command is typed.

Ping reports success with a message such as "Host x,y,z,w responding" where x,y,z,w is the internet address of the target. It may also report one of several failures:

- Host not responding
- Host responded but the returned echo packet was defective
- The initial echo request packet could not be sent

When exiting, ping also prints an array of statistics about its operation. These statistics are in two categories: details of local network usage and details of packets processed. These statistics often provide clues about network problems to a network specialist.

Optional features

```
ping -t hostname
```

will go into a loop continually sending echo requests to host "hostname", each time waiting for a response before sending the next request. To exit this loop, type the single letter "q". When in looping mode ping reports all echo failures, and also maintains a summary line of trials and successes.

```
ping -s
```

starts an echo server, a program that will respond to echos sent to this PC from elsewhere in the network. (Note that all PC/IP programs, including ping, always act as echo servers whenever they are in control of the PC.)

Using ping to isolate network trouble

When a host fails to respond, it may mean either that that host is down or that some network or gateway in the path from the user to the host is down. (It could also mean that the host does not implement the IP/ICMP echo request protocol.) Further ping experiments can usually determine which (and thus whom to call for repair.) A successful ping directed to another host on the same network as the original host usually means that the original

(continued on next page)

host is down or not listening to the network. Failure to get echos from any host on that network means that the trouble is along the path somewhere. A ping directed to the gateway into the network in question is the next step. One can continue to work back from the target toward the originator until the point where communication breaks down is found.

The echo request sent by the ping command is dispatched using a low-level protocol that does not try to guarantee delivery. As a result, there is a possibility that any one echo request may be accidentally lost for some reason such as temporary overload in some gateway. Thus one cannot be confident that a particular network or gateway has failed unless a series of ping experiments consistently succeed in getting to the point in question and consistently fail to get beyond that point.

Using ping to evaluate a serial line:

Since ping contains a built-in echo server it can be used to test or evaluate a serial line in two ways. If a gateway is attached at the other end of the serial line, the command "ping me" exercises the serial line in both directions as well as the gateway. Alternatively, if one loops back the other end of the serial line so that all data sent down the line comes immediately back to the PC, the command "ping me" will still work, using an internet address chosen by ping. In both cases, the command form "ping -t me" is appropriate to start a continual test of the line. Any packets damaged in transit will lead to error reports; the summary of tries and successes provides a picture of the total effect of line noise.

26 October 1984. This document is in ping.txt

PC/setclock, version 5.0

A program to obtain a clock reading from a network time service and set the PC date and time accordingly.

Usage:

```
setclock [time-server]
```

where "time-server" is either a character-string name or an internet address of a network host that provides an IP time service. Setclock sends a request, using the standard IP time service protocol, to "time-server". If the name "time-server" is omitted, setclock sends requests to a default list of internet addresses of the known time servers. This list is stored within setclock and can be set or changed with the customizer. Setclock takes the first response, converts the calendar clock reading found therein to the local date and time and displays it. Finally, setclock calls the standard PC/DOS entry points to set the system date and time.

If no time server responds, or the network is not operational, setclock displays a message to that effect and leaves the current date and time settings of PC/DOS unchanged.

Setclock is designed for use either as a stand-alone command or as a command invoked by an autoexec.bat batch file. There are two advantages to using setclock in an autoexec.bat batch file. First, DOS does not ask the user to type the date and time on every bootload operation. Second, it provides an immediate test of whether or not the network connection is operational. If setclock receives at least one response, it returns to DOS with the DOS variable ERRORLEVEL=0; otherwise ERRORLEVEL=1.

Customization:

The following parameters of setclock can be customized with the custom command:

- 1) Local standard time offset, in minutes before GMT. West of GMT the value is positive, east of GMT the value is negative. For EST the value is +300. For SET the value is -60.
- 2) Local standard time designation string. Three letters, such as EST, EDT, or SET.
- 3) Internet addresses of up to five time servers. The servers are polled at two second intervals in the order they were set by the customizer, so one may place preferred services nearer the head of the list.

25 October 1984. This document is in file setclock.txt

PC/telnet, Version 7.1

A remote login package for the IBM PC, using the TCP/IP protocol and emulating a display terminal.

Usage:

```
telnet hostname
or
telnet -p portno hostname
```

Where "hostname" is either a character-string name of the target host, or an internet address in standard form. (See the section on hostnames in the network overview for more details.) When used with the "-p" option, the argument "portno" is used as a port number at the target machine. This feature is used to connect with certain telnet-like services available on some hosts.

