

The Cornell PC/IP Programs (V1.1)

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Cornell Computer Services—Network Planning & Development

Overview

This document discusses configuration and use of terminal emulators TN, TN3270, and C19, and the related network application Ping. Comments directed to network administrators are placed in square brackets. This document focuses primarily on the basics of configuring and using the TN and TN3270 terminal emulation programs based on the Telnet protocol, which allow a microcomputer user to connect to "host" mainframe computers as a display terminal. The connection to the host is made over a local network through a "gateway," and then across a "backbone" network, and then perhaps across other gateways and over other networks to eventually reach the host. The "gateway" is a computer on the local network which has hardware and software interfaces for both the local network and the "backbone" network. The backbone network is a high speed network used to interconnect networks spread around campus, so that by connecting to the backbone you can access many hosts on many different networks.

[The Telnet programs and Ping can be used with Macintoshes which are connected to a gateway with twisted-pair cable. This hardware connection can be made with Apple's AppleTalk Personal Network (APN—available as LocalTalk or PhoneNet) or a Corvus Omninet^a network. *Warning:* The Telnet programs do not support reassembly of IP fragments. For serial RS-232 connections, such as a connection to a Sytek port or a modem, Serial C19 allows users to access IBM hosts using the same user interface as TN3270. This requires that you have an IBM 7171 ASCII protocol converter with the C19 terminal definitions installed attached to the host. The Ping application is available to allow the network administrator to send ICMP ECHO packets to determine whether a given IP address is up and available.]

Currently there are four different Telnet programs:

TN3270:	use with IBM hosts:	<i>very fast screen-drawing for use on small-screen Macs;</i>
TN:	use with ASCII hosts:	<i>very fast screen-drawing for use on small-screen Macs;</i>
TN3270U:	use with IBM hosts:	<i>completely Color and MultiFinder compatible;</i>
TNU:	use with ASCII hosts:	<i>marginally MultiFinder compatible (no drawing in background).</i>

Note that of these four applications, only the slower, U or "Universal" version of the TN3270 application is completely Color and MultiFinder compatible; the other versions cannot draw while they are in the background under MultiFinder and are useable *only* in monochrome mode. A MultiFinder compatible TN will be developed soon, and in addition the functionality of all four programs will be combined in an upcoming version.

The User Interface

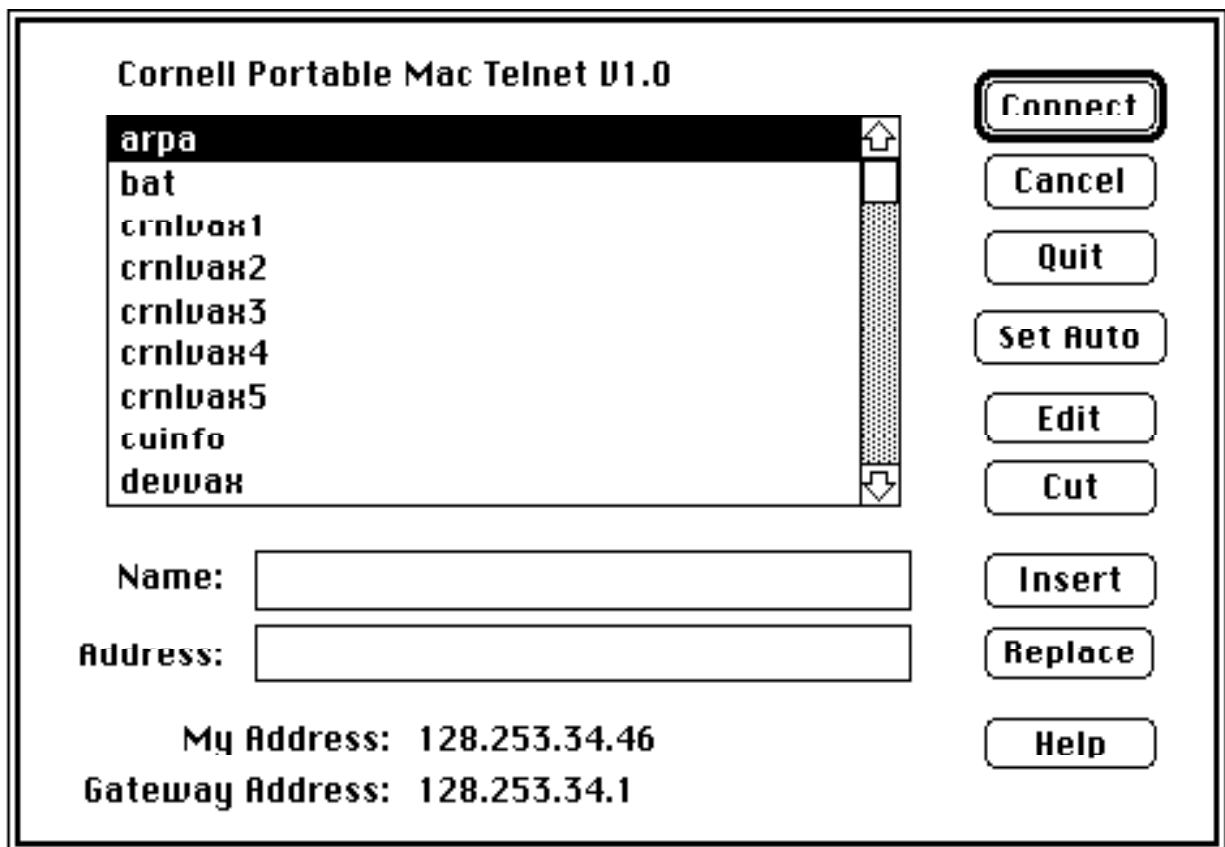
TN and TN3270 present very different terminal interfaces to the user when dealing with the two kinds of host, but aside from different display and keyboard modes, and different techniques for file transfer, the applications have much in common. When communicating with IBM mainframes you should use the TN3270 application, which emulates the IBM 3278-2 video display terminal. For communicating with hosts which use the ASCII character set, you should use the TN application, which emulates the Heath-19 video display terminal (the Heath-19 is similar to Digital's VT52 and is referred to as "h19" on UNIX).

