DOMAIN/IX BSD4.2 TCP/IP Release Document

Software version 3.0

Part No. 010231

Revision 00

This document describes DOMAIN/IX BSD4.2
TCP/IP Software Version 3.0.

The release notes for standard DOMAIN
Software and other optional products are
documented in other sets of release notes and
are located in the system /doc directory.

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<u>Reader Notice</u>

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    prf <£ile-pathname> -pr <printer_name> -npag

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CHAPTER 1

OVERVIEW OF DOMAIN/IX BSD4.2 TCP/IP SOFTWARE VERSION 3.0

The DOMAIN/IX BSD4.2 Transmission Control Protocol/Internet Protocol (TCP/IP)
product provides file transfer and remote log-in capabilities between nodes
running DOMAIN/IX.

DOMAIN/IX BSD4.2 TCP/IP Version 3.0 contains the following:

o   A new feature, the subnet utility

o   Changes to running **tcp_server** with -debug

o   Larger UDP packet size

o   Corrected bugs

1.1 THE SUBNET UTILITY

TCP and IP are protocols defined by the Defense Advanced Research Projects Agency
(DARPA) to permit communication between networks using different protocols and
transmission media. DARPA refers to this overall network of different networks
as an Internet. One of the most well-known among DARPA Internets is the ARPANET,
a communications network that spans the country.

According to the traditional design of the DARPA protocols, any communications
network can communicate with a DARPA Internet as long as they supply a unique
Internet address for each host within the network. (The DARPA Internet manages
these addresses in network-wide routing tables.) This way, any host within a
network could access the DARPA network.

Since then, many individual network administrators have created their own internets to address several communication needs. They use internets to:

o   Separate sprawling communications networks into several manageable networks

o   Connect geographically-separate Local Area Networks (LANs) with a high-speed point-to-point link

o   Combine different types of LANs such as ETHERNET LANs and DOMAIN rings

o   Ease network congestion by putting heavily-trafficked hosts on separate cables

The traditional DARPA Internet model does not support the concept of individual network users creating their own internets. That is, even though a communications network may belong to a larger internet, each network within an internet needs a unique network number to remain on a DARPA Internet. So, to communicate between two internets on a DARPA Internet, the hosts must know the network topology of the other.

Consider, for example, two hosts on the ARPANET -- one at the University of Southern California (USC) and the other at Massachusetts Institute of Technology (MIT). To send a message from the USC host to the MIT host, the USC host must specify the appropr~ate network within the internet at MIT.

Also, any changes to a network within an internet affect DARPA Internet routing tables. So, any time network administrators change networks within their internets, they must update the DARPA routing tables.

The subnet utility provides more flexibility in the network structure by allowing network administrators to subdivide their network without affecting the DARPA Internet. This way, administrators can keep their network activities separate from the entire DARPA Internet.

Referring to our example, the USC host can now send a message to host at MIT by specifying a network and host number. The network number represents the entire MIT internet. When the message reaches the MIT gateway, the gateway checks whether subnets are implemented, and if so, relays the message to th~ appropriate network within the MIT internet.

To implement a subnet utility, you don't have to use a different DARPA Internet addressing mechanism. You simply specify a new <u>interpretation</u> of the current Internet address by supplying a <u>subnet mask.</u>

Currently, you supply a 32-bit Internet address that identifies each host (workstation) on your network. The subnet utility allows you to specify a subnet address for each LAN within your network.

For each host on your network, you specify a unique 32-bit Internet address. DARPA defines three types of Internet address: A, B, or C. You can distinguish which type of address is in use by the size of each field. That is,

   o   Type A addresses have a 7-bit network number, a 24-bit host number and the value of the most significant (leftmost) bit is 0.

   o   Type B addresses have a 14-bit network number, a 16-bit host number and the value of the two most significant (leftmost) bits are 10.

   o   Type C addresses have a 21-bit network number, an 8-bit host number and the value of the three most significant (leftmost) bits are 110.

