

KINETICS ***FastPath™ 4
Gateway***

Installation Guide

Publication No. 4200094-00 Revision A

FastPath 4 Gateway

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Federal Communications Commission Warning

The FastPath 4 gateway generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device, pursuant to Subpart J of Part 15 of the Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

The FCC rules are designed to provide reasonable protection against such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the equipment with respect to the receiver.
- Move the equipment away from the receiver.
- Plug the equipment into a different outlet, so the equipment and the receiver are on different branch circuits.

If necessary, consult Kinetics or an experienced radio-television technician for additional suggestions. You might find the following FCC booklet helpful:

How to Identify and Resolve Radio-TV Interference Problems,
U.S. Government Printing Office, Washington, DC 20402,
Stock No. 004-000-0034504.

Manual Revision History

Manual Revision	Date	Summary of Changes
A	July 21, 1988	Initial release, FastPath 4 Gateway Installation Guide, Publication No. 4200094-00.

Preface

The Kinetics FastPath gateway connects a PhoneNET, LocalTalk, or equivalent AppleTalk local-area network (LAN) with an IEEE 802.3, Ethernet, or thin-Ethernet LAN. The gateway needs an external transceiver to complete the network connection to a standard Ethernet LAN; it does not need an external transceiver for connecting to a thin-Ethernet LAN. When properly connected, the gateway allows devices on one kind of network to communicate with devices on the other kind of network.

This manual is intended for users who want to use one or more FastPath gateways to combine two or more LANs into an internet.

The following publications contain detailed information about AppleTalk network equipment, standards, and uses:

1. *LocalTalk Cable System Owner's Guide*, Apple Computer. Supplied with LocalTalk connector kits, this is the place to start for information on installing LocalTalk network hardware. It replaces the *AppleTalk Personal Network Guide*.
2. *PhoneNET User's Guide*, Farallon Computing. Supplied with PhoneNET connector kits, this is the place to start for information on installing PhoneNET network hardware.
3. *Inside Macintosh*, Addison-Wesley Publishing Company, Inc. All five volumes are available in bookstores, from Apple Computer, and from the publisher. The AppleTalk Manager chapter provides detailed information about programming the Macintosh to work in AppleTalk networks. It also provides background information about the AppleTalk architecture.
4. *Inside AppleTalk*, Apple Computer. This provides the complete AppleTalk network specification.

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The following publications contain detailed information about Ethernet and IEEE 802.3 network standards and uses:

5. *The Ethernet: A Local Area Network: Data Link Layer and Physical Layer Specifications*, DEC, Intel, and Xerox Corporations, Version 2.0, November 1982.
6. *Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications (ANSI/IEEE Standard 802.3-1985)*, (ISO/DIS 8802/3), IEEE, 1985, available from IEEE, 345 East 47th Street, New York, NY 10017. This provides the Ethernet standard.
7. *Networks and Communications Buyer's Guide*, available from Digital Equipment Corporation. This provides information on installing cable and cable connections for DEC networks.

The following RFCs (Requests for Comment) define standard network practices. Each of them is available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22314; or from the DDN Network Information Center (NIC), SRI International, 333 Ravenswood Avenue, Room EJ291, Menlo Park, CA 94025.

8. Mogul, J., and J. Postel, *Internet Standard Subnetting Procedure*, RFC 950, August 1985. This RFC describes a method for implementing subnets and is the basis for the 4.3BSD subnetting scheme of the University of California at Berkeley.
9. Reynolds, J., and J. Postel, *Internet Numbers*, RFC 997, March 1987. This RFC, or its successor, is the official status report on IP network numbers.
10. Braden, R., and J. Postel, *Requirements for Internet Gateways*, RFC 1009, June 1987. This lengthy RFC defines the formal requirements for gateways used on IP networks.

The following document describes the ISO Open Systems Interconnection Reference Model:

11. *Reference Model of Open Systems Interconnection*, Document No. ISO/TC97/SC16 N227, International Organization for Standardization (ISO), Document No. ISO 7498-1984(E).

The following Kinetics and Excelan publications can also help you establish your internet:

12. *Counterpart*, Kinetics, Inc. This third-party vendor catalog lists sources for equipment and software that can be used with Kinetics products.
13. *Excelan Product Catalog*, Excelan, Inc. This catalog lists all current Excelan and Kinetics products.
14. *FastPath Programmer Manual*, Kinetics, Inc. This manual provides information for programming the FastPath gateway to convert protocols other than AppleTalk.
15. *Network Primer*, Kinetics, Inc. This publication introduces the language and components of Macintosh network operation. It discusses hardware, software, standards, and protocols.

About this Guide

This guide describes how to install, configure, and test the FastPath gateway hardware and software. In both the hardware and software phases, the instructions begin with a short list of the procedure for experienced users, then proceed with detailed procedures for new users. The appendices provide reference material to help you make the best use of FastPath gateways.

Chapter 1, "Introduction," provides an overview of the functions and capabilities of the FastPath gateway.

Chapter 2, "Physical Installation," describes how to physically install the FastPath gateway.

Chapter 3, "Software Installation," describes how to configure the gateway by interactively specifying the necessary data, by loading a prepared file, or by letting the gateway configure itself automatically. You can use standard AppleTalk/EtherTalk routing, Internet Protocol (IP) subnet routing, or KIP-Style Addressing and Routing (K-STAR). This chapter also describes how to load a gateway program.

Chapter 4, "Troubleshooting," describes solutions to some of the common problems that you might encounter.

Chapter 5, "Network Utilities," describes Look and Echo, which are network utility programs that can help you analyze your internet.

Appendix A, "Glossary," is a glossary of some of the technical terms used in this manual.

Appendix B, "Technical Specifications," provides technical specifications of the FastPath hardware.

Appendix C, "Decimal-Hexadecimal Conversion," is a chart for converting numbers between decimal and hexadecimal notation.

Appendix D, "AppleTalk Considerations," provides a brief description of the hardware that forms the physical part of an AppleTalk network, along with some of its restrictions.

Appendix E, "Ethernet Considerations," provides a brief description of Ethernet hardware and some of its restrictions.

Appendix F, "Internet Addressing and Berkeley Subnetting," provides a technical discussion of Internet addressing and Berkeley subnetting.

Appendix G, "FastPath Diagnostic Messages," provides a list of messages you can receive from FastPath software.

Appendix H, "Support Information," describes how to contact Kinetics for assistance.

An index is provided at the end of this guide for easy cross-reference.

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Chapter 1 Introduction

The Kinetics FastPath 4 gateway connects Ethernet (or IEEE 802.3)¹ and LocalTalk (or equivalent)² networks, thereby creating internet communication paths among many different kinds of computers. The gateway passes information between the two networks and converts information from one type of network into a form that the other can understand.

This chapter discusses the features of the FastPath 4 gateway and some issues related to establishing an internet.

The FastPath 4 gateway is highly adaptable to your needs, because it

- Requires no configuration effort to work in internets that use only AppleTalk protocols
- Can be configured from either the Ethernet side or the LocalTalk side
- Remembers its configuration, even when the power has been off
- Links LocalTalk networks to Ethernet networks, which connect to many types of computers
- Is programmable, making it adaptable to different environments

1. In this manual, the term *Ethernet* refers to both Ethernet (Version 1.0 or 2.0) and IEEE 802.3 standard networks.

2. In this manual, the phrase *LocalTalk network* refers to any network that is based on LocalTalk, PhoneNET, or any other system of cabling and connectors that supports AppleTalk protocols, running at 230 kilobits per second.

FastPath 4 Gateway

- Supports AppleTalk internet protocols. Any program working on a LocalTalk network will work across the FastPath gateway and Ethernet
- Conforms to AppleTalk and Ethernet hardware and software standards

Easy Installation

If all of the communication through your FastPath 4 gateway will use AppleTalk protocols, the FastPath installation is easy—just connect the cables, as discussed in Chapter 2 of this guide. When shipped, the FastPath 4 gateway is ready for AppleTalk communication, with no further preparation. Figure 1-1 illustrates such a situation.

More complex situations, such as those involving other protocols on an existing Ethernet network, can require some software installation.

In either case, FastPath installation requires the FastPath 4 gateway itself, properly installed LocalTalk and Ethernet hardware, and an AC power source.

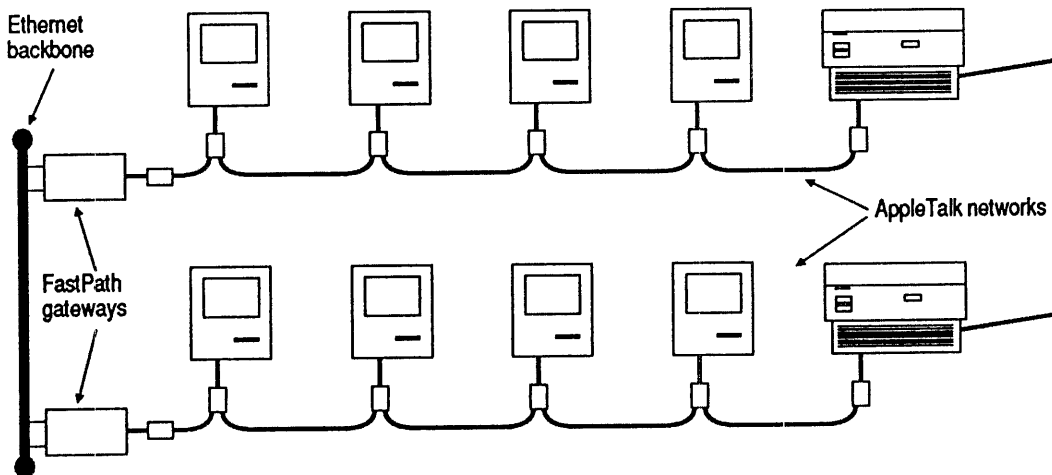


Figure 1-1: Simple Internet Layout

Network Differences

By interconnecting LocalTalk and Ethernet networks, the FastPath hardware and software join the networks into one *internet*. Devices anywhere on the internet can communicate with each other as if they were connected by one unified network path. To create this internet, the gateway must resolve two major areas of difference between LocalTalk and Ethernet networks:

- **Hardware.** The two network types use different kinds of cables and connectors, with different physical and electrical characteristics.
- **Protocol.** Each network type uses a different format and sequence for the transmitted information.

Internet Complexity

FastPath gateways let you build an internet configuration that is as simple or complex as necessary to match your needs. With a set of gateways, you can

- **Make use of existing Ethernet cable.** You can connect multiple LocalTalk networks to the Ethernet cable without disturbing the existing Ethernet network.
- **Increase speed and efficiency.** By attaching groups of AppleTalk devices to the same Ethernet backbone cable, you can take advantage of the fact that Ethernet transmits information more rapidly than does LocalTalk.
- **Link Apple devices—Macintosh or Apple II computers, LaserWriters or Imagewriters, and other devices—to devices on an Ethernet network.** With the appropriate application software, the devices on LocalTalk networks can exchange information with line printers, host computers' memory, IBM PCs, or other devices on Ethernet.
- **Run various protocols.** Several different communication protocols are used on Ethernet cable. You can use FastPath gateways to link LocalTalk networks to Ethernet networks that use these different protocols.