Our philosophy in designing these programs is that most microcomputer users want to use host applications with a minimal concern for detailed reproduction of all the characteristics of the original host terminal, which they have probably never used. Thus we do not attempt to exactly reproduce the appearance of a 3270 screen, and the keyboard is set up to accord with the expectations of a Macintosh user, e.g., the Delete key deletes rather than doing a backspace (see the section on "Using the Keyboard"). We do attempt to provide flexibility, so the sophisticated terminal user can remap the keyboard if he or she so desires.

Some points of commonality among the programs include the dialogs for network interface configuration and making connections, key macros which allow the user to modify key mapping, button bars on the screen which allow the user to send some common control keys with the mouse, and cursor placement using the mouse.

Connecting to a host computer: The Open Connection Dialog

Double-click the program document or application icon to start. The first window you see will be a copyright notice. If your gateway is up and configured properly, and the application has been configured properly, you will either connect automatically to a preselected host, or you will see a dialog like this one:



THE "OPEN CONNECTION" DIALOG

If you see a different dialog, check the section on "Error Conditions." The program assumes that your first wish is to connect to a host, so the program immediately offers you a dialog to do so. At this

point, your major options are to "Connect" to a host, "Cancel" the dialog without connecting to a host, or "Quit" the program. You can also edit the host list or use "Set Auto."

You can select a host and connect to it by several different methods:

- 1) Double click on a host in the list,
- 2) Select a name in the list and then click the "Connect" button or type the Return key, or
- 3) Enter either a name from the list or an "Internet Address" for the host computer in the "Name" field, and click Connect or type Return.

When the dialog is initially presented, the first host in the list is highlighted. You can type Return soon after starting the application from the desktop to connect to this host without going through the dialog. (You can reorder the list to select a useful default—see "Editing the Host List" below.)

When a name in the list is selected, you will Connect to it; if no name is highlighted, the dialog will use the name or address in the "Name" field to make the connection. (Addresses should be entered in "dot notation," e.g. "128.12.1.2". The "Address" field is used only when adding new hosts to the table.) You should receive a logon prompt from the host within a few seconds; if this takes longer, the program will eventually give up and show you a dialog stating that the host is unreachable. You can see the packet counters at the top right of the terminal window go up as packets are sent and received. (The one on the left counts packets sent.)

After you've received the logon prompt, you can use the terminal as if it were a terminal directly connected to the host. When you log off from your host, you will be again presented with the "Open Connection" dialog; the "Quit" button is now the default button, so if you type Return the application will exit to the Desktop.

Editing the Host List

When you type, the input is entered in either the "Name" or "Address" field of the dialog. To add a host, enter the Name and Internet address of the host in the fields, and click the "Insert" button; if your address is valid and the name is unique in the list, the host will be added to the list before the currently selected host (if no host is selected, the new host is added to the end of the list). You can easily reorder the list by using "Cut," moving the selection to a different name, and then using "Insert."