From the point of view of the target host, PC/telnet emulates a standard "network virtual terminal". From the point of view of the keyboard user, PC/telnet emulates a Heath H19 terminal. The terminal emulation is only approximate. A set of conventions and list of incompatibilities appears on the next page.

Typing the command with the name or internet address of a target host causes PC/telnet to try to establish a connection. When that connection is successful, the target host should display its greeting banner. The following conventions apply to the translation between H19 emulation and network virtual terminal emulation:

- 1) Function key F10 is an escape used to invoke PC/telnet functions. F10 followed by a question mark displays a list of escape sequences. Others are F10 followed by:
 - a Send "Are You There?" inquiry to the target host.
 - b Send "break" to the target host.
 - c Close the connection and exit from telnet.
 - e Send to target on every typed character.
 - l Local echo. (PC/telnet echos typed input.)
 - E Send to target only when End-Of-Line is typed.
 - q exit from telnet without closing connection.
 - r Remote echo. (Target host echos typed input.)
 - x Send any outstanding data now.
 - U turn on the line-25 clock and status report (default is on)
 - u turn off the line-25 clock and status report.
- 2) Function key F10 is also used to change the mode of operation of the terminal emulator within PC/telnet. These escapes are:
 - B Backspace key sends BS, control-backspace sends DEL.
 - D Backspace key sends DEL, control-backspace sends BS.
 - d If output line too long, discard extra characters.
 - w If output line too long, wrap around to next line.
- 3) The PC "Print-Screen" feature, triggered by key "PrtSc", can be used from within PC/telnet, but immediately preceding its use one must restore the display buffer to the format expected by PrtSc. Function key F10 typed twice does this format adjustment.

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Closing connections:

At the end of a login session, some hosts will close the connection, in which case PC/telnet exits, returning to the PC operating system. Other hosts issue an invitation for another login. In the latter case, type F10 followed by "c" to close the connection and exit from PC/telnet. Other methods of exiting, such as F10 followed by "q", or powering down the PC, will leave a dangling TCP/telnet connection that some hosts may not clean up properly. A later attempt to login to that host from the same PC may encounter interference from the unclosed previous connection.

If you close a connection without logging out, most hosts will deal with the situation in the same way they handle telephone line hangups. If you exit telnet without either logging out or closing the connection, the host may not realize you are gone, and there is no way to pick up the connection again. (The host, noticing lack of activity for a long time, may eventually log you out and close the connection.)

If you try to open a connection to a host that does not respond, PC/telnet will try eight times, then display an error message and exit. Note that this message may mean either that the target host is not listening to the network or that some network or gateway in the communication path to that host has failed. (The command PC/ping may be useful in isolating the trouble.)

Versions of PC/telnet are available for both local area networks and for serial lines. On a serial line, at speeds below 9600 baud, the combination of remote echo and send-on-every-character modes causes display to fall far behind typed input. Local echo and send-on-newline modes are recommended for operation at lower line speeds.

Terminal emulation conventions and compatibility:

The following conventions allow the PC keyboard to behave like that of a Heath H19:

- 1) There is no repeat key. To repeat any key, hold it down.
- 2) The function keys are keys F1-F5.
- 3) The color keys are F6(blue), F7(red) and F8(gray).
- 4) The H19 has separate keys for ASCII "Carriage Return" and ASCII "Line Feed". These two functions are combined on the PC "Enter" key (the one to the right of the tilde key). To send an ASCII CR, type "enter". To send an ASCII LF, type "control-enter".
- 5) The H19 has separate keys for ASCII "Backspace" and ASCII "Delete". These two functions are combined on the PC "back-space" key (the one to the right of the equal-sign key). To send ASCII DEL, type "backspace". To send ASCII BS, type "control-backspace". A customization option and an F10 escape allow interchanging backspace and control-backspace. For convenience, the keypad key labeled "Del" also sends an ASCII DEL.
- 6) The PrtSc key operates normally on the PC. That is, it sends the current display to an attached printer.

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- 7) Note that the emulator exactly emulates the Heath H19 line wraparound feature. That is, in line wraparound mode, the emulator automatically goes to the next line after placing a character in column 80, rather than waiting to see if the program or typist will try to put something in column 81.