FastPath 4 Gateway

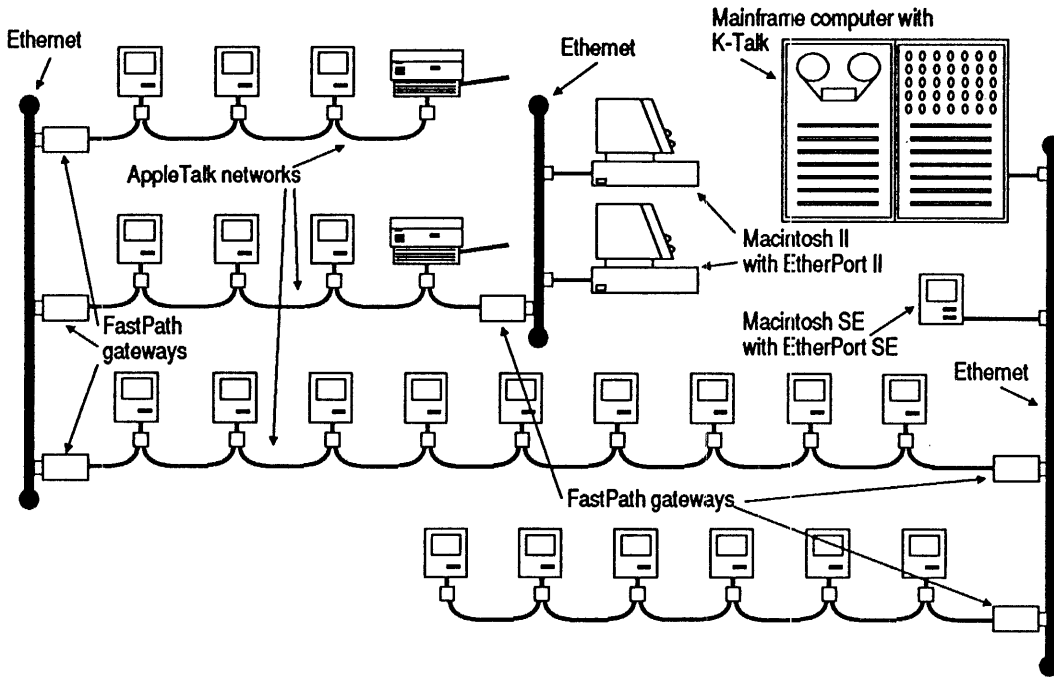


Figure 1-2: Complex Internet Layout

An internet could have a simple layout, like the one shown in Figure 1-1, in which a single backbone provides an Ethernet connection between LocalTalk networks. It could also be very complex, with several networks interconnected as shown in Figure 1-2. Although the internet in Figure 1-2 is complex, all of its devices can communicate with each other.

FastPath 4 Hardware

The FastPath 4 gateway's metal case contains a printed-circuit board, a power supply, and a backup battery. Its back panel, as shown in Figure 1-3, includes a power switch, a slide switch, a fuse clip, a serial-number label, and connectors for LocalTalk, standard Ethernet, thin Ethernet, and a power cord.

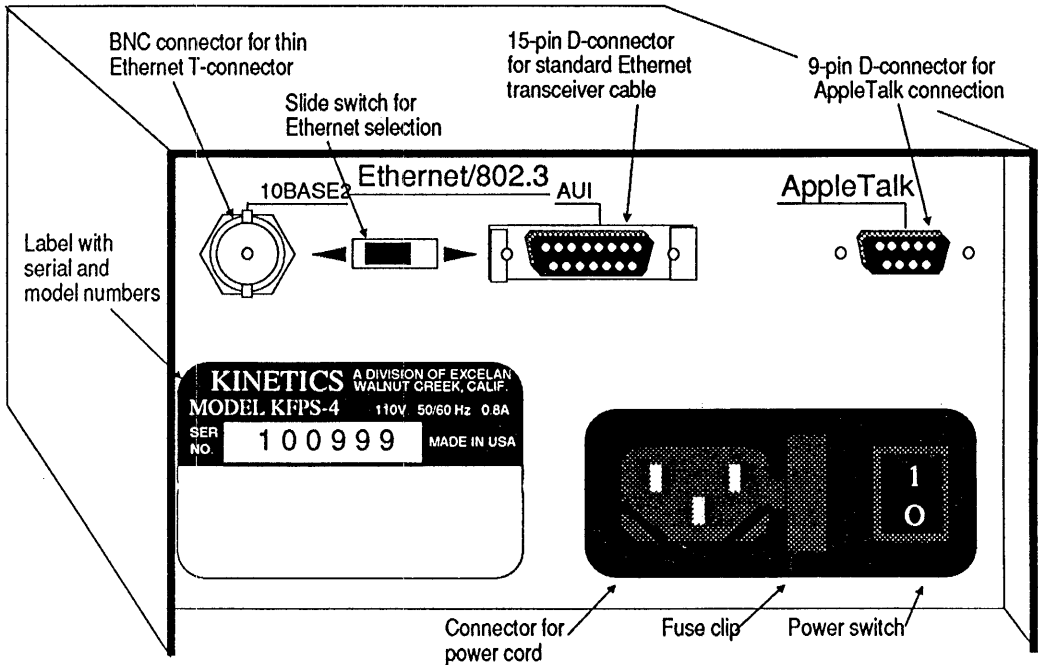


Figure 1-3: FastPath 4 Back Panel

On the front of the case are three LED lights. The leftmost LED is the power light, indicating that the gateway is receiving power. The other two LEDs are the network traffic lights for the LocalTalk and Ethernet connections; in normal operation, these two LEDs light to indicate communication packets going through their respective connections.

On the back panel, the 15-pin D-connector is for a cable connected to an external, IEEE 802.3 Type A transceiver, connected in turn to standard Ethernet cable. The circular BNC connector is for a T-connector that is part of an IEEE 802.3 thin-Ethernet cable. The 9-pin D-connector is for a LocalTalk connection box.

A slide switch, between the two Ethernet connectors, selects which type of Ethernet is to be connected to the gateway. When you install the gateway, you slide the switch toward the desired connector.

FastPath 4 Gateway

The power switch is a rocker switch marked with the internationally recognized designations—1 for "on" and 0 for "off."

The fuse is held by a plastic clip between the power switch and the power cord. You must remove the power cord before you can remove the fuse clip.

The battery prevents the gateway from losing information and programs if it is disconnected or if a power outage occurs. The battery lasts the life of the gateway, so you will never have to replace it.

The power supply is adjusted for the standard power source of the country in which it is purchased, either 110 or 220 volts AC. If you intend to install the gateway in a country with different voltage requirements, ask your dealer or Kinetics to adjust it for that voltage.

The model number and serial number of the gateway are printed on a label on the back panel.

The Ethernet address of the gateway is printed on a label on the bottom of the chassis.

FastPath Software

Along with the FastPath 4 gateway, you received some disks containing programs and files to help you manage the gateway. Included on these disks are the FastPath Manager application, a gateway program, models for specialized gateway programs, sample configuration files, and the diagnostic programs Look and Echo.

FastPath Manager

To configure and load the gateway, run the FastPath Manager program. Through this program, you can

- Enable or disable automatic configuration of the gateway.
- Enable or disable automatic booting of the gateway.

- Reset or restart the gateway.
- Load a gateway program into the gateway.
- Supply values for parameters of the gateway program.
- Specify AppleTalk network numbers and zone names.
- Specify addresses for Ethernet and IP use.
- Configure the gateway by loading a previously saved configuration file.

Chapter 3, "Software Installation," describes these and other functions.

Gateway Software

In many installations, you do not have to load a separate gateway program because the necessary instructions are in the FastPath 4 gateway's permanent memory (PROM). One gateway program, for K-STAR routing, is provided with the gateway. For information on writing custom gateway programs, refer to the *FastPath Programmer Manual*.

AppleTalk and EtherTalk Routing

If the FastPath 4 gateway just interconnects AppleTalk networks, it runs gateway code directly from its PROM. Figure 1-1 shows such an internet.

The PROM code also handles communication between devices on a LocalTalk network and a UNIX host computer that is running Kinetics K-Talk software.

Internet Protocol Routing

If you want the devices on a LocalTalk network to communicate through IP (Internet Protocol), you can select IP Subnetting or K-STAR in the configuration program. If you select IP Subnetting, the gateway runs directly from the PROM code.

FastPath 4 Gateway

K-STAR Routing

For more flexible communication with a host computer using the TCP/IP (Transmission Control Protocol/Internet Protocol), you should load the K-STAR gateway program.

K-STAR software allows either static or dynamic assignment of IP addresses to AppleTalk nodes. Static addresses are useful for certain nodes, such as file servers, that need to have a constant address and are unlikely to be relocated. You can assign a static address through a Telnet program. (Kinetics can supply you with such a program if you do not already have one.)

The FastPath 4 gateway, if loaded with the K-STAR software gateway program, automatically assigns a dynamic IP address whenever a device on the attached LocalTalk network requests such an address. The device keeps its assigned IP address until it is turned off or disconnected from the network. Even then, it keeps the address if it is turned on or reconnected within four to five minutes.

When an AppleTalk device (on a LocalTalk network) sends a message through a gateway that is configured for IP, the gateway can encapsulate the AppleTalk packet in an IP envelope. That is, it attaches IP addressing information to the message, so the IP devices in the internet see the message as a normal IP packet. When the host receives this, it can strip off the envelope to reveal the AppleTalk packet.

Help Areas

Each FastPath Manager window includes a Help area. When you press the mouse button, the Help area displays information about the currently selected field. The Help area also displays error and warning messages as needed.

LocalTalk Connection

Each LocalTalk or equivalent connector kit includes a connection box and a length of cable. The cabling can be any of several physical media, including

- Shielded twisted-pair wire (as in LocalTalk connector kits, manufactured by Apple Computer)
- Unshielded twisted-pair wire (as in PhoneNET connector kits, manufactured by Farallon Computing)
- Fiber-optic cable (as in Fiber Optic System for AppleTalk, manufactured by DuPont)

A connection box is a small plastic enclosure with two cable connectors and a short cable ending in one of two types of device connector:

- A 9-pin, trapezoidal, DB-9 connector. You can connect this type to a FastPath gateway; to a LaserWriter or LaserWriter Plus printer; or to a Macintosh 128K or 512K computer.
- An 8-pin, round, DIN-8 connector. You can connect this type to a Macintosh II, Macintosh SE, Macintosh Plus, or Apple IIGS computer; to a LaserWriter II printer; or to an ImageWriter II printer that has the LocalTalk option.

The maximum length of a single LocalTalk or equivalent network, and the number of devices you can attach to it, depends on the medium you use.

For example, LocalTalk hardware allows a maximum of 32 connections and a maximum network length of 300 meters (984 feet) between repeaters, bridges, or gateways. PhoneNET hardware also allows a maximum of 32 connections, but its maximum network length is approximately 900 meters (2952 feet). The documentation provided with your equipment describes the applicable limits.

Cable and cable connectors are not supplied with the FastPath 4 gateway. You can purchase the necessary cables, connectors, and other hardware through your Kinetics representative or your local dealer.

Ethernet Connection

The nodes of an Ethernet network are connected by some form of Ethernet hardware. An Ethernet network can use any of several kinds of physical media, including

- Standard Ethernet cable, with an external transceiver and transceiver cable
- Thin Ethernet cable, with a T-connector
- Twisted-pair wire (such as LattisNet, manufactured by SynOptics Communications)

You can connect a Macintosh directly to Ethernet if the Macintosh is equipped with a Kinetics EtherPort SE or EtherPort II board or a Kinetics EtherSC connection box.

The Ethernet cable should be installed before you begin installing the gateways. You might want to consult a professional installer, because Ethernet cable installation requires some expertise. For example, the installed cable must be terminated at both ends and should include a connector or transceiver in the correct location for each FastPath gateway you want to install. Also, the number of FastPath gateways you can connect to an Ethernet cable depends on the total length of the cable and the number of other devices on the cable.

Cable and cable connectors are not supplied with the FastPath 4 gateway. For a list of sources where you can purchase the necessary cable, transceivers, and other needs, refer to *Counterpart*, the Kinetics third-party vendor products catalog.

Planning an Internet

Before you set up an internet, you should carefully plan its connections and gateway configurations, whether you are building an Ethernet backbone between LocalTalk networks or connecting LocalTalk networks to a host computer.

Connection Devices

Network communication takes place on several levels. Not only do electrical signals have to travel through wires, but the

information carried by those signals must be mutually understandable to the sender and the receiver, and sometimes to intermediary devices.

Internet connection devices are grouped into four categories—repeaters, bridges, routers, and gateways—depending on which communication levels they deal with. Figure 1-4 shows the domains of such devices within the seven levels, or layers, of the Open Systems Interconnection (OSI) reference model adopted by the International Organization for Standardization (ISO).