To modify a host address, you can use "Edit" to copy the name and address into the Name and Address fields, and then use "Replace" after entering the new address. To remove a host, simply select it and press the "Cut" button.

Set Auto

If you click "Set Auto," the name of the selected host will be saved in the current document file; if you have no document file open, it will be saved in the application. Thenceforth, when you launch from this document/application, the program will skip the "Open Connection" dialog, and attempt to connect with the host immediately. If you want to go through the Open Connection dialog when launching from a document with a host name saved in it, hold down the Apple/Flower key while launching; if you want to stop auto-connecting permanently, you can click "Set Auto" when no name is highlighted.

After you're connected ...*Using the keyboard*

TN3270 has several menu options for configuring the keyboard and keypad. It handles the Delete key in a different way than a 3270 backspace, performing a Backspace-Space-Backspace, except when Insert mode is on, when it will perform a Backspace-Delete. (This action effectively reverses the effect of typing in either mode.) In addition, both programs provide key macros, which can be used to map any key to a sequence of characters and commands. Each combination of a key and modifier keys (Shift, Option, etc.) is treated as a unique key. The macro commands allow you to move the cursor, and generate keys such as Return and various PF keys. Note that the key equivalents listed for menu items in the Key menus may be superseded by key macros, and thus can be misleading! You can easily restore the standard key interpretation by turning the macros off.

Transferring programs and text

TN and TN3270 support different techniques for transferring files. TN is configured to run as a Trivial File Transfer Protocol (TFTP) server, so you can run TFTP on the host and connect to your workstation to transfer files. TN3270 uses a special protocol for this purpose, "FT3270." This protocol allows the serial-based C19 application and TN3270 to use the same user interface for file transfer with an IBM mainframe.

Using FT3270 for file transfer

To set up FT3270 on your IBM mainframe, we provide the following files:

FT3270	MODULE
FT3270	HELP
UPLOAD	EXEC
UPLOAD	HELPCMS
DOWNLOAD	EXEC
DOWNLOAD	HELPCMS

FT3270.MODULE must be present in order to perform file transfers. The EXECs simplify the interface to the program and perform additional error checking. In order to use FT3270.MODULE, you must first upload it in binary mode as a fixed record length file. Once uploaded, you must 1) "CP SPOOL PUN to *" to spool the punch to your userid; 2) "PUNCH FT3270 MODULE (NOHeader" and then 3) "RECEIVE spoolid" (where spoolid is the spool id of the file) in order to convert the file properly.

To initiate a file transfer, use the upload or download exec on the host. Files may be transferred in either "text" or "binary" mode. In "text" mode characters are translated between IBM's EBCDIC character encoding and ASCII character encoding using the same translate tables as KERMIT, and translation of Carriage Returns is handled as appropriate for the Macintosh. In binary mode bytes are transferred without translation.

Syntax:

```
DOWNLOAD filename filetype <vol <filename | "file name">> <(<REPlace><BINary>>
```

```
UPLOAD <filename | "file name"> <filename <filetype <vol>>> <(<REPlace> <BINary>>
```

The default volume on the host is your A drive. The default directory on the microcomputer is the directory from which the application was launched. The default microcomputer target filename for downloading is "filename.filetype"; uploading reverses this default name mapping, so "filename.type" becomes "filename filetype a". Slashes in the microcomputer filename are interpreted at the Macintosh end as colons, so they function as directory path specifiers. On the Macintosh file system, you need to place a colon before a path name to specify the current directory; additional leading colons specify parent directories. If a Macintosh file name has spaces in it, enclose the name in quotation marks.

The Info menu

A menu containing helpful information on various functions of the programs is at the right end of the menu bar. For example, there are items which have more help on key mapping and downloading ...

Error Conditions



THE "CANNOT FIND AN INTERNET GATEWAY" DIALOG

The "Cannot find an Internet Gateway" dialog appears just after launching if the application was unable to find the gateway on your local area network. Even without a gateway, you can still fruitfully use some applications to communicate between two computers on the same network (e.g., ping can be used to help determine if the network cable is broken). In this case, you can press the "OK" button and the default should work fine.