Figure 1 shows how a 32-bit Internet address is divided into network and host numbers. The M refers to the most significant bit field.

```
              01         8          16         24         32
              +-+------+---------------------------+
      Type A  |M|  net |          host             |
              +-+------+---------------------------+
                2
              +--+--------------+-----------------+
      Type B  |M |     net      |      host        |
              +--+--------------+-----------------+
                 3
              +---+----------------------+--------+
      Type C  | M |       net            | host   |
              +---+----------------------+--------+
```
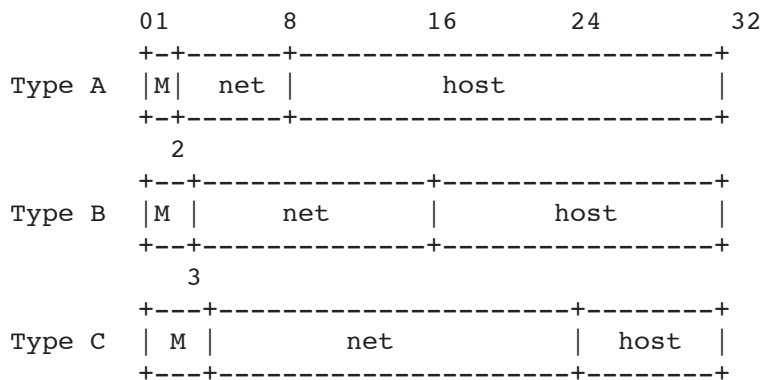
          Figure 1. Type A, B, and C Internet Addresses

When using the subnet utility, you can further subdivide the Internet address into network, <u>subnet</u> and host field. Note that the size of the network address remains the same, the host field is divided into subnet and host fields.

Figure 2 shows some possible ways you can subdivide an Internet address into
network, subnet and host numbers.

```
               0        8        16       24       32
               +--------+--------+-----------------+
   Type A      |  net   | subnet |      host       |
               +--------+--------+-----------------+
                           OR
               +--------+-----------------+--------+
               |  net   |     subnet      |  host  |
               +--------+-----------------+--------+


               +-----------------+--------+--------+
   Type B      |       net       | subnet |  host  |
               +-----------------+--------+--------+
                           OR
               +-----------------+------------+----+
               |       net       |   subnet   |host|
               +-----------------+------------+----+


               +------------------------+---+----+
   Type C      |          net           |sub|host|
               +------------------------+---+----+
```
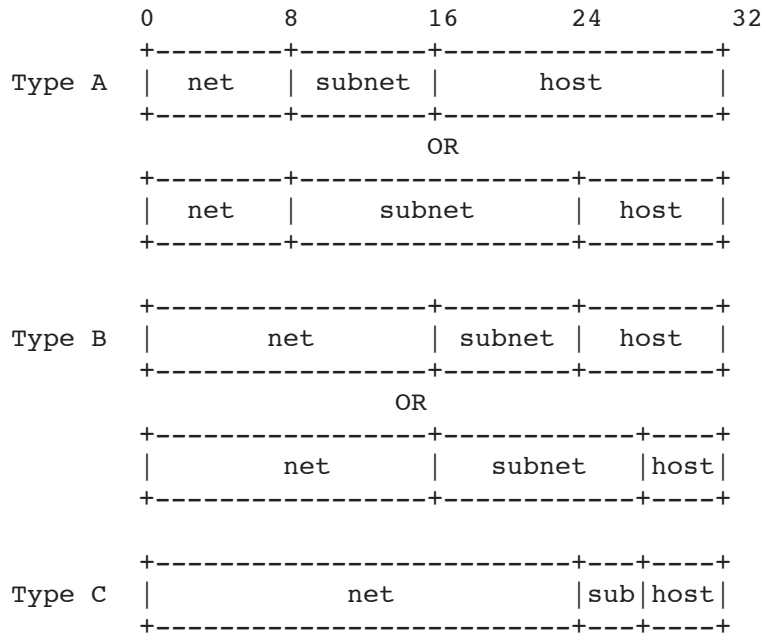
Figure 2. Internet Addresses with Subnet Fields

When determining your Internet addresses, you don't need to remember the size of
each field. Instead, you can simply be sure to specify a number within the given
range. The range of an the Internet address is represented in decimal number
values. That is, the 4-byte Internet address is represented by four decimal
numbers within the range of 0 and 255.

For example, Type C addresses have a one-byte host address, so you can choose
any number between 1 and 254. (DARPA Internet reserves 0 and 255.) The network
address is 3 bytes long and you can choose any number between 192.0.1 through
223.255.254. This number starts after 192 because the first three bits (0
through 192 in decimal) are reserved to signify the Type C address.