A *repeater* is a device used to connect two or more networks at the Physical layer of the ISO-OSI reference model. The networks connected to a repeater must use the same physical medium (Ethernet cable, for example). The repeater is insensitive to the protocols used on that medium. The principal use of a repeater is to amplify or regenerate signals, to alter the topology or extend the effective length of a network.

A *bridge* is a device used to connect two or more networks at the Data Link layer of the ISO-OSI reference model. The networks can have different physical media. The networks also can use different upper-level protocols, because the bridge only understands addresses.

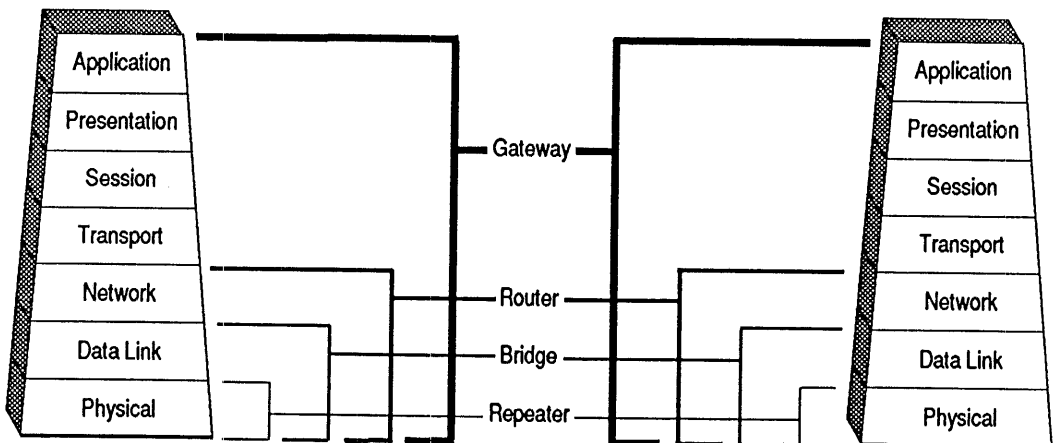


Figure 1-4: ISO-OSI Domains of Connection Devices

FastPath 4 Gateway

For example, a bridge could conduct an AppleTalk packet from a PhoneNET cable to an Ethertalk cable, but could not transform that packet into one readable by a TCP/IP device. However, another bridge, attached elsewhere on the Ethertalk cable, could conduct the packet to a second PhoneNET cable where AppleTalk devices could read it.

Bridges are also useful in connecting networks that use the same medium and protocol; an internet of small networks bridged together can be more manageable than a single large network.

A *router* is a device used to connect two or more networks at the Network layer of the ISO-OSI reference model. The networks connected to a router generally use the same protocol and physical medium. The router must understand the protocol, because it uses information within each packet to determine how to route that packet.

A *gateway* is a device used to connect two or more networks at the protocol layers of the ISO-OSI reference model. The networks can use different protocols and physical media. A gateway can accept a packet in the format of one protocol and retransmit the packet in the form required by a different protocol.

The FastPath 4 device performs some of the functions of a bridge, a router, and a gateway. It can be an Appletalk bridge, passing AppleTalk packets from one network to another. In a more complex internet, it can modify AppleTalk packets to route them through TCP/IP or other networks. It can also forward TCP/IP packets from one network to another. Because of the mixture of uses, this guide refers to the FastPath 4 device as a gateway.

Multiple LocalTalk Networks

Connecting multiple LocalTalk networks allows a larger number of nodes—Macintosh or Apple II computers, LaserWriters or Imagewriters, and other devices—to exchange information. Because of hardware limitations, the number of devices that can be included in a single LocalTalk or equivalent network is limited. Both LocalTalk and PhoneNET, for example, limit the maximum number of devices to 32.



FastPath gateways count toward the 32-device limit on each LocalTalk or PhoneNET network.

Bridges

If you have several LocalTalk networks chained together through bridges, information sent from one end to the other must travel through all those bridges and networks before reaching its destination. Each *hop*—a packet's passage through a network—slows the communication.

Communication is faster if you bridge the LocalTalk networks through a common Ethernet backbone cable, for two reasons:

- The information travels straight through the backbone to the destination network, instead of being relayed through other networks in the bridged chain.
- Ethernet operates at a higher transmission speed and has a higher bandwidth than AppleTalk.

Zones

FastPath gateways support ZIP (Zone Information Protocol), which lets you designate one or more networks as a logical group, or *zone*, within your internet. Any user in the internet can communicate with devices in any zone, but it is fastest and most convenient to communicate with devices that are within one's own zone.

Assignment of AppleTalk networks into zones should be based on network traffic patterns, not on how the individual networks are connected. In Figure 1-5, for example, suppose the LaserWriter and five Macintoshes in the shaded areas belong to the Engineering department and the other devices belong to Sales. Further, suppose there is a lot of network traffic within each department, but little traffic between the two departments. Even though the two Engineering networks are physically apart from each other, they should be together in one zone and the two Sales networks should be in a different zone.

FastPath 4 Gateway

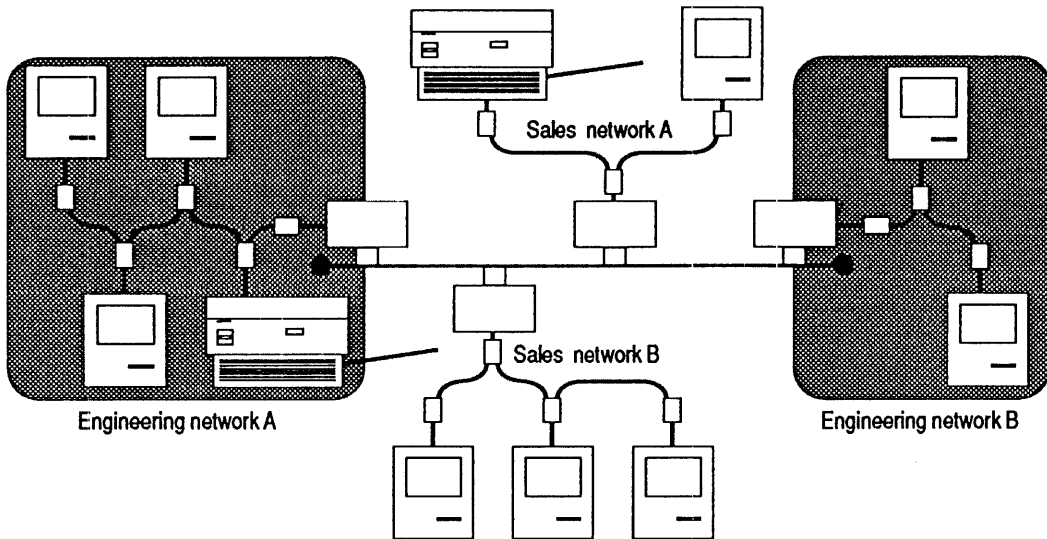


Figure 1-5: AppleTalk Zones

Host Computers

When a host computer—often a mainframe or minicomputer—is attached to the internet and equipped with appropriate software, your Macintosh computers can use the resources of the host and the host can use the LaserWriters or other resources on the internet.

For example, with a gateway properly configured for K-STAR operation, AppleTalk devices can communicate with a UNIX host that is running K-Talk or CAP (Columbia AppleTalk Protocol) software. Or, through a Telnet program, AppleTalk devices can communicate with a host that is running TCP/IP (Transmission Control Protocol/Internet Protocol) network software.

Refer to *Counterpart*, the Kinetics third-party vendor catalog, and to the *Excelan Product Catalog* for an up-to-date list of related software products for host computers.

Chapter 2

Physical Installation

Physical installation of a Kinetics FastPath 4 gateway is simple, if the Ethernet network is already installed. If you are experienced at network installation, use the quick installation procedure described below. Otherwise, please read the remainder of this chapter before you begin installing the equipment.

Quick Procedure

If you are familiar with the requirements involved in setting up Ethernet and LocalTalk networks, you can probably use the quick procedure listed below and then skip to Chapter 3, "Software Installation."

1. Unpack the gateway carefully.
2. Connect the gateway to both networks.
3. Connect the gateway to a power source, then turn it on.

As soon as you turn the power on, the gateway attempts to configure itself. If the gateway connects a LocalTalk or equivalent network to a simple Ethernet backbone, the gateway is ready to use. Otherwise, you should read Chapter 3.

Before You Begin

Before you do anything else, unpack the equipment and take certain preliminary precautions:

1. Remove the FastPath 4 gateway, power cord, and disks from the shipping container. Handle the FastPath 4 gateway carefully. It is sturdy, but contains precise crystal oscillators. Dropping the gateway can alter the frequency

FastPath 4 Gateway

of the oscillators and thus cause the gateway to malfunction.

Save the shipping container and packing material, in case you need to return the gateway.

2. Inspect the gateway for any signs of physical damage. If it appears damaged, notify the carrier and then contact Kinetics as discussed in Appendix H.
3. Write down the gateway's serial number and keep it with your network records. The serial number is on a label on the back panel.
4. Fill out the warranty card that is included with this guide, and return the card to Kinetics.
5. Make a copy of all supplied disks and store the originals in a safe place.
6. Make sure you have everything you need. If you have any doubt, refer to "System Requirements," below.
7. Check local regulations regarding network devices and cabling. The FastPath 4 gateway conforms to U.S. electrical standards, but local building and fire codes could impose additional requirements.
8. Read the instructions supplied with all cable connectors. Installation of some connectors requires a small screwdriver.
9. Check the voltage rating on the gateway's back panel to be sure that the gateway is compatible with your AC power source.
10. Make sure the Macintosh you use for configuring the gateway has AppleTalk enabled. To check this, launch the Print Chooser, Chooser, or Control Panel desk accessory (depending on the version of System file you are using) and make sure the AppleTalk Connected or AppleTalk Active box is ticked.
11. Make sure all FastPath gateways are listed in your network records. For example, if you have a network

diagram, note the planned location of FastPath gateways on the diagram. Keep your records on hand during the installation. You'll need them for recording the serial numbers, gateway names, zone names, network numbers, and Ethernet addresses for each gateway you add to your network.

12. If you connect the FastPath gateway to a host computer that uses protocols other than AppleTalk or TCP/IP, you need a gateway program other than those supplied with the FastPath 4 gateway. For information on programming the FastPath 4 gateway, refer to the *FastPath Programmer Manual*.

Equipment Requirements

Before going on to install the FastPath 4 gateway, make sure you have one FastPath gateway for each LocalTalk network you want to connect to an Ethernet cable. In addition, you need to make sure you have all of the necessary equipment for the LocalTalk and Ethernet areas of your internet.

The number of FastPath gateways you can connect to one Ethernet cable depends on the length of that cable. Appendix E discusses the limits of Ethernet connections.

AppleTalk

An AppleTalk network can use any one of several media, as discussed in Chapter 1. It requires cable and connection boxes, all of which should be of the same type within a network.

You must have one LocalTalk or equivalent connection box for each FastPath gateway. The connection box is available with either of two kinds of connector: the 9-pin D-connector, as found on Macintosh 512K and 128K models, or the round connector, as found on all newer Macintosh models. The FastPath 4 gateway requires the kind with the 9-pin D-connector.

If you use LocalTalk kits, you should secure each connection with a cable tie to keep the plugs from working loose and disrupting the network.

FastPath 4 Gateway

You also need at least one length of LocalTalk or equivalent cable for each FastPath gateway. This cable links the connectors that are attached to the AppleTalk devices.

Standard Ethernet

A standard-Ethernet network includes standard Ethernet cable, external transceivers, and transceiver cables. A terminator must be attached to each end of the Ethernet cable.

For each FastPath gateway you want to install, one transceiver should be installed in the correct location on the Ethernet cable. The transceiver must be connected to the gateway by a transceiver cable.

Thin Ethernet

A thin-Ethernet network includes thin-Ethernet cable and T-connectors.

The cable should include one T-connector, installed in the correct location, for each FastPath gateway you want to install. The stem of the T-connector must be connected to the gateway. Each side of the T-connector must be connected to either the Ethernet cable or a terminator. If a T-connector is attached to the end of the cable, a terminator should be attached to the connector's open side.