Heath H19 features not emulated:

hold screen/scroll	keyclick disable
graphics	keyboard disable
shifted keypad	block cursor
alternate keypad	AutoCR
identify as VT-52	AutoLF
transmit page	transmit 25th line
offline/online switch	parity enable
XOFF/XON flow control	most ANSI escapes
control-suppression of transmitting display mgt codes	
restore power-up configuration	
ESC x setting of parameters	
control-space does not send null (but control-2 does)	

File transfer with PC/telnet

The PC/tftp server package can be invoked while using PC/telnet. With this feature, one can use PC/telnet to log in to a remote host, and then move files between that host and the PC, using the other host's tftp command to control the transfer. Compared with initiating the transfer from the PC, this method has two advantages:

- 1) Because the user authenticates himself upon logging in to the distant host he can transfer any files to which he has access, not just publicly accessible files.
- 2) The user can invoke other commands on the distant host in conjunction with the transfer. (E.g., compile and load a program before sending it.)

Seven functions of PC/telnet support tftp service. They are invoked by typing function key F10 followed by:

T	Enable the tftp server.
t	Disable the tftp server (upon completion of any transfer currently in progress).
i	Send this PC's internet address, in decimal format, as if it had been typed on the keyboard. Control-i sends the address in octal format. This function simplifies the issuing of tftp commands on other systems.
I	Display this PC's internet address on line 25 in octal and decimal formats. (For use if the other system needs this address in some odd format.)
y	Accept a file transfer request.
n	Refuse a file transfer request.
A	Accept all file transfer requests, without asking.

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When another host requests a file transfer to or from this PC, the PC/tftp server asks the PC/telnet user for permission to accept the request. (Type F10/y or F10/n.) For a successful transfer, the user must accept the request before the remote host loses patience, times out, and aborts the transfer. Hosts commonly have a 10 to 30 second timeout.

Further information on file transfer may be found in the description of PC/tftp service, and in the description of tftp usage for the remote host. Some hosts have a tftp command that is similar to the PC/tftp command, so that writeup in this manual may offer some help if no other documentation is available.

Experimental feature:

The PC/telnet escape F10/! invokes a nested DOS command interpreter, permitting the user to invoke other DOS commands locally on the PC without shutting down the telnet connection. This feature has been added quite recently, and has not been fully checked out; user-friendliness and freedom from surprises, restrictions, and bugs is not guaranteed. The feature requires a configuration of 192K bytes of memory, and while running the nested command interpreter, network commands cannot be used. One should not stay in DOS for extended periods because while in DOS, arriving messages are ignored, and if the host at the other end of the telnet tries to send such a message it may become impatient with the lack of response from the PC, and close the connection. To return to PC/telnet, issue the DOS command EXIT.

Customization:

The following parameters of telnet can be customized with the PC/custom command:

- 1) The parameters for TCP window size and TCP low window are of particular interest to PC/telnet users. See the description of PC/custom for explanation of these parameters.
- 2) Start in line-at-a-time mode or character-at-a-time mode.

DOS note:

The DOS feature of redirecting output to a file cannot be used for PC/telnet display output.

Debugging note:

There are several debugging features built in to PC/telnet that can be useful in tracing network problems. See the section "debugging options" for more information.

8 April 1985. This document is in file telnet.txt

PC/term

A terminal emulator for the IBM Personal Computer. This program is not strictly a part of the PC/IP network software, since it makes no use of the IP protocol family. It turns the PC into a terminal so that it may be used to log in to hosts that provide dial-up login facilities. It is included as part of the PC/IP package because it uses a terminal emulation package that is identical to the one used in PC/telnet.

Operating instructions:

- 1) To run the emulator type the DOS command "TERM". It will immediately activate "data-terminal-ready", which notifies the attached modem or host computer system of its presence. It then clears the screen and begins emulation, without any greeting messages.
- 2) To exit the emulator without deactivating "data-terminal-ready", type F10, followed by "q". This method of exit leaves the modem or attached computer system with the impression that the terminal is still attached. (exit off-hook)
- 3) To exit the emulator and deactivate "data-terminal-ready", type F10, followed by "c". This method of exit tells the modem or attached computer system that the terminal has been disconnected. (exit on-hook)
- 4) To exit the emulator with "data-terminal-ready" restored to the value it had when the emulator command was first typed, type break (control-scrolllock).
- 5) To send a break type F9.
- 6) To set configuration options type F10, follow instructions.