Table 1 summarizes the range of values you can specify for Type A, Band C addresses.

**TABLE 1. Range of Network and Host Values
for Type A, B, and C Addresses**

| Type | Size in Bytes | | Range of Values | |
	Network	Host	Network	Host
A	1	3	1 – 126	0.0.1 – 255.255.254
B	2	2	128.1 – 191.254	0.1 – 255.254
C	3	1	192.0.1 – 223.255.254	1 – 254

To create a subnet, you subdivide the host portion of your Internet address. Table 2 lists the range of subnet and host values for each type. Note that since Type C host numbers are only 8 bits long, you're limited to 15 subnets and 14 hosts. For this reason, most users implement subnets with Type A or B addresses.

**TABLE 2. Range of Subnet and Host Values
for Type A, B, and C Addresses**

| Type | Size in Bits | | Range of Values | |
	Subnet	Host	Subnet	Host
A	16	8	0.1–255.255	1 – 254
A	8	16	1 – 255	0.1 – 255.254
B	8	8	1 – 255	1 – 254
C	4	4	1 – 15	1 – 14

As stated previously, when implementing subnets you are merely changing the interpretation of your Internet address by supplying a bit mask or subnet mask. The mask identifies which bits of the Internet address correspond to a subnet number, and which bits correspond to the host number.

To supply the mask, you edit your Internet networks file (/sys/node_data/[.node_id]/networks). You must supply

- o   A semicolon to separate the mask information from the physical interface information

- o   The word, mask

- o   Your Internet address with network and subnet fields denoted by one's (255), and host field denoted by zero's (0)

For example, the following is a network entry without a subnet mask.

NOTE: Previously, TCP/IP releases referred to the ETHERNET interface as il. This has been changed to eth. Version 3.0 will accept either eth or il, however future revisions will accept only eth.

This example indicates that you have a Type A internet address, on an ETHERNET (eth) interface. We know this is a Type A address because the first number is within the range of 1 and 126.

10.9.9.7 on eth0

The following is a network entry with a subnet mask. Given that this is a Type A address, we know that the first field is the network number. The next field is the subnet number because it is all one's, and the host number corresponds to the last two bytes, as indicated by zeros.

10.9.9.7 on eth0; mask 255.255.0.0

The following is a two-byte subnet mask for a Type A address:

10.9.9.7 on eth0; mask 255.255.255.0

The following is a one-byte subnet mask for a Type B address where the first two bytes indicate the network number, the third byte is the subnet number, and the fourth byte is the host number.

129.9.9.9 on eth0; mask 255.255.255.0

The following is a Type C address with a 4-bit subnet and 4-bit host field.

195.9.9.7 on eth0; mask 255.255.255.240

For more information on specifying Internet addreses and adjusting the networks file, see the Configuring and Managing TCP/IP manual (008543).

1.2 Changes to Running **tcp_server** with the Debug Option

You can run the **tcp_server** in a window with the debug option to troubleshoot
TCP/IP. Prior to this revision, the debug mode displayed all its activity in
the window. With Version 3.0, you can control what types of debug information
tcp_server displays during the debug session by specifying values on the command
line. This allows you to suppress debug information about activities that you
don't need to see.

To get available debug information, run **tcp_server** in a window with the −debug
option on the command line as follows:

    $ **/sys/tcp/tcp_server −debug [hexadecimal value]**

The hexadecimal value you specify corresponds to a 16−bit mask. If the bit is
set, the corresponding information will be displayed. The bits are defined as
follows:

Bit	Debug Information
0001	General information
0002	IP level information
0004	ARP information
0008	TCP information
0010	Data in TCP packets
0020	UDP information
0200	Broadcasts
1000	TCP Finite State Machine information
2000	Device level information
4000	Additional detail at any level

If you specify the -debug option without any hexadecimal values, you'll get general information. To get additional information, you can specify bit values corresponding to other debug information.

For example, to specify TCP and IP information, you add the bits 0002 and 0008 to specify the following command line:

> $ **/sys/tcp/tcp_server -debug 000a**

To specify TCP, IP, and device level information, you add the bits 0002, 0008, and 2000. So you specify the following command line:

> $ **/sys/tcp/tcp_server -debug 200a**

Controlling which information gets displayed is often quite helpful during troubleshooting. For example, you might want to get all the available information except for one certain type -- such as broadcast information. (You might want to suppress broadcast information when the **routed** or **rip_server** server is running on your network because these servers generate many broadcasts.)