Do not attach thin-Ethernet cable directly (without a T-connector) to the FastPath gateway. This creates a situation in which the Ethernet cable is not terminated properly and cannot function as a network.

Each T-connector can be covered with a plastic boot, to prevent the metal of the T-connector from coming into contact with the metal of the FastPath gateway box. The plastic boot slips over the T-connector and has a small flap to cover the T-connector when it's not connected to a FastPath gateway or other device.

Using Existing Cable

If you already have an Ethernet network installed, you can take advantage of the existing network's cable to connect multiple LocalTalk networks. The two separate network types (the Ethernet network and the connected LocalTalk networks) have equal access to the cable. They can share the same cable without necessarily affecting each other.

The requirements for using an existing cable are the same as those for a newly installed cable:

- It should have a T-connector or a transceiver for each FastPath gateway you want to install.
- The total number of devices, including the gateways and all currently connected devices, cannot exceed the Ethernet limit (refer to Appendix E, "Ethernet Considerations").

Detailed Installation Procedure

When you are certain that you have satisfied all of the cabling and other requirements, follow the steps listed below to install your FastPath 4 gateway.

1. Choose the best location and position for the gateway. The FastPath 4 gateway is not intended to be a portable device. Once you install it, you will probably want to leave it in the same location. Therefore, you should take some care in determining that location.

Once the gateway is installed, there is rarely any need to see or touch it. Therefore, you can place it on a top shelf or other location with low accessibility. In some installations, a convenient gateway location is in the room containing your telephone switching equipment.

You can mount or place the FastPath 4 gateway in any orientation.

The FastPath 4 gateway must have air circulation on three sides, including the bottom. Do not wrap or cover it. Do not install it beneath a shelf unless the shelf is high enough to allow free air circulation. Make sure the

FastPath 4 Gateway

gateway's feet are on a hard surface, not on carpeting or loose cloth.

As far as the Ethernet or LocalTalk network is concerned, the gateway is just another node. It does not have to be at the end of a network.

2. Connect a LocalTalk connection box to the gateway, as shown in Figure 2-1. Insert the 9-pin plug into the corresponding connector on the upper right corner of the FastPath gateway's back panel, tightening its screws with finger pressure only.
3. Connect the connection box to the existing LocalTalk network. Plug one end of a cable into the connection box that is attached to the gateway. Plug the other end of the cable into another connection box connected to an existing Macintosh or other network device. It doesn't matter which of the connection box's two sockets you use.

If the gateway is at the end of the LocalTalk or equivalent network, make sure that any required termination device

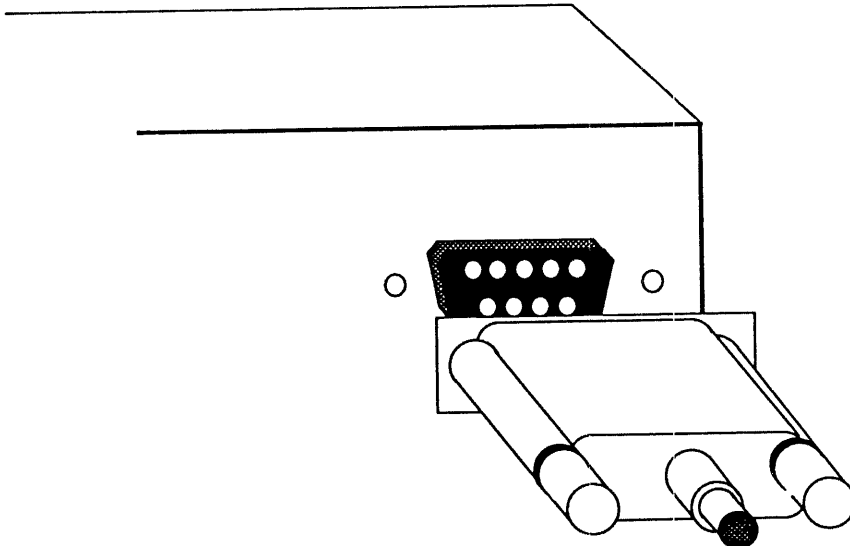


Figure 2-1: Connecting the AppleTalk Cable

is in place. For example, PhoneNET connection kits include terminating resistors that must be installed in the connectors at both ends of the network. LocalTalk connectors do not require termination.

Make sure the plugs are fully inserted. If your connectors are LocalTalk kits, you should secure them with a cable tie to prevent the plugs from working loose and disrupting the network.

4. Connect the Ethernet cable.



If you intend to configure the gateway at a temporary location, you can skip Step 4 until after you have loaded and configured the gateway as described in Chapter 3.

If you are connecting the gateway to a standard Ethernet cable, plug one end of the transceiver cable into the Ethernet connector at the center top of the gateway's back panel, as shown in Figure 2-2. Plug the other end of the transceiver cable into the transceiver on the Ethernet cable

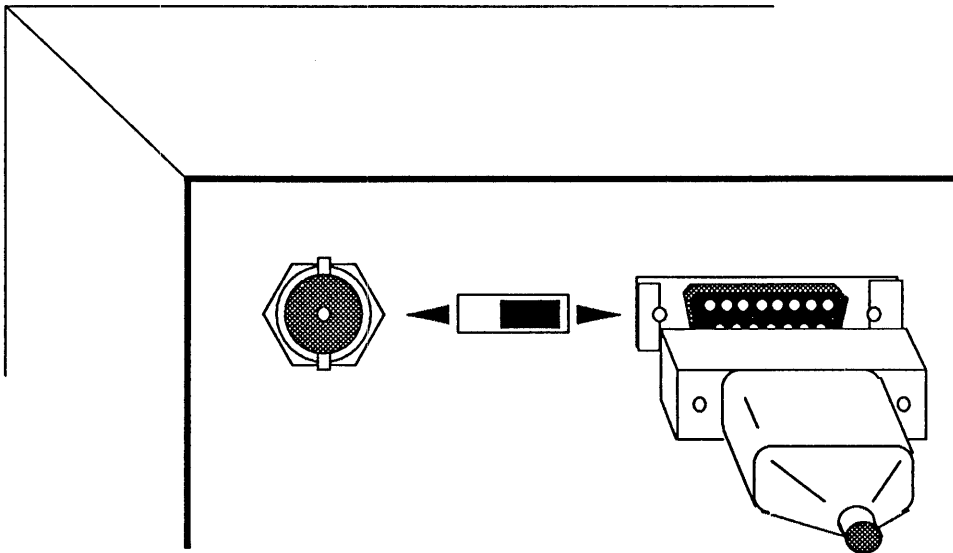


Figure 2-2: Connecting to Standard Ethernet

FastPath 4 Gateway

by following the instructions supplied with the transceiver. On each end of the cable, slide the locking mechanism to secure the connection.

If you are connecting the gateway to a thin-Ethernet cable, plug the T-connector into the round connector at the upper left corner of the gateway's back panel, as shown in Figure 2-3. Twist the sleeve on the T-connector clockwise to lock the T-connector into place.

5. Set the slide switch.

If you have connected a thin-Ethernet cable, move the slide switch to the left (toward the thin-Ethernet connector). If you have connected a standard Ethernet cable, move the slide switch to the right (toward the standard Ethernet connector).

6. Apply power to the gateway. Plug one end of the power cord into the power receptacle on the bottom right corner of the gateway's back panel and plug the other end into an electrical socket.

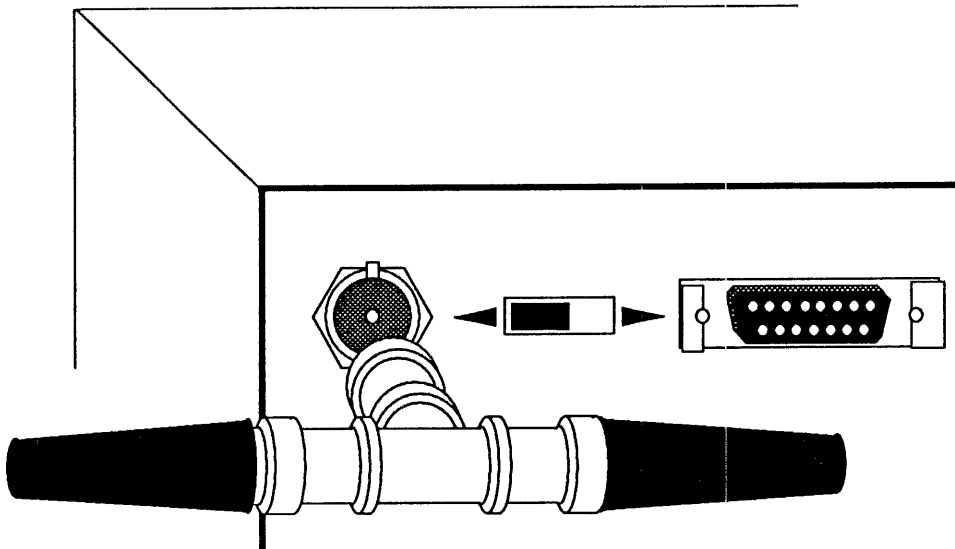


Figure 2-3: Connecting to Thin Ethernet

Find the power switch, marked 1 and 0, on the gateway's back panel. Push the side marked 1 to turn on the power.



When the FastPath 4 gateway is on, it is warm to the touch. This is normal. The gateway does not contain or need a fan.

Hardware Self-Testing

As soon as you turn on the power to the FastPath 4 gateway, it lights all three LEDs on the front panel and then conducts several brief tests to ensure that its memory and specialized circuits are in good working order. As shown in Figure 2-4, the leftmost LED is the power light, indicating that the gateway is receiving power. The other two LEDs are the network traffic lights for the LocalTalk and Ethernet connections; in normal operation, these two LEDs light to indicate communication packets going through their respective connections.

When both of the network traffic lights have been turned off again, the self-testing is complete and successful.

If both network traffic lights remain on, the tests have revealed a fatal error and the gateway cannot be used until the problem is corrected. If one traffic light remains on, the tests have revealed a nonfatal error and the corresponding network interface is inoperable. In either case, if the error condition persists, you should contact your dealer or Kinetics, as discussed in Appendix H.

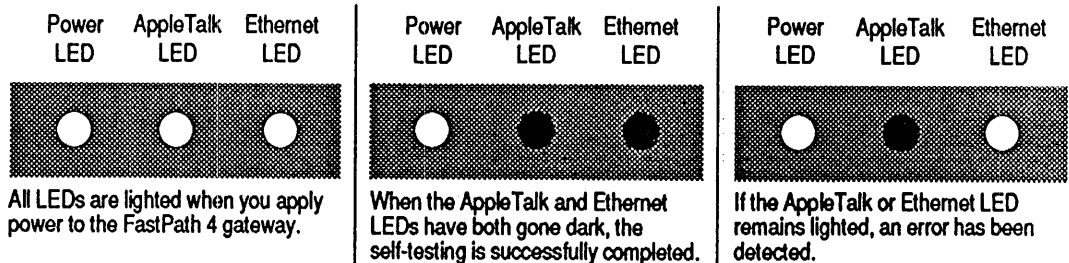


Figure 2-4: Results of Self-Testing

FastPath 4 Gateway

Fatal Problems The gateway tests itself for fatal problems by

1. Attempting to light the network traffic lights
2. Testing CPU stack memory
3. Testing unprotected memory

In normal operation, the middle and right LED lights, on the front panel of the FastPath 4 gateway, indicate incoming network traffic on the AppleTalk and EtherNet connections. The first test turns on all of these lights, thus indicating that the CPU, the control port, and the LEDs themselves are all functional. The lights remain on until the last tests are completed successfully.

The second test writes to and reads from a small area of RAM (memory) that will be used for further testing. If it fails, the remaining tests would be meaningless.

The areas of RAM that store configuration data and downloaded gateway programs are protected from being overwritten by test data. The remaining RAM, which is used for packet buffers and other temporary storage, is unprotected. The third test writes to and reads from this unprotected RAM to check its integrity.

Nonfatal Problems

If no fatal problems are found, the lights remain on and the gateway tests itself for nonfatal problems by exercising the AppleTalk and Ethernet control chips.