The "Closed: foreign reset" Alert

This alert informs you that you have received a TCP Reset from the host, which usually implies either that the host has crashed and restarted, or that the host has timed out your terminal session and unilaterally terminated it. TN periodically sends Telnet "Are You There" inquiries to the host to keep it awake. [TN3270 does not, so if you do not keep active in your session, you may be peremptorily disconnected. Note that if the terminal end crashes, your session on the IBM host will not be terminated automatically, so you may not log in until the operator kills your login session. At Cornell, the host IBM

FAL TCP/IP package is configured to periodically send Telnet "Timing Mark" commands to the workstation to keep the session alive; this will eventually cause TCP to time out and log the user out if the connection is lost.]



THE "NO RESPONSE FROM ... VIA NETWORK" NOTICE

The "No response from ... via Network" modeless dialog appears if the program can no longer reach the host at some point after you have made your connection. If there is a break in your local network connection or a problem with your local network gateway, the message will read as it does in the picture. Communication will usually resume with only a brief interruption; if, however, the dialog remains up for more than a minute or two, you should contact your network support center. If the message reads "No response from host FooBar via Network," the host or some other part of the network beyond the gateway has a problem. If you want to look at the terminal screen, you can hide this dialog by clicking in the terminal window. [TCP puts up this modeless alert after sending a number of retries; it sends an ICMP PING request to the gateway to determine whether it is up or not.]

Other Alert Texts

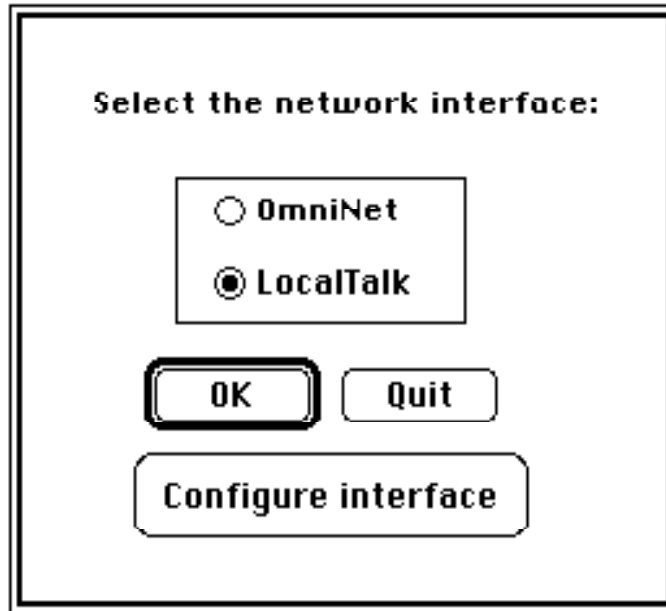
Other alerts may also appear to inform you of different problems. For example, an alert may appear stating that the network interface is not installed or turned on, or that memory is inadequate to run the application.

Configuring the Network Interface

Holding down the "Option" key while launching will allow you to perform the "Select Network Interface" dialog. Using this dialog, you can select the network interface you wish to use. If you need to set other program parameters, you can press the "Configure interface" button; this will show you the "Configure Interface" dialog, which allows you to configure the network interface you have selected.