Standard terminal configuration options:

full/half duplex line discard/wrap baud rate

Extra emulator configuration options:

reverse BS/DEL normal/inverse video select port

Type F10 again to exit from the option-setting menu.

- 7) Type F10 twice before using the PC Print-Screen feature, to restore the screen buffer to the format expected by PrtSc.

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Configuration customization.

The "power-up configuration" may be customized by using the DOS DEBUG command as follows:

- 1) While in DOS, type the command "DEBUG TERM.COM"
- 2) To the debugger, type command "g" to enter the emulator.
- 3) Hit key F10 and set the desired power-up configuration.
- 4) Choose menu item "q" to return to the debugger.
- 5) Type command "w" to save the new configuration on the disk.
- 6) Type command "q" to return to DOS.

For a list of keyboard conventions and terminal emulation limitations, see the writeup of PC/telnet, which uses the same terminal emulator.

9 June 1983. This document is in file term.txt

PC/tftp, Version 7.0

A file transfer package for the IBM PC, using the UDP/IP protocol.

Usage:

```
tftp [ get ] local-file-name hostname foreign-file-name [octet]
      [ put ]
```

where

- 1) The first argument should be "get" to move a file from another machine to the PC, or "put" to move a file from the PC to another machine.
- 2) "local-file-name" is the name of the file in the file system of the PC.
- 3) "hostname" is either a standard character-string name of the other computer, or the internet address of that computer. See the section on hostnames for more details on this argument.
- 4) "foreign-file-name" is the name of the file in the file system of the other computer. Note that the foreign computer may require that this file name be "fully qualified," that is it may need to include a directory name in idiosyncratic syntax in order that the foreign system can identify the wanted file. If the foreign file name syntax requires use of characters reserved by PC/DOS, then the name must be surrounded by double-quote marks. (The PC/DOS reserved characters are greater-than, less-than, and reverse slash.)
- 5) The optional argument "octet" instructs tftp to move the file literally, byte-by-byte, from one computer to the other. If this argument is omitted, the file is assumed to be a text file, and tftp automatically performs any necessary character set conversions to and from the network standard character set representation, known as "netascii". For compatibility, PC/tftp also accepts the argument "image" with the same meaning as "octet".

Notes:

Not all hosts implement TFTP service. It is currently available on most Multics, PDP-11 UNIX, VAX-UNIX, Alto, IBM PC, and TOPS-20 machines attached to the network.

TFTP does not demand a password from the user, so most foreign hosts are not willing to let just any file be transferred. As a general rule, one can move a file from a foreign host if that file is publicly accessible on that host. If it is protected from public access, it is usually protected also from TFTP "get"

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operations. Similarly, a file may be moved to directory in a foreign host only if that host would normally permit anyone to put files in that directory. An important restriction that most hosts enforce is that one may not "put" a file on top of an already-existing file of the same name. This restriction is especially important to understand if for some reason a "put" operation fails or is aborted. Despite the failure, the foreign host may have created an empty or partial file, with the name specified. Another attempt to "put" the file with the same name will then fail because of the access-control restriction.

All PCIP packages follow the DOS convention of returning an ERRORLEVEL value when they exit. In the case of PC/tftp, the value zero means that the file was successfully transferred, while the value one means that some error prevented completion of the transfer. The ERRORLEVEL feature is primarily of use if PC/tftp is invoked as a command from a DOS batch file.

The version of TFTP distributed with Berkeley 4.2 UNIX contains two defects that are often noticed only by PCIP users. First, it ignores the using computer's specification of netascii or octet mode, and performs all transfers in octet mode. Thus when a text file is transferred to or from a PC the resulting file is not translated, and end-of-line characters are not properly represented. Second, if a single packet sent to the PC gets lost during the transfer, the UNIX TFTP never retries and it ignores retries from the PC. Thus the loss of a single packet guarantees failure of that file transfer.

See also the writeups of PC/tftp service and dialup line file transfer.

29 October 1984. This document is in file tftp.txt

PC/tftp server, version 7.0

An implementation of a file transfer server for the IBM PC.

Usage:

tftp serve

The PC/tftp server package allows users at other network hosts to initiate file transfers to and from this PC.