The fourth test writes and reads test data on the AppleTalk control chip to determine if that chip and its supporting circuitry are functional. If the gateway passes this test, it turns off the middle LED.

The last test partially initializes the Ethernet control chip and writes test data to it, to determine if that chip and its supporting circuitry are functional. If the gateway passes this test, it turns off the rightmost LED.

If either of the network traffic lights remain on, the corresponding network interface is nonfunctional.



If both of the network interfaces are nonfunctional, both lights remain on as they would for a fatal error.

When both of the network traffic lights have been turned off, the self-testing is complete and successful. The left light remains on, indicating that the gateway is turned on and receiving power.

Chapter 3

Software Installation

The Kinetics FastPath gateway uses a set of configuration data, including various network numbers and addresses. In many situations, the FastPath 4 gateway can get this information automatically. In other situations, your assistance is required.



If you are experienced at network installation, you can use the information provided in the section "Setup Summary" included after the section, "Automatic Configuration." Otherwise, please read this entire chapter before you configure the gateway.

Automatic Configuration

If the FastPath 4 gateway is installed to connect LocalTalk networks through a simple Ethernet backbone, it prepares itself by running the necessary gateway program from its PROM. If this is the case, your FastPath 4 gateway is ready to use.

In the following situations, the gateway cannot configure itself automatically and must be configured through the FastPath Manager program:

- The gateway is already configured. (Even if the gateway has been turned off after it is once configured, its built-in battery keeps any program and configuration data intact in the gateway's memory.)
- The combination of networks includes two networks or subnets with the same network numbers.
- The Auto Config software switch was turned off when the gateway was last configured manually.
- The Remote Boot software switch was turned on when the gateway was last configured manually.

FastPath 4 Gateway

- You have clicked on the **Pause** button.

When you turn on the gateway, it sends exploratory messages and listens for packets through both of its network interfaces. It uses whatever information it can glean from these packets as the basis for its automatic configuration. Required configuration data include:

- The gateway's Ethernet address, a unique, 12-digit hexadecimal number
- The AppleTalk network number that identifies the Ethernet network that is connected to the gateway
- The AppleTalk network number that identifies the LocalTalk network that is connected to the gateway
- The name of the AppleTalk zone that includes the Ethernet network
- The name of the AppleTalk zone that includes the LocalTalk network

The Ethernet address of the gateway is stored in the gateway's permanent memory. It is also printed on a label attached to the bottom of the gateway chassis.

If the gateway can discover an existing AppleTalk network number and zone name for either network, it uses these data in its own configuration. If the LocalTalk network does not have a network number, the gateway assumes one, derived from the last two bytes of the Ethernet address. If that number is in use by another network, the gateway increments the number by 1 until it finds an apparently unused network number.

If no AppleTalk network number is known for the Ethernet network, the gateway assumes a network number of 1. If that is in use by another network, the gateway tries 2. It continues incrementing by 1 until it finds an apparently unused network number.

If only one of the two networks has a zone name, the gateway assigns the same name to the other network. If neither network has a zone name, the gateway assigns the name "Default Zone" to both.

All running AppleTalk bridgers and gateways on the network broadcast periodic RTMP (Routing Table Maintenance Protocol) packets describing their respective views of the internet. If the newly installed gateway receives RTMP data that conflict with its own automatic configuration data, the gateway uses the RTMP data.



When you use FastPath Manager to configure the gateway, it stores the configuration information in a specific area of gateway memory. The information remains there until you manually reconfigure the gateway; the automatic configuration feature does not overwrite this configuration area. If you use FastPath Manager to disable the feature, then automatic configuration fails the next time the gateway is restarted, and operation depends on what is stored in the configuration area of gateway memory.

Setup Summary

In more complex situations, you must use the FastPath Manager program to load and configure the gateway. The remaining sections of this chapter provide a full description of how to do this. Experienced users can use the procedure summary below.

These instructions assume that the physical installation is complete and that manual configuration is needed.

1. Launch the FastPath Manager program.
2. Choose **Find All Gateways** from the **Gateways** menu, then select the gateway you want to configure.
3. If a gateway configuration file is needed and available, choose **Open Configuration File** from the **File** menu, then select the appropriate configuration file. If no appropriate file is available, you can enter data directly.
4. Edit information in the configuration windows, as needed.
5. Make sure the gateway is not conducting network traffic.
6. If a gateway program is needed, choose **Download File** from the **File** menu, then select a gateway program from

FastPath 4 Gateway

the File Selection window. Usually, this is needed only if you are using a K-STAR configuration.

7. Click on the Go button to load the configuration data and start the gateway.

Launching FastPath Manager

When you insert the FastPath Manager disk and double-click on its icon to open it, the desktop displays the disk's contents. The FastPath Manager disk includes a System folder along with the FastPath Manager program; you can boot a Macintosh directly from that disk. The System file contains a minimum of desk accessories and fonts, to keep it small.

Double-click on the FastPath Manager icon to launch the application. The first screen shows copyright information about the program. After a short delay, the program opens the Diagnostics window and the main configuration window.

Monitoring Diagnostic Messages

The Diagnostics window opens automatically when you launch FastPath Manager, but remains hidden underneath the configuration windows. To bring it to the top of the desktop, pull down the Windows menu and select Diagnostics.

This window monitors the LocalTalk network and displays any Kinetics diagnostic packets that it finds there. It does not read the Ethernet network. The gateway never transmits such packets on the Ethernet network.

The messages displayed in the Diagnostics window are read from the network, so they are not necessarily all from the gateway you have selected.

These are the same messages that would appear in the Diagnostic Packets window of the Look utility, which is described in Chapter 5. The messages themselves are described in Appendix G.

Another way to observe diagnostic messages is through the Log Messages window. Refer to "Log Messages Window," below.

Selecting a Gateway

To select a gateway for configuration, pull down the Gateways menu and select Find All. If you prefer, you can press the command-A key combination instead of using the menu. Either way, FastPath Manager displays a window listing all gateways on the local network, as shown in Figure 3-1. (The program does not communicate with gateways elsewhere on the internet.)



If you run FastPath Manager from a Macintosh that is directly connected to an Ethernet backbone (through an EtherPort II, EtherPort SE, or EtherSC controller), and you have selected EtherTalk in the Control Panel, Find All finds and lists all gateways attached to that backbone.

In the list window, select one or more gateways that you want to configure, then click on the Open button to open a configuration

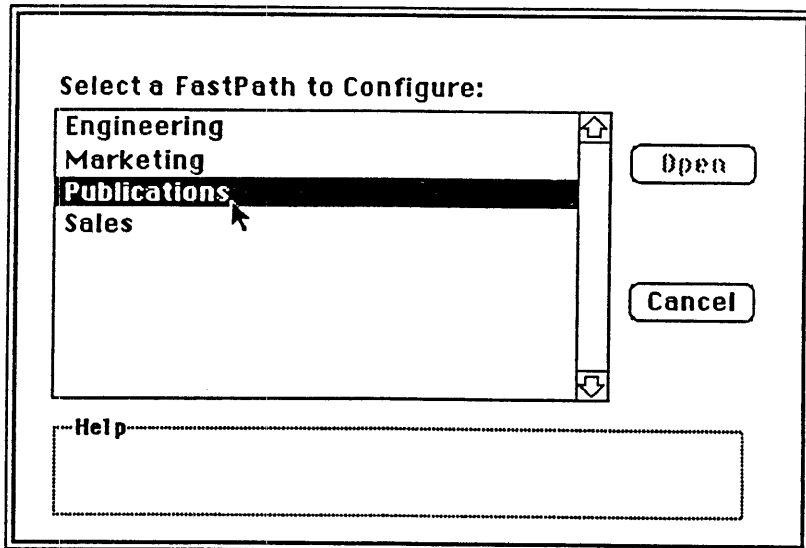


Figure 3-1: Gateway List

FastPath 4 Gateway

window. If you selected more than one gateway, a window is opened for each of them.

The name of each gateway is at the top of its window, as shown in Figure 3-2.

Each open gateway configuration window is listed under the Windows menu. To configure a specific gateway, pull down the menu and select the desired gateway name.

When you have selected a gateway, you can load a program and enter configuration data.

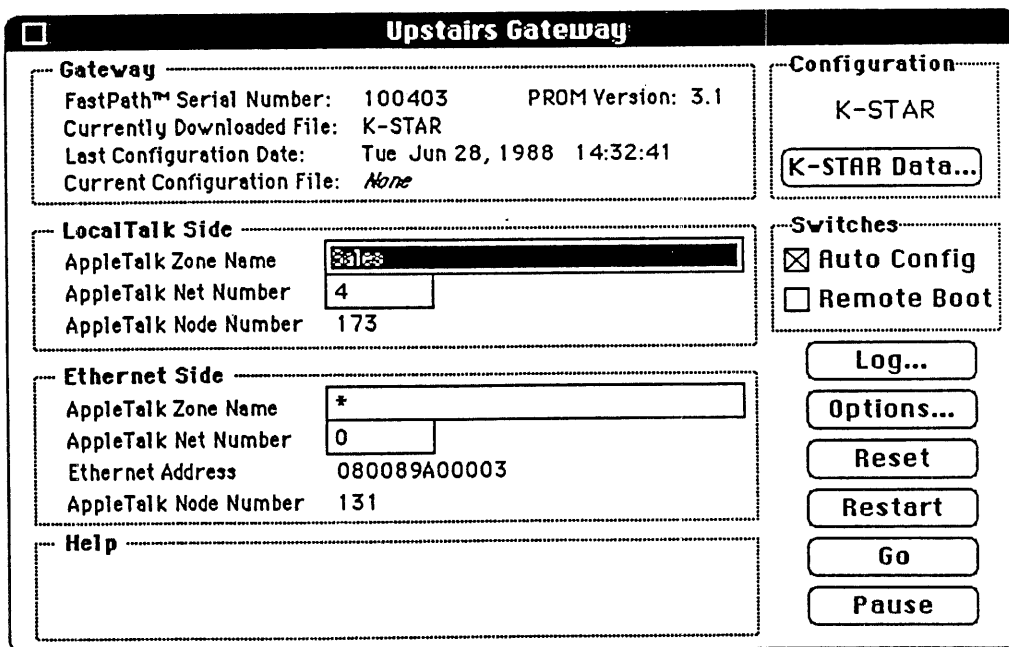


Figure 3-2: Main Configuration Window

Configuring a Gateway

The gateway needs data about the two networks to which it is connected. You can enter the necessary data in either of two ways:

- Load a previously prepared configuration file.
- Write the data in the appropriate fields of the FastPath Manager windows.

You can also combine these methods: Load a file that contains data similar to what you need, then use FastPath Manager to change some items.

While you are entering data or loading a file, the data remain in FastPath Manager not in the gateway itself. When you are ready, there are three ways to send data to the gateway:

- Click on the **Go** button, as described below.
- Click on the **Restart** button, as described below.
- Close the main configuration window. When you do so, FastPath Manager displays the dialog box shown in Figure 3-3. If you click on the **Yes** button, the program sends the data to the gateway and closes the window. If you click on the **No** button, the program just closes the window. If you click on the **Cancel** button, the program abandons the window closure.

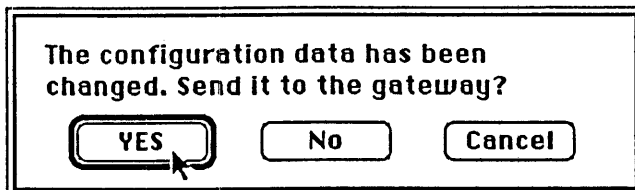


Figure 3-3: Dialog Box to Close Configuration Window

FastPath 4 Gateway

Loading a Configuration File

To load a configuration file into the FastPath 4 gateway, do the following:

1. Pull down the **File** menu and select **Open Configuration File**. If you prefer, you can press the command-O key combination instead of using the menu.

The window includes two buttons labeled **List All Text Files** and **List Configuration Files Only**. By default, the displayed list includes only those configuration files that were written by Version 4.0 (or later) of FastPath Manager. If you want to load a file that was written by an earlier version or by a word processing program, click on the **List All Text Files** button.