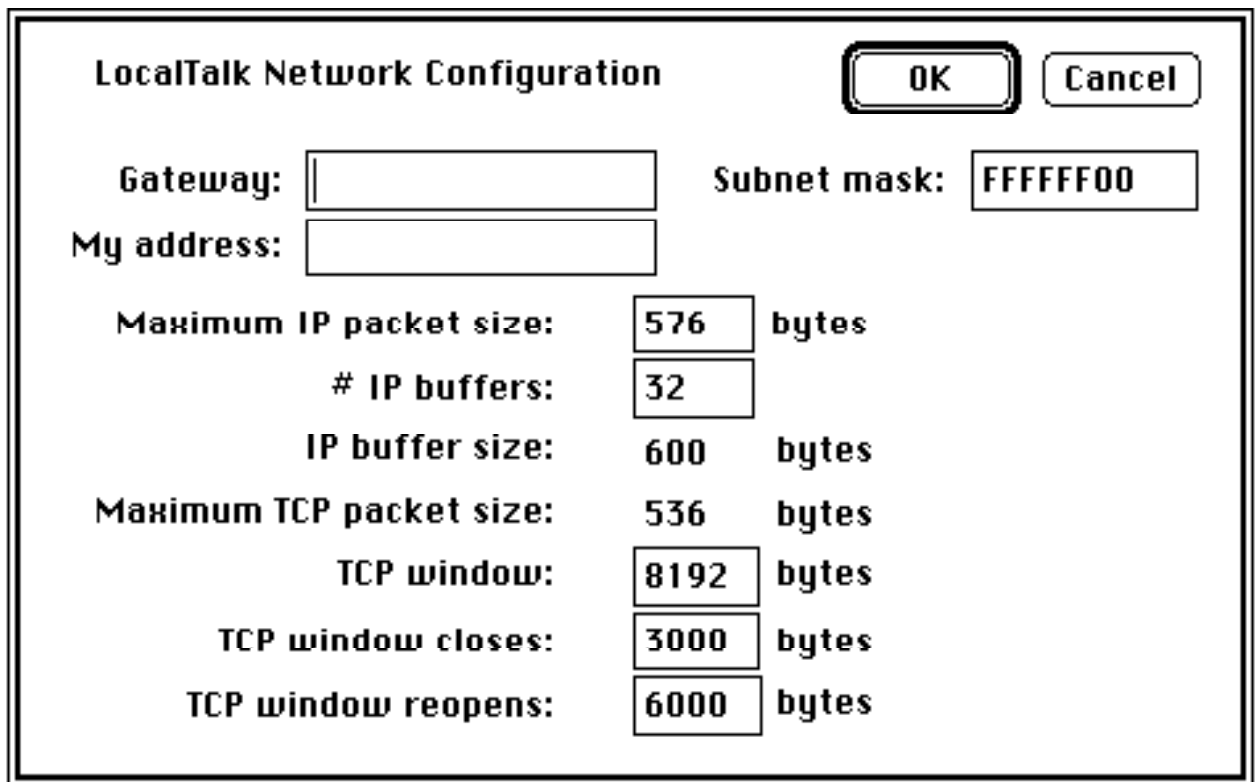
Configuring IP addresses for you and your Gateway

The settings you should choose for the "Gateway" and "My Address" fields are determined by the gateway you are using and the software it is running. These addresses should be entered in decimal "dot notation," e.g. "128.84.1.1".



A dialog box titled "Select the network interface:". It contains two radio buttons: "OmniNet" (unselected) and "LocalTalk" (selected). Below the radio buttons are three buttons: "OK", "Quit", and "Configure interface".

THE "SELECT NETWORK INTERFACE" DIALOG



A dialog box titled "LocalTalk Network Configuration". It has "OK" and "Cancel" buttons in the top right. The dialog contains several fields for network configuration:

- Gateway:** An empty text field.
- Subnet mask:** A text field containing "FFFFFF00".
- My address:** An empty text field.
- Maximum IP packet size:** A text field containing "576" followed by the label "bytes".
- # IP buffers:** A text field containing "32".
- IP buffer size:** A text field containing "600" followed by the label "bytes".
- Maximum TCP packet size:** A text field containing "536" followed by the label "bytes".
- TCP window:** A text field containing "8192" followed by the label "bytes".
- TCP window closes:** A text field containing "3000" followed by the label "bytes".
- TCP window reopens:** A text field containing "6000" followed by the label "bytes".

THE "CONFIGURE INTERFACE" DIALOG

Cornell AT-Gateway: When using the Cornell AT-Gateway, you do not need to set either field; the program will send an ARP (Address Resolution Protocol) packet for the IP address 1.1.1.1, the gateway

will respond with its hardware address, and the program will use its AppleTalk or Corvus node number as the host number portion of its IP address. If you are using an Omninet interface, you should use the Corvus Modem Port INIT (Dec. 7, 1987) if you are using a Macintosh SE or II; if you are using a Mac+, you should install the older DRVr and INIT (1/17/86, DRVr is 4562 bytes) resources in your System file using ResEdit to avoid crashes.

Kinetics FastPath Gateway running KIP (version 0188): When using the FastPath with KIP, you must first set up the /etc/atalkatab table so the gateway will be configured to allocate a range of static addresses, and then set the "My Address" field in the configuration to an address within that range. "Gateway" can be left blank. The program will broadcast an ARP for 1.1.1.1, which will fail, and will then find the gateway using the AppleTalk Name Binding Protocol. (You can avoid setting the "My Address" field if you are willing to waste some host addresses: if you have enough addresses available to allocate a 256-host subnet per gateway, you could allocate the first 128 host numbers as static addresses and the rest as dynamic.) In the future, we will support dynamic IP address assignment.