To get **tcp_server** to report all information except broadcast information, you can supply the following bit mask on the command line:

> $ **/sys/tcp/tcp_server -debug f0ff**

1.3 Larger UDP Packet Size

TCP/IP Version 2.1 supported a maximum User Datagram Protocol (UDP) packet size of 1024 bytes. Version 3.0 supports a UDP size of up to 9132 bytes.

CHAPTER 2

INSTALLING DOMAIN/IX BSD4.2 TCP/IP SOFTWARE

This chapter describes how to install DOMAIN/IX BSD4.2 TCP/IP Version 3.0 software on a DOMAIN node or server. You can add this software to a user node or a DOMAIN server processor (DSP) that is running SR9.5 of the AEGIS or DOMAIN/IX operating system. If the node you plan to update does not meet this requirement, follow the appropriate software update procedures as described in <u>Installing DOMAIN Software</u> (008860) or in the appropriate release notes.

2.1 TERMS

We use the following terms when describing the update procedure.

- o "Work node" is the node on which you enter the commands that do the software installation. The work node must be running SR9.5 software and using SR9 naming rules.

- o "Target node" or target volume is the disked node whose software you are installing or updating. The target node must be running SR9.5 software and using SR9 naming rules. The target node and the work node may be the same node.

- o "Source node" (also "source volume" or "administrative node") is a disked node that has already been updated with the new software. This node is the source for software installed across the net.

2.2 TYPES OF INSTALLATION

There are two types of installation procedures, the administrative install and the user install. The administrative install procedure installs a complete DOMAIN/IX BSD4.2 TCP/IP file system on a node (or nodes) in the network. This ensures that those files and directories that need specific access rights are set up correctly, and that spool directories and other "public" areas of the file system will only exist in one place. Subsequent user installs allow individuals to copy a subset of the file system to their own nodes. Before any user can run a user install, the administrative install must be complete.

Use the administrative install procedure to install the software on the node you choose as the administrative DOMAIN/IX BSD4.2 TCP/IP site. Normally, all other nodes are user sites. Subsequent user installs use the administrative node as the source node.

2.3 INSTALLING BSD-TCP SOFTWARE ON THE ADMINISTRATIVE NODE

Install BSD-TCP to run TCP/IP within a DOMAIN network only. BSD-TCP does not provide gateway support to communicate to other networks; you must use DOMAIN TCP/IP instead.

If you have purchased DOMAIN TCP/IP, don't install BSD-TCP. DOMAIN TCP/IP is a superset of BSD-TCP and contains all the software you need. Refer to the DOMAIN TCP/IP Release Notes for details on installing the latest version. Refer to the manual Configuring and Managing TCP/IP for more details about the two products.

This section explains how to install the BSD-TCP software.

BSD-TCP is supplied with DOMAIN/IX but must be installed separately. We recommend that the system administrator install TCP/IP software on the administrative node immediately after installing DOMAIN/IX. The Release Notes do~ument for e?ch TCP/IP product explains how to install the software from the distribution media. The following BSD4.2 programs and servers rely on the presence of a properly configured SR9.5 tcp_server.

```
lpr(l)       lpd(8)          rcp(l)
rlogin(l)    rlogind(8c)     ruptime(l)
rsh(l)       rshd(8c)        inetc(8c)
ftp(l)       ftpd(8c)        rexecd(8c)
tftp(l)      tftpd(8c)       routed (8c)
telnet(l)    telnetd(8c)
rwho(l)      rwhod(8c)
```

You must run the TCP/IP installation from an AEGIS Shell. Use the following procedure to install the software from the distribution media.

1. In an AEGIS Shell, use the **wd** (WORKING_DIRECTORY) command to set your work node's working directory to the entry directory of the administrative node. After the installation is complete, the administrative node will be the source for user installations of TCP/IP software.

    $ **wd** //target_node <RETURN>

2. Insert the media into the drive and enter the appropriate **rbak** command, as shown below. Note that the **-dev m0** option is mzero.