2. Select and open a configuration file from the File Selection window.

The configuration windows display the information in the file you loaded. If that information is exactly how you want to configure the gateway, just click on the **Go** button. If you want to change something, proceed as described in "Configuring Manually," below. Later, you can save the amended configuration in a new file or replace the old file.

Configuring Manually

The configuration windows automatically provide you with as much information as possible and let you enter information from the keyboard. Actual configuration occurs only when you click on the **Go** button. Until then, none of the information entered in the configuration windows is actually sent to the gateway.

In the main configuration window, the **Configuration** area displays the currently selected type of routing: **AppleTalk only**, **IP subnetting**, or **K-STAR**. To select a different routing method, pull down the **Configuration** menu and select the desired method. Each of the methods is discussed below.

If you select **IP subnetting** or **K-STAR**, a button labeled **Subnet Data** or **K-STAR Data** appears in this area. When you have provided the **AppleTalk** zone name and network number

for both attached networks, click on this button to open a window where you can enter more configuration data.

The next sections discuss how to configure your FastPath 4 gateway for AppleTalk, for IP subnetting, and for K-STAR.

Configuring for AppleTalk Only

If all of the traffic on your internet will be AppleTalk packets, the gateway's automatic setup feature can usually handle all of the configuration requirements. However, you might want to adjust some things in the main configuration window and the Options window, as described below.

Main Configuration Window

As shown in Figure 3-2, the main configuration window is divided into several distinct areas, each of which is discussed below.

Name

The top of the window shows the gateway's name. If you have not yet assigned a name, FastPath Manager assigns a default name based on the gateway's AppleTalk node number, such as Node 220. To give it a name of your own choosing do the following:

1. Pull down the **Gateways** menu and select **Name...** . If you prefer, you can press the command-N key combination instead of using the menu.
2. When the Name dialog box appears, you can either leave the default name intact or you can type a more descriptive name in the blank. The name can be any string of 1 to 32 characters. Embedded spaces are allowed. Assigning a name that is easy to remember and use will help you identify the gateway later.
3. Click on the **OK** button to accept the name you typed. This also closes the dialog box.

FastPath 4 Gateway

Gateway Area

The Gateway area shows data about the gateway's current configuration.

If you have loaded a gateway program or a configuration file, the file names is displayed in the Currently Downloaded File field or the Current Configuration File field, respectively. If no gateway program or configuration file has been loaded, the word "none" is displayed in the appropriate blank.

The Last Configuration Date field identifies the last time you sent configuration data to the gateway by clicking on the Go or Restart button or by closing the main configuration window.

AppleTalk Side Area

The AppleTalk Side area specifies information about the network attached to the gateway's AppleTalk connector.

As discussed in Chapter 1, an AppleTalk zone is a logical group of one or more networks within the internet. If you are configuring the first gateway or bridge on the internet, or the network does not have a zone name assigned to it, enter a new name in the AppleTalk Zone Name field. The name can be any string of 1 to 32 characters. Embedded spaces are allowed.



You should not leave a network without an assigned zone. Network traffic increases when no zone names are present.

If the attached network has been assigned to a zone already, you can leave the default asterisk (*) in the AppleTalk Zone Name field. If you want to assign the network to a different zone or create a new zone, enter that zone name. Remember, however, that all AppleTalk bridges on a given network must agree on that network's zone name.

Each AppleTalk network in the internet must have a unique network number. Network numbers allow bridges and gateways to find and recognize each other, so they can exchange information. During automatic configuration, if the gateway is attached to a LocalTalk network that does not have a network number, the gateway derives one from the last two bytes of the Ethernet address.

If you want to change the default network number, enter the new number in the AppleTalk Net Number field. An AppleTalk

network number can be any decimal integer from 1 to 65535, but it must be unique within the internet.

You cannot alter the AppleTalk node number. AppleTalk assigns it automatically when the gateway is turned on and connected to the LocalTalk network.

Ethernet Side Area

The Ethernet Side area shows information about the network that is attached to one of the gateway's Ethernet connectors.

You can assign an AppleTalk zone name and network number to the Ethernet network as discussed above for the AppleTalk side. The Ethernet network needs an AppleTalk zone name and network number because the AppleTalk gateway program treats the Ethernet side as a separate AppleTalk network.

The FastPath 4 gateway automatically uses a unique Ethernet address. The address is printed on a label on the bottom of the chassis. You cannot change this field.



If you run this version of FastPath Manager to configure an earlier model of the FastPath gateway, the last three bytes of the Ethernet Address field are in a box and can be changed.

You cannot alter the AppleTalk node number. AppleTalk assigns it automatically when the gateway is turned on and connected to the Ethernet network.

Help Area

When you press the mouse button, the Help area displays a description of the field or area that is currently selected by the cursor. The Help area remains displayed as long as you hold the mouse button down. Releasing the mouse button blanks the Help area.

The Help area also displays error and warning messages when appropriate.

Each of the subsidiary configuration windows includes a similar Help area.

Switches

Two selection boxes are in the Switches area: Remote Boot and Auto Config. To turn either of these features on or off, click on its selection box. The box displays an X when the feature is on.

FastPath 4 Gateway

As with other configuration data, these switches take effect only after you have clicked on the Go button.

The Auto Config switch lets you turn the gateway's automatic configuration feature off or on for either AppleTalk or IP Subnet configuration. This switch is disabled if you have selected K-STAR configuration.

By default, the automatic configuration feature is on. If you configure the gateway with this feature off and then click on the Restart button, the gateway will require manual configuration before it can start again.

The Remote Boot switch causes the gateway to idle in the "boot-me" state until it gets further instructions. In this state, the gateway sends packets to tell other nodes that it needs restarting. If one of those other nodes is set up as a boot server, it can start a gateway from the "boot-me" state after sending it the appropriate gateway program. Any remote device can be a boot server if it is running the appropriate software. Kinetics does not provide or support boot-server software.

With FastPath Manager, you can restart the gateway from the "boot-me" state by clicking on the Go button.

Buttons

Six buttons are in the lower right corner of the window:

- The **Log...** button causes the Log Messages window to appear. This window displays diagnostic information as described in "Log Messages Window," below.
- The **Options...** button causes the Options window to appear. This window lets you control any options that have been built into the gateway program, as described in "Options Window," below.
- The **Reset** button removes any gateway program and all configuration data from the gateway's RAM. Use this button if you want to unload a gateway program.

Before resetting the gateway, FastPath Manager displays a dialog box warning you that all information in the gateway will be lost. If you still want to reset it, click on the OK button.

After resetting, the gateway waits for 25 seconds and restarts itself. This delay gives you time to load a file or set some aspect of the configuration.

- The **Restart** button lets the gateway finish processing any packet that is in process, then proceeds as if the power had been turned off and back on. It checks for errors, waits for user action, then starts the gateway again.

The gateway runs its hardware self-testing (as described in Chapter 2) and then uses a checksum to see if a valid gateway program is loaded. It then waits for 25 seconds, to give you time to load a file or change some aspect of the configuration. After the delay, it restarts the currently loaded program (unless you have turned on the Remote Boot switch).

If the checksum test finds that the loaded gateway program is bad, the gateway ignores the program and starts the default code (after the 25-second delay).

- The **Go** button sends the gateway all information that is currently shown in the configuration windows. It then starts the gateway. Use this button after you have loaded and configured the gateway as needed.
- The **Pause** button restarts the gateway, then prevents it from running its gateway program. This stops the gateway indefinitely. To resume gateway operation, click on the **Reset** or **Go** button.

This button can be useful if you have clicked on **Reset** or **Restart** and want to make more configuration changes than the 25-second timer would allow. It is also useful if you want to stop the gateway for diagnostic purposes without affecting the configuration data.

FastPath 4 Gateway

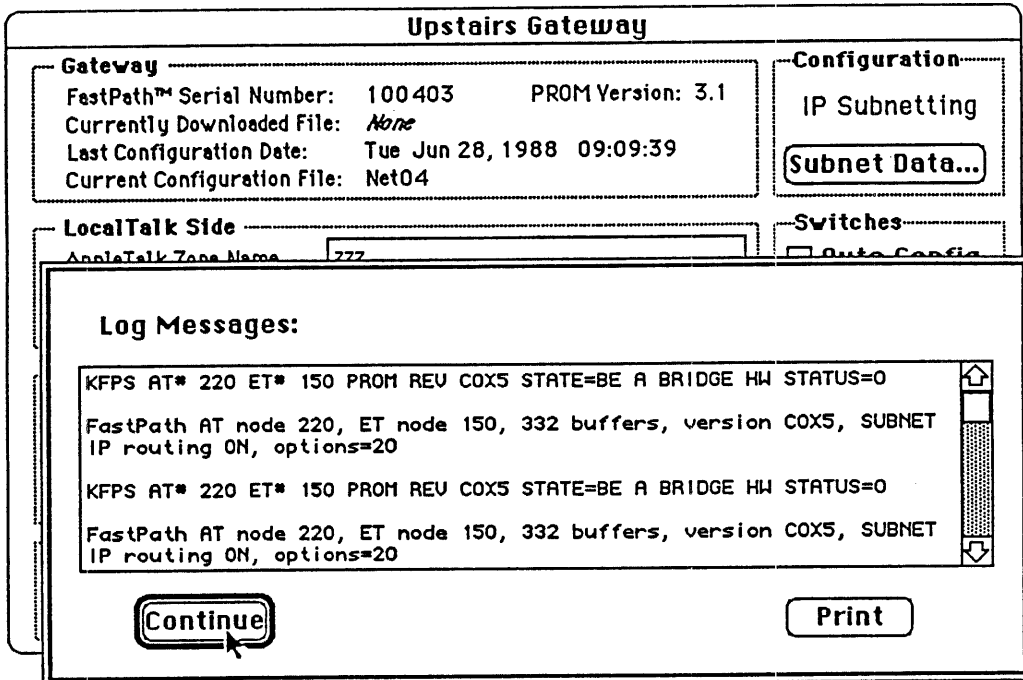


Figure 3-4: Log Window

Log Messages Window

The Log Messages window, which appears when you click on the Log button in the main configuration window, is shown in Figure 3-4. This window displays a diagnostic messages log that differs from the Diagnostics window in these important aspects:

- The Log Messages window displays the most recent messages generated by the gateway, regardless of whether FastPath Manager was running when the messages were generated.

The Diagnostics window begins monitoring when you launch FastPath Manager.

- The Log Messages window shows messages pertaining to both of the networks, Ethernet and LocalTalk, that are directly connected to the gateway.

The Diagnostics window reads only the LocalTalk network.

- The Log Messages window shows only the messages that were generated by the currently selected gateway.

The Diagnostics window displays all messages read from the LocalTalk network.

- The Log Messages window shows only the most recent 586 or fewer diagnostic-message characters, read from a buffer in the gateway's memory.

The Diagnostics window holds as many as 32 kilobytes, read directly from the network.

Options Window

The Options window, which appears when you click on the **Options** button in the main configuration window, is shown in Figure 3-5. This window lets you enable or disable any options that are in the gateway program. It provides selection boxes for 32 options, along with a 32-byte parameters space.

The Help area operates like the one in the main configuration window.

If you have loaded a gateway program that has options, you can enable each option by clicking on the appropriate box and disable it by clicking on the box again. When an option is enabled, the corresponding box contains an X. When the option is disabled, the box is empty; the disabled state is the default for all options.

Clicking on a box that does not correspond to one of the gateway program's options causes no action except to toggle the X on and off.