Notes:

1. Server tftp can also be invoked from within the telnet command, while logged in to another host. See the writeup of PC/telnet for usage instructions.
2. While server tftp is running, no other use can be made of the PC. To turn server tftp off, type "q". If a file transfer is already in progress, server tftp will shut down immediately, leaving the host at the other end of the transfer wondering where it went.
3. There is no access control whatever. The tftp server allows a remote host to initiate a "get" or "put" operation for any file on any accessible disk. (The version of the tftp server that is invoked from PC/telnet asks the user for confirmation of each file transfer request that it receives.)
4. The PC/DOS operating system is not designed for unattended use, so leaving a PC alone with the tftp server running does not work very well. For example, if the distant host tries to initiate a put to a write-protected diskette or unreadied disk drive, PC/DOS will stop in its tracks and ask the operator of this PC what to do. Until someone answers this query, the tftp server appears to be dead.
5. In initiating file transfers from other hosts, the user at the other host must know the IP address of the PC that is running server tftp. This IP address may not be associated with any name table name. [In Berkeley UNIX 4.2, one can learn the IP address of the host originating a telnet connection by using the command "who am I". This feature simplifies transferring files back to the PC from which one originated a telnet connection.]
6. PC/DOS will prefix any file name supplied by the foreign host with the default drive and the default working directory for that drive. To override these defaults, the foreign tftp initiator can supply a full drive descriptor and path name. However, because of the special characters (colons and back-slashes)

(more on next page)

appearing in fully qualified PC/DOS file names, one may have to use some quoting convention on the foreign host to type the file name at command level. [For example, on another PC, path names should be enclosed in double quotes. On UNIX, back-slash characters should be doubled or replaced with forward-slash characters, which PC/tftp will accept instead.]

8. The tftp server permits only one file transfer at one time. If any host requests a transfer while one is already in operation, the tftp server will refuse the second request.

See also the writeups of PC/tftp and PC/telnet.

8 April 1985. This document is in file tftps.txt

PC/whois, version 5.0

A program to obtain directory information about a registered user of another network host, using the IP/TCP "finger" protocol.

Usage:

```
whois name@host
```

Where "name" is the character string name of a registered user at the target host, and "host" is either a character-string name of the target host or an internet address in standard form. (See the section on hostnames in the introduction for more details.) If "name" is omitted, some hosts will respond with a list of currently logged-in users.

The whois command sends an inquiry, and displays the answer, if any. The form and contents of the answer are determined entirely by the target host. Note that some hosts do not respond to whois requests. They may either ignore the request (in which case PC/whois displays the message "...host not responding") or reject it (in which case PC/whois displays the message "Closed: foreign reset".)

If the target host is not forthcoming with a response, PC/whois will give up after about 20 seconds. Typing the letter "q" will cause PC/whois to abort the operation immediately. This feature is useful if one discovers that the quantity of output is more extensive than anticipated.

4 December 1984. This document is in file whois.txt

Status

This is a list of serious known bugs and features that, although described in this manual, are not actually implemented yet.

PC/term: control-scrolllock exits on-hook, rather than with DTR restored to its original value.

PC/term: at data rates of 4800 bits/second and below, when two-character sequences are transmitted in response to a single keyboard key, (such as for function keys and cursor controls) one of the characters is sometimes lost.

Internet Protocol: Because the PC implementation does not currently reassemble fragmented packets, none of the PC/IP packages can be used with hosts that gratuitously fragment large packets or through gateways that fragment packets. Currently MIT-Multics is the only known ARPANET host that gratuitously fragments large packets, making tftp service unusable for files larger than 128 bytes. (PC/telnet is usable with MIT-Multics, because Multics TCP never tries to send large packets.) Within the M.I.T. environment, large packets are fragmented only when they traverse the CHAOS network.

PC/TCP: Does not reacknowledge re-received packets. If an acknowledgement is lost, this bug can cause a telnet connection to time out unless more characters are typed, or some other event causes the other host to resynchronize.

PC/Telnet: if, while using the tftp server, a disk problem occurs that leads DOS to display a message (e.g., "Disk not ready: abort, retry or ignore?") DOS attempts to display the message without realizing that PC/telnet is operating the screen with offset pointers. Thus the DOS message may appear in a random place on the screen, cut apart in two pieces, or even not appear at all. If the user types a response to the question, the response will be accepted by DOS and (assuming that the DOS file operation is successful) the display returns to normal.