    For cartridge tape:
      $ **rbak -dev ct -f 1 install -as install -l -ms -force -sacl** <RETURN>

    For magnetic tape:
      $ **rbak -dev m0 -f 1 install -as install -l -ms -force -sacl** <RETURN>

    For floppy disks:
      $ **rbak -dev f -f 1 install -as install -l -ms -force -sacl** <RETURN>

3. When the installation script has been copied to your disk, use the **wd** command to set your work node's working directory to the /install directory on the target node.

        $ **wd //**<u>target node</u>**/install** <RETURN>

4. Execute the install script and follow its prompts.

        $ **install** <RETURN>

The **install** script is interactive. The following examples are excerpted from the transcript of a typical administrative install of TCP/IP. Information you supply during the install is in bold type. Note that while these responses are typical, yours may be different.

    Software Installation Types are:

            STD   -- Install SR9.5 standard software
            RESTART   -- Restart the software installation
            OPT   -- Install optional software
            ACL   -- Set ACLs for existing software
            CLEANUP   -- Run the Cleanup Procedure for ADD MODE installations
            DOMAIN_IX -- Install the DOMAIN/IX software

    Please Enter Installation Type: **opt**

    Please wait...

```
     Name        Description                          Disk Blocks Needed
                                                      (Adding New Software)


     TCP_BSD4.2   TCP/IP FOR BSD4.2 DOMAIN/IX RINGS              150


     Enter the name of a single optional software product you
     would like to install.

     Please enter an optional software product name: tcp_bsd4.2

     Please enter the name of the TARGET volume that the SR9.5 software will
     be installed on. (e.g., '//UPDATE_ME'):
     Enter Target Volume: //administrative_node

     Source MEDIA is one of:
          CTAPE   --  Software Release Cartridge Tape
          MTAPE   --  Software Release Magnetic Tape
          FLOPPY  --  Software Release Floppies
          NET     --  A volume on the network with SR9.5 Optional Software
          QUIT    --  Exit from the installation.
     Enter Source Media:
                    .
                    .
                    .
                    .
                    .


     Restore complete.


      Options:

          RERUN     --  There were errors in the transcript
                        pad and you wish to rerun the installation.

          FINISH    --  The installation ran to completion error free.
                        There is no additional optional software you
                        wish to install.

          CONTINUE --   Install additional optional software.

     Enter Option:

        **Please shutdown, reset and restart the target node**


The Configuring and Managing TCP/IP manual (008543) explains how to configure
and manage the TCP/IP software. Read this document, then install TCP/IP software
on user nodes as needed, as described in a later section of these Release
Notes.
```

2.4 INSTALLING BSD-TCP SOFTWARE ON USER NODES

BSD-TCP software is supplied with DOMAIN/IX but must be installed separately.
The following bsd4.2 programs and servers rely on the presence of a properly
configured SR9.5 TCP server:

```
lpr(l)      lpd(8)          rcp(l)
rlogin(l)   rlogind(8c)     ruptime(l)
rsh(l)      rshd(8c)        inetc(8c)
ftp(l)      ftpd(8c)        rexecd(8c)
tftp(l)     tftpd(8c)       routed (8c)
telnet(l)   telnetd(8c)
rwho(l)     rwhod(8c)
```

You can only install DOMAIN/IX BSD4.2 TCP/IP software as a user if your system
administrator has installed this software on the administrative node.

To install DOMAIN/IX BSD4.2 TCP/IP software on a user node, follow these
steps.

    1)   Log in to a work node and start an AEGIS Shell on the work node. (This
        can be the target node.)

    2)   Set your working directory to //administrative_node/install

          $ **wd //**<u>administrative_node</u>**/install** <RETURN>

    3)   Execute the install shell script and follow the prompts;

          $ **install** <RETURN>

The **install** script is interactive. The following examples are excerpted fromthe
transcript of a typical user install. Information you supply during the install
is in bold type. Note that while these responses are typical, yours may be
different.
       Software Installation Types are:

```
        STD        -- Install SR9.5 standard software
        RESTART    -- Restart the software installation
        OPT        -- Install optional software
        ACL        -- Set ACLs for existing software
        CLEANUP    -- Run the Cleanup Procedure for ADD MODE installations
        DOMAIN_IX  -- Install the DOMAIN/IX software
```

       Please Enter Installation Type: **opt**

       Please wait...

```
Name        Description                          Disk Blocks Needed
                                                 (Adding New Software)


TCP_BSD4.2  TCP/IP FOR BSD4.2 DOMAIN/IX RINGS              150
```

Enter the name of a single optional software product you
would like to install.