If you select an option that requires user-supplied data, enter it in the Option Parameters area. That area displays the entire 32 bytes of parameter space, but your option probably uses only a small part of that space. Two buttons on the right let you choose

FastPath 4 Gateway

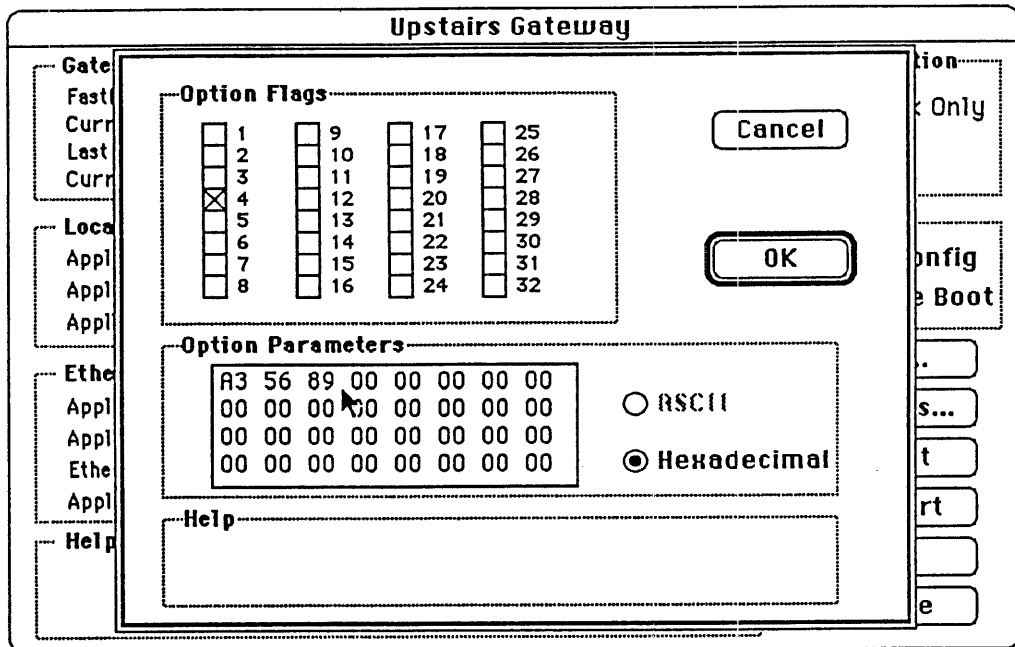


Figure 3-5: Options Window

whether to enter parameters as ASCII characters or as hexadecimal numbers.

You can use the mouse to move the cursor to the specific character where you want to start typing. When you type, you overwrite the existing characters; you do not insert new characters between them. Pressing the Backspace or Delete key moves the cursor backward but does not alter any characters.

The standard options for the FastPath 4 gateway's built-in software and the K-STAR gateway program are described in Table 3-1. If you use a different gateway program, its options may or may not be similar to these.

If you have selected boxes or entered parameters, but want to abandon those choices, click on the **Cancel** button to return to the main configuration window.

Table 3-1: FastPath 4 Software Options

Option*	Effect When Not Selected (Default)	Effect When Selected
1	None	None
2 (K-STAR and PROM code)	The gateway refuses to transmit Ethernet packets if CRS (carrier sense) signal from the transceiver is absent.	The Ethernet controller ignores the possible absence of a CRS. This option is primarily for use when the gateway is connected to an Ethernet broadband network.
3 (PROM code)	The gateway applies a mask to decide whether it should attempt IP address resolution.	The gateway sends all IP packets to a default router.
4 (K-STAR)	The gateway recognizes (and transmits) an IP broadcast address as one having all 1-bits in the relevant portions. For example, the Class C network broadcast address would be <i>nn.nn.nn.255</i> (all 1-bits in the host portion only).	The gateway recognizes (and transmits) an IP broadcast address as one having all 0-bits in the relevant portions. For example, the Class C network broadcast address would be <i>nn.nn.nn.0</i> .
5 (K-STAR)	The gateway can send EtherTalk packets through its Ethernet connection.	The gateway cannot send EtherTalk packets. If FastPath Manager is running on a device that is connected directly to the Ethernet network, it cannot locate this gateway when option 5 is enabled.
6 (K-STAR and PROM code)	When the gateway needs to know the Ethernet address that corresponds to a known AppleTalk node number, it sends out a query packet using the standard AppleTalk Address Resolution Protocol (ARP).	The gateway sends two separate packets, one using AppleTalk ARP and the other using IP ARP as if the gateway were an IP host.
<p>* In the first column of this table, <i>PROM code</i> indicates an option you can use with the built-in gateway code for AppleTalk or IP routing. <i>K-STAR</i> indicates an option you can use with the K-STAR gateway program.</p>		

When you have made the desired selections and entries, click on the **OK** button to accept that information and return to the main configuration window.

FastPath 4 Gateway

Configuring for IP Subnetting

If your FastPath 4 gateway will have to communicate with IP devices and you choose not to use K-STAR, then you should select IP Subnetting from the Configuration menu while the main configuration window is displayed.

After you have provided any necessary information in the main configuration window, click on the Subnet Data button to display the Subnet Data window.

Subnet Data Window

The Subnet Data window is shown in Figure 3-6. This window lets you specify IP address data for both networks connected to the gateway. If you are not familiar with IP addressing conventions, read Appendix F, "IP Address Management."

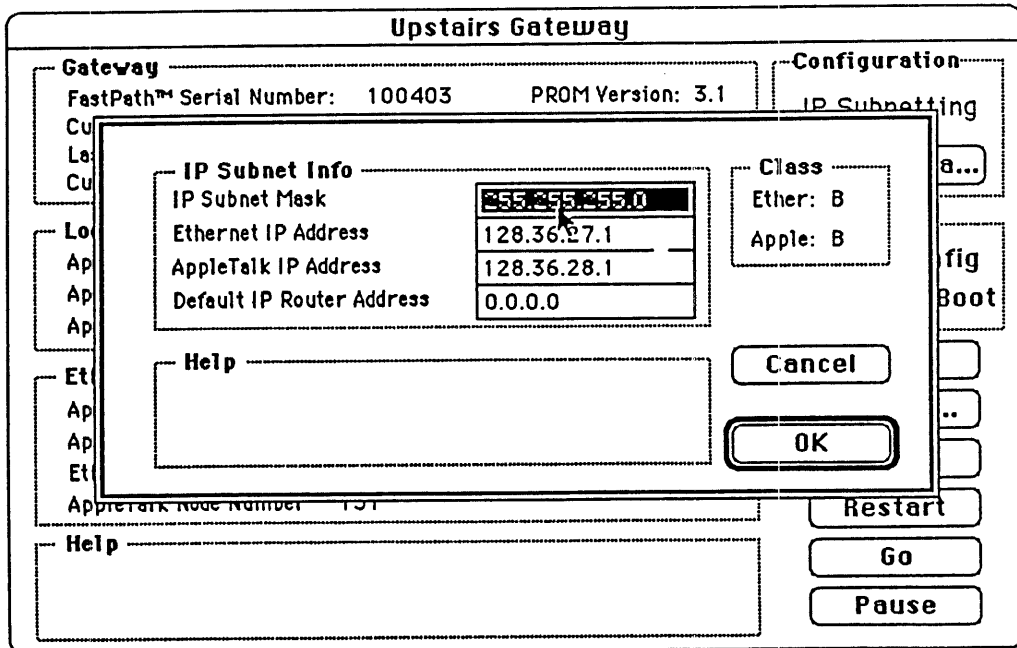


Figure 3-6: Subnet Data Window

- IP Subnetwork Mask** The IP Subnetwork Mask field uses a 32-bit binary number to specify which bits of the IP address are to be used as a subnet address. The 1-bits in the mask correspond to the subnet portion (including the network portion) of the IP address and the 0-bits correspond to the host number. If you enter a mask in this field, you must enter all 32 bit values.
- Gateway IP Addresses** The gateway has two IP addresses, one for each network attached to it.
- The Ethernet IP Address field specifies the IP address of the gateway Ethernet port. The AppleTalk IP Address field specifies the IP address of the gateway's AppleTalk port.
- Default Router** A router is a device that keeps track of where to send messages that are intended for remote networks. The FastPath 4 gateway can perform routing for AppleTalk packets but not for IP packets.
- If an IP message packet is addressed to one of the networks directly attached to the gateway, the gateway can route it correctly. If the addressee is not on an attached network, however, the message must go through an IP router.
- If you fill in the IP Address of Default Router field, the gateway always sends nonlocal IP messages to the specified router.
- Class Area** The Class area tells whether the Ethernet and AppleTalk IP addresses a Class A, B, or C. FastPath Manager calculates the classes, based on the first two bits of each address.
- For more information about IP address classes, see "Network Classes" in Appendix F.
- Help Area and Buttons** The Help area operates like the one in the main configuration window.
- If you want to abandon all data changes in this window, click on the **Cancel** button to return to the main configuration window.
- When you have entered all necessary data, click on the **OK** button to accept your data and return to the main configuration window.

FastPath 4 Gateway

Configuring for K-STAR

If you choose to use K-STAR, then you should select K-STAR from the Configuration menu while the main configuration window is displayed.

FastPath Manager provides two windows for K-STAR configuration: The K-STAR Data window, which appears when you click on the K-STAR Data button in the main configuration window, is shown in Figure 3-7. From this window, you can go to the Servers and Parameters window, which is shown in Figure 3-8.

In either window, the Help area operates like the one in the main configuration window.



The automatic configuration feature is disabled when you select K-STAR configuration.

IP Information	
IP Address of FastPath Box	89.0.13.59
IP Subnetwork Mask	0.0.0.0
IP Broadcast Address	0.0.0.0
IP Address of Default Router	0.0.0.0

Table Sizes	
Dynamic Addresses	40
Static Addresses	20

Administrator	
IP Address of Administrator Host	0.0.0.0

UDP Side	
AppleTalk Zone Name	*
AppleTalk Network Number	4
AppleTalk Node Number	23

Help

More...
Cancel
OK

Figure 3-7: K-STAR Data Window

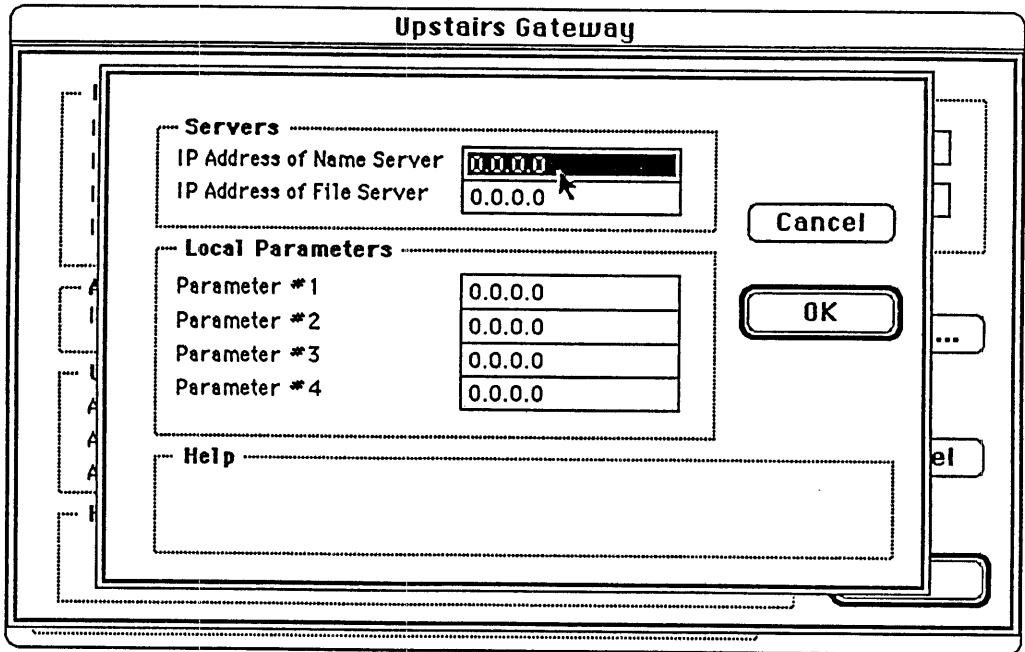


Figure 3-8: K-STAR Servers and Parameters Window

K-STAR Configuration Guidelines

The two K-STAR windows contain more data fields than any single installation is likely to need. To determine your needs, follow the guidelines listed below:

1. If your network uses 0-bits instead of 1-bits to indicate IP broadcast addresses, turn on option 4 as described in "Options Window," above.
2. If you do not want the Ethernet network to carry any EtherTalk packets, turn on option 5, as described in "Options Window," above.