PC/AT: All PC/IP programs have been checked on the PC model AT using both the Ethernet and serial line drivers. Although all appear to work correctly, some problems that may be symptoms of lost interrupts have been noted. The most serious symptom is that while transferring files to or from diskettes, the diskette drive occasionally appears to fall out of the ready status. (A retry always finds that the disk is actually ready.) Note that when this problem occurs, the error message that DOS produces triggers an instance of the previous problem.

PC/tftp: Exhibits occasional flakiness. If one starts a series of transfers to or from the server, on some PC's tftp will crash after 50 or 100 files have transferred. On other PC's, there is apparently no problem.

8 April 1985. This document is in file status.txt

PC/IP bugs, tasks, problems, projects, and bright ideas

8 April 1985

*** means critical, needed immediately

** means important to have soon

* means would improve quality of operation significantly

(no stars) means would be nice to do when time permits

Asynchronous line driver:

- 1) Doesn't check size of incoming packets, can fail.
- 2) Exits if PC gateway doesn't respond. (Should return error.)*
- 3) Port number and interrupt line should be a customizable configuration option.
- 4) Loses transmitted characters on escape sequences at low data rates.*
- 5) Does not restore 8259 mask status on exit, misrestores interrupt vector.

Ethernet driver:

- 1) Debugging messages should be controlled by NETTRACE.

IP protocol handler:

- 1) Doesn't reassemble fragmented packets.*
- 2) Doesn't reply to time stamp or information requests.
- 3) Doesn't upcall on destination unreachable.*

UDP protocol handler: (no known problems)

TCP protocol handler:

- 1) Should upcall with character blocks, not one character.*
- 2) Should reacknowledge re-received packets.
- 3) Should not send destination unreachable for unhandled broadcast packets.

PC/telnet version 7.1

- 1) F10/close doesn't work while connection is being opened. (Should ensure that half-opened connection isn't completed, then exit.)*
- 2) Output buffer full condition damages multi-character sequences.
- 3) Should catch DOS exit call on file errors and fix screen before DOS tries to display its error message.
- 4) Leaves garbage on screen at exit if all received data hasn't been displayed yet.

(more)

PC/ping version 5.0:

- 1) In test mode, line 25 should contain
 - time since test started*
 - name and internet address of ping target
 - identification of the program in use
 - number of packets sent and number lost
- 2) Loses packet buffers; often dies in test mode.

PC/tftp version 7.0:

- 1) Shouldn't touch PC file until other site confirms willingness to try transfer.*
- 2) Need way to shut off a transfer that isn't wanted.
- 3) Sometimes fails in extended use.

PC/tftp server:

- 1) Should allow multiple connections.
- 2) Needs graceful shutdown after current transfer is complete.
- 3) Crashes when aborting after a disk write protect error.
- 4) When responding to a get, runs at half the speed of a put.
- 5) Should use large buffers to read and write files to DOS for better performance.

PC/hostname version 5.0: (no known problems)

PC/setclock version 5.0: (no known problems)

PC/custom version 2.0:

- 1) Need separate control of protocol level tracing parameters.
- 2) Need ability to set DMA channel parameter.

PC/term command:

- 1) Doesn't work on port 2.*
- 2) Should display modem status register contents in F10 mode.
- 3) full/half duplex, line discard/wrap options should be per port.
- 4) F10/b should send break and return to emulation, to match tn.
- 5) Two-character output sequences are lost at speeds of 4800 baud and below.
- 6) Control-scroll lock should exit with DTR restored to entry value.

(more)

PC/onhook and PC/offhook commands: (no known problems)

PC/whois command version 5.0: (no known problems)

PC/nickname version 2.0: (no known problems)

PC/iprint version 1.0

- 1) Needs control of imagen font, etc.

PC/netwatch version 5.0

- 1) Should confirm source address, destination, type, length match in line 25.
- 2) Need ability to monitor all packets going to/from a designated address.

Other general projects:

- 1) Need a canned response for "whois" requests.
- 2) Need a polling "whois" to find out who is on PC's.

Future directions, need discussion before proceeding:

- 1) XT Spinwriter server.
- 2) XT Name server.
- 3) XT time server
- 4) XT Boot server.
- 5) XT mail forwarding server.
- 6) Mail sending package.
- 7) Mail reading package. (Coordinated with mail-holding service.)
- 8) Implement block stream protocol; implement remote command invocation package.

This document is in file tasks.txt