Please enter an optional software product name: **tcp_bsd4.2**

Please enter the name of the TARGET volume that the SR9.5 software will
be installed on. (e.g., '//UPDATE_ME'):
Enter Target Volume: **//user_node**

INSTALLING sys
                .
                .
                .
                .

 Options:

        RERUN   --   There were errors in the transcript
                       pad and you wish to rerun the installation.

        FINISH   --   The installation ran to completion error free.
                       There is no additional optional software you
                       wish to install.

        CONTINUE --   Install additional optional software.

    Enter Option:

       Please shutdown, reset and restart the target node

Chapter 6 cf the System Administration for DOMAIN/IX BSD4.2 manual (009355)
explains how to configure and manage the TCP/IP software once it has been
installed. Read this document or consult your system administrator for help in
configuring TCP/IP software.

CHAPTER 3

CHANGES IN DOCUMENTATION

The DOMAIN/IX BSD4.2 TCP/IP document set consists of the following manuals:

    o   <u>Configuring and Managing TCP/IP</u> (008543)

    o   <u>Using telnet and ftp</u> (008667)

    o   <u>System Administration for DOMAIN/IX BSD4.2</u> (009355)

The new features in TCP/IP Version 3.0 have been added to the revised manual, <u>Configuring and Managing TCP/IP</u> (008543). This manual was previously titled <u>Managing TCP/IP-Based Communications Products</u>, (008543).

<u>Configuring and Managing TCP/IP</u> describes how to configure, manage, and troubleshoot DOMAIN and DOMAIN/IX BSD4.2 TCP/IP.

<u>Using telnet and ftp</u> describes how to use two common TCP/IP utilities: the TELNET remote terminal emulator and the FTP file transfer program. This book describes both the DOMAIN and DOMAIN/IX versions of these utilities.

In addition, the manual, <u>System Administration for DOMAIN/IX BSD4.2</u> (009355), contains a subset of information contained in the <u>Configuring and Managing TCP/IP</u> that is relevant to BSD4.2 TCP/IP.

CHAPTER 4

BUGS AND BUG FIXES

4.1 BUGS IN RELEASE 3.0

This section documents known bugs in the TCP/IP documentation, software installation procedures, and software.

4.1.1 BUGS IN DOCUMENTATION

This release comes with a new revision of the manual, <u>Configuring and Managing TCP/IP</u> (008543). Currently, there are no known bugs reported for the documentation.

4.1.2 BUGS IN DOMAIN/IX BSD4.2 TCP/IP SOFTWARE

The following bug currently exists in the DOMAIN/IX BSD4.2 TCP/IP software:

   o   The **telnet ^S** sequence and **^Q** sequence do not work well because DOMAIN/
        IX BSD4.2 TCP/IP allows the remote system to transmit up to 8K bytes
        of data at a time for performance reasons.

4.2 RESTRICTIONS IN DOMAIN/IX BSD4.2 TCP/IP SOFTWARE

TCP/IP transmits broadcasts using a host address 0. It does, however, recognize broadcasts from other hosts using broadcast addresses of 0 or –1.

4.3 BUG FIXES SINCE RELEASE 2.1

The following DOMAIN/IX BSD4.2 TCP/IP bugs have been corrected since TCP/IP
Version 2.1:

   o   Version 3.0 supports Trailer Encapsulations as defined by Request for
        Comment (RFC) 893, so, you can communicate with TCP/IP implementations
        that support trailers. This version corrects a problem with trailers
        that occurred in Version 2.1.

   o   Prior to this release, if you passed a bad data buffer address to a
        get or put operation, the TCP server would hang and become unuseable.
        Version 3.0 corrects this problem.

   o   Version 3.0 can now handle TCP/IP windows larger than 32K bytes.

   o   Conditional put operations of 4K bytes or more wouldn't work at times.
        Version 3.0 corrects this.

   o   DOMAIN/IX BSD4.2 TCP/IP users can now specify a backlog of 0 in a call
        to **listen().** This is equivalent to setting a backlog of 1.