After providing any necessary information in the main configuration window and Options window, click on the K-STAR Data button to display the K-STAR Data window.

3. Supply the IP address of the gateway, in the K-STAR Data window.

4. If the gateway is on the same IP network as a UNIX host running the atalkad host software (daemon), fill in the IP Address of Administrator Host field of the K-STAR Data window. That field and atalkad are discussed in the next section, "K-STAR Data Window."

If there is no such host, fill in the Table Sizes and UDP Side areas of the K-STAR Data window and all pertinent information in the Servers and Parameters window, as described in the next two sections.

5. If the gateway is attached to an Ethernet network that uses IP subnet addressing, but there is no device on that network that sends ICMP packets to supply the subnet mask, you must supply that mask in the IP Subnetwork Mask field of the K-STAR Data window.
6. If both of the following conditions are true, fill in the IP Address of Default Router field of the K-STAR Data window:
 - The local Ethernet network includes at least one IP router.
 - No router on the local Ethernet network uses Routing Information Protocol (RIP) packets to maintain IP routing data.
7. If your internet indicates IP broadcast addresses by some method other than a host portion of all 0-bits or 1-bits, fill in the IP Broadcast Address field of the K-STAR Data window.

The next two sections describe the K-STAR Data window and the Servers and Parameters window.

K-STAR Data Window

The K-STAR Data window lets you specify various data to help the FastPath 4 gateway assign IP addresses dynamically. As shown in Figure 3-6, this window is divided into several distinct areas, each of which is discussed below.

IP Information Area

The IP Information area lets you specify several addresses relevant to the subnet that is attached to the gateway, as described below.

In the IP Address of FastPath Box field, you must enter the IP address assigned to the gateway.

The IP Broadcast Address field governs the address used to address all nodes within a given subnet. By default, this field displays a zero (0) and the gateway calculates a broadcast address based on its subnet address. If you enter a value in this field, FastPath Manager does not check its validity; the gateway will attempt to use the value you enter.

Normally, the host portion of an IP broadcast address is all 1-bits, giving a byte value of 255 (in decimal notation). If option 4 is selected in the Options window, the host portion is all 0-bits. For example, if the subnet is 128.2.36, the calculated IP broadcast address would be 128.2.36.255 or 128.2.36.0, depending on option 4.

The IP Subnetwork Mask field uses a 32-bit binary number to specify which bits of the IP address are to be used as a subnet address. The 1-bits in the mask correspond to the subnet portion (including the network portion) of the IP address and the 0-bits correspond to the host number. If you enter a mask in this field, you must enter all 32 bit values.

If you do not enter anything in the IP Subnetwork Mask field, the gateway attempts to determine the correct entry. If it can determine the local subnet mask from ICMP (Internet Control Message Protocol) packets on the network, it uses that mask value. Otherwise, it assumes a mask based on the address class with no subnetting, as listed in Table 3-2.

The IP Address of Default Router field is useful if there is an IP router on the local Ethernet network but neither it nor any other router on that network uses Routing Information Protocol (RIP)

FastPath 4 Gateway

Table 3-2: Default Subnet Masks

Network Address Class	Value of First Byte	Default Subnet Mask
Class A	1-127	1111 1111 0000 0000 0000 0000 0000
Class B	128-191	1111 1111 1111 1111 0000 0000 0000 0000
Class C	192-223	1111 1111 1111 1111 1111 1111 0000 0000

packets to maintain IP routing data. (A router is a device that keeps track of where to send messages that are intended for remote networks.) The FastPath 4 gateway can perform routing for AppleTalk packets but not for IP packets.

If an IP message packet is addressed to one of the networks directly attached to the gateway, the gateway can route it correctly. If the addressee is not on an attached network, however, the message must go through an IP router.

If you specify an address in the IP Address of Default Router field, the gateway always sends nonlocal IP messages to that router. If you do not specify a default router address, the gateway uses the router address from the most recent Routing Information Protocol (RIP) packet that it has detected among the network traffic. IP routers send these RIP packets periodically to update their routing tables just as AppleTalk routers send RTMP packets.

Administrator Area

If the internet includes a UNIX-based host computer, that host can serve as a network administrator. To do so, it must be running a special *daemon*, or process, normally called *atalkad*. Kinetics does not provide *atalkad*, but can help you obtain it. In the IP Address of Administrator Host field, enter the IP address of the host running the *atalkad* daemon.

UDP Side Area

Ethernet cabling can carry messages under more than one protocol, through the use of different data in packet headers. Information in the UDP Side Area pertains to AppleTalk packets encapsulated in User Datagram Protocol (UDP) messages that are communicated through the gateway's Ethernet port.

The UDP network does not have to be in the same AppleTalk zone as the Ethernet network, even though they share the same cable.

If you do not specify an AppleTalk network number or zone name for the UDP side, the gateway tries to determine it from a file (named `atalkatab`) on the administrator host computer.

You cannot alter the AppleTalk node number. The K-STAR software automatically derives it from the last byte of the gateway's IP address.

Table Sizes Area

In the Table Sizes area, you can specify the maximum number of dynamically assigned IP addresses and the maximum number of static IP addresses to be served by the gateway in this AppleTalk network. These two numbers cannot add up to more than 60 addresses. If you exceed this limit, FastPath Manager displays an error message in the Help area.

Buttons

Clicking on the Cancel button causes FastPath Manager to abandon all data changes in this window and to return you to the main configuration window.

Clicking on the OK button causes FastPath Manager to accept your data and return to the main configuration window. Use this button when you have entered all necessary data.

Servers and Parameters Window

The Servers and Parameters window lets you specify information about a name server, a file server, and other local parameters that are used by network-oriented applications. Some or all of these fields might not apply to your network.

Servers Area

A name server is a computer or host process that translates host names into addresses. If your internet has a name server, enter its IP address in the IP Address of Name Server field.

A file server is a computer or host process that acts as a remote storage or device controller. This means that other computers on the internet can read and write files on the file server's disks and, in some cases, use printers or other devices that are attached to the server. If your internet has a file server, enter its IP address in the IP Address of File Server field.

FastPath 4 Gateway

Local Parameters Area Macintosh applications can be written to request parameters from the gateway. You can configure four such parameters in this area for later access by such applications. The gateway just stores the parameters; it does not use them.

Buttons

If you want to abandon all data changes in this window, click on the **Cancel** button to return to the K-STAR Data window.

When you have entered all necessary data, click on the **OK** button to accept your data and return to the K-STAR Data window.

Printing a Configuration

To keep your network records complete, you can print a list of all of the FastPath gateway's configuration data, as shown in Figure 3-9. The gateway's name is at the top of the sheet, followed by window replicas showing all applicable data. To print this list, either pull down the **File** menu and select **Print Configuration** or press the command-P key combination.

Saving a Configuration File

You can also save your configuration data in a disk file. To do so,

1. Pull down the **File** menu and select **Save Configuration File**. If you prefer, you can press the command-S key combination instead of using the menu.
2. Type a file name in the **File Selection** window. If necessary, use the buttons to change disks.
3. Click on the **Save** button.

The saved configuration file can be useful if anything disturbs the configuration of the gateway, or if you want to configure another gateway similarly.

Upstairs Gateway

Gateway FastPath™ Serial Number: 100123 PROM Version: 3.1 Currently Downloaded File: K-STAR Last Configuration Date: Fri Jun 24, 1988 10:05:27 Current Configuration File: Net13		Configuration K-STAR																																																																									
LocalTalk Side AppleTalk Zone Name * AppleTalk Net Number 13 AppleTalk Node Number 185		Switches Auto Config YES Remote Boot NO																																																																									
Ethernet Side AppleTalk Zone Name * AppleTalk Net Number 0 Ethernet Address 080089A00030 AppleTalk Node Number 176		Table Sizes Dynamic Addresses 40 Static Addresses 20																																																																									
IP Information IP Address of FastPath Box 89.0.13.39 IP Subnetwork Mask 0.0.0.0 IP Broadcast Address 0.0.0.0 IP Address of Default Router 0.0.0.0																																																																											
Administrator IP Address of Administrator Host 0.0.0.0																																																																											
UDP Side AppleTalk Zone Name * AppleTalk Network Number 0 AppleTalk Node Number 0																																																																											
Servers IP Address of Name Server 0.0.0.0 IP Address of File Server 0.0.0.0																																																																											
Local Parameters Parameter #1 0.0.0.0 Parameter #2 0.0.0.0 Parameter #3 0.0.0.0 Parameter #4 0.0.0.0																																																																											
Option Flags <table border="1"> <tr><td>1</td><td>9</td><td>17</td><td>25</td></tr> <tr><td>2</td><td>10</td><td>18</td><td>26</td></tr> <tr><td>3</td><td>11</td><td>19</td><td>27</td></tr> <tr><td>4</td><td>12</td><td>20</td><td>28</td></tr> <tr><td>5</td><td>13</td><td>21</td><td>29</td></tr> <tr><td>6</td><td>14</td><td>22</td><td>30</td></tr> <tr><td>7</td><td>15</td><td>23</td><td>31</td></tr> <tr><td>8</td><td>16</td><td>24</td><td>32</td></tr> </table>		1	9	17	25	2	10	18	26	3	11	19	27	4	12	20	28	5	13	21	29	6	14	22	30	7	15	23	31	8	16	24	32	Option Parameters <table border="1"> <tr><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td></tr> <tr><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td></tr> <tr><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td></tr> <tr><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td><td>00</td></tr> </table>		00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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Printed Tue Jun 28, 1988 15:35:00

Figure 3-9: Configuration Printout

Loading the Gateway Program

If your FastPath 4 gateway is to use K-STAR routing, you must select and load the K-STAR gateway program. Gateway programs for other protocols are also possible, but are not commercially available at this time.

Gateway software for AppleTalk routing and some IP subnetting resides in the gateway's PROM and therefore does not have to be loaded.

To load a program into the FastPath 4 gateway,

1. Pull down the **File** menu and select **Download File....** If you prefer, you can press the command-L key combination instead of using the menu.
2. Select and open a gateway program from the File Selection window. That window lists all text files on the disk.

The gateway program encapsulates packets, to convert them between AppleTalk and other protocols, so a device that uses one protocol can handle a packet of data from a device that uses a different protocol.

Which gateway program you load depends on the specific routing scheme and protocols that the internet is to use. At this time, only one gateway program is provided on the FastPath Manager disk: K-STAR. If your network situation requires a gateway program that is not available, read the *FastPath Programmer Manual* for information on writing custom gateway programs.

Chapter 4

Troubleshooting

Some problems in network operation are easy to find and fix. The situation might be as simple as a gateway accidentally switched off or a cable connection worked loose. This chapter suggests solutions to some problems that can arise during network installation or operation.

Inspection of Equip- ment and Connections

If there is a problem with network operation, first try to isolate the area in which the problem occurs. Then use the list below to check the equipment and connections in a particular area or on the whole network.

- Make sure the FastPath gateway is plugged in and switched on.
- On each Macintosh computer in the network, make sure the LocalTalk connector is plugged into the printer port, *not* the phone port.
- Make sure no cable connections are loose or unplugged. LocalTalk cable connections can work loose if not secured with cable ties.
- Refer to your network medium's documentation to ensure that the cables are installed correctly.
- Swap equipment to check for defective devices, cable, connections, and power sources.

FastPath 4 Gateway

Problems during Installation

Two common kinds of installation problems are:

- The FastPath Manager program refuses to load a file or gateway program.
- The FastPath Manager program can't find the gateway.

This section suggests some likely causes and solutions for these problems. After reading this section, if you still can't fix the problem, contact your dealer or call Kinetics as discussed in Appendix H.

Unable to Load

Problem: The FastPath Manager program refuses to let you load a file or gateway program.

- **Possible cause:** The FastPath gateway is installed incorrectly.

Solution: Check and correct the installation by reviewing the installation instructions, step by step.

- **Possible cause:** A gateway program is already loaded and running.

Solution: If you want to keep your other