Kinetics FastPath Gateway running etalkgw.srec (version 1.0): When using the FastPath with the standard Kinetics software, you need to set the "Gateway" field to the IP address of the gateway. The program will broadcast an ARP for this address, the gateway will respond, and the Macintosh will use its AppleTalk node number as the host number in its IP address. If you wish to set the Macintosh IP address, you may do so; this will override the default AppleTalk node number assignment. (If you configure the AppleTalk as a sub-subnet, with, say, 5 bits of host address, you should set the Gateway field to the address of the *subnet* gateway, and the subnet mask to the mask for that gateway. The etalkgw software will then perform a proxy ARP to acquire the gateway address.)

Setting the Subnet Mask

The subnet mask should be set to conform to the configuration of the subnet on which the program will be run. The mask is entered in hexadecimal notation, and should completely specify the whole 32-bit field with 8 hexadecimal digits. If no entry is made, it is assumed that all host numbers within your Internet network class are on the network to which you are attached.

Other parameters

You can modify the number of buffers allocated and the maximum IP and TCP buffer size. Buffers are statically allocated, with a maximum of 50 buffers. You can also modify the TCP window parameters. When a buffer is used, the size of the window is decremented by the size of the buffer. Window size gives the initial window size to advertise; when the remaining window goes below the "window closes" figure, a zero size window will be transmitted to the host. When the application processes more data and frees a buffer, the window will be reopened if the new window size is greater than the "window reopens" figure.

Important Resources

A number of resources are placed in the resource fork of the application and/or document file. Resources placed in a document will supersede resources existing in the application. The resource name is followed by the numbers which are used. If you want to set up an application on a fileserver, you need to place CONF, CUST, DEFG, HOST, NETD, and TMZO resources in a user's document so that

configuration changes will affect only the user's document, and set the application's "Shared" bit in the GetInfo dialog under ResEdit.

CONF, 0-1: Configuration information saved by Save Configuration. CONF 1, if it exists, contains application-specific configuration information (such as serial configuration data in C19).

CUST, 0-1: Network interface configurations, usually manipulated with the "Configure Interface" dialog. CUST 0 contains Omninet configuration data; CUST 1 contains LocalTalk configuration data.

DEFG, 0-1: A string containing the name of the default gateway.

HOST, 1: A table of hosts, which is usually manipulated through the "Open Connection" dialog. Each line is terminated with a Line Feed (Hex 0A).

KEYI/KEYX, 0: Key macro resources. KEYI resources are used with IBM hosts, KEYX resources with ASCII hosts. Resource names correspond to the key mapped.

LHST, 0: A host to which the application connects automatically on startup. NETD, 0: The default network interface, with 0 for Omninet and 1 for LocalTalk.

TMZO, 0-1: Your timezone.

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Version Information

Version 1.1 contains several minor bug fixes.

The Program Tab "fix" for VM/XA compatibility (t3n11, t3n11u).

Key macros were fixed to use all keys (e.g. Option-2) (all programs).

The screen display enabled after display of Info item (c1911u only).

BUG NOTICE: PF keys 22-24 do not behave correctly. This will be fixed in the next release.

The TCP/IP protocols, in brief

When you use TN, your Macintosh, your local area network gateway, and your host all use a network communications protocol suite known as TCP/IP. This acronym stands for the two most important protocols in the suite, the "Transmission Control Protocol" (TCP) and the "Internetwork Protocol" (IP). IP is used to control transmission of packets of data across dissimilar networks; the gateway on your local networks runs IP, along with protocols for communication with other gateways. Your Macintosh uses IP to communicate with the gateway.

Programs executing the TCP protocol run at each end of your terminal connection, guaranteeing that the messages transmitted by the IP protocol have arrived at your machine undamaged. You might think of IP as a kind of postal express, which is quite good with addresses, but whose mailbags occasionally overflow. TCP is like a pair of clerks at each address, who correct the occasional lost or damaged letter by adding a kind of "certified mail" service. They use a joint scheme for coding and sequencing their messages to prevent error; they are also persistent about keeping in touch when a message is not promptly acknowledged.

Telnet is the protocol in the suite which manages terminal emulation; it uses TCP to guarantee that communications are performed correctly. Another protocol used in Cornell TN is TFTP, the "Trivial File Transfer Protocol." TFTP relies on a protocol called the "User Datagram protocol" (UDP), which in its turn relies on the services of IP. TFTP provides error-free file transfer between two hosts; a drawback with TFTP is that it does not recover from transmission errors, so that transfers of large files may prove difficult over noisy networks. TFTP is currently used only with ASCII hosts; file transfer with IBM hosts is supported using an FT3270 file transfer protocol, which can run over either TCP or a serial connection using Cornell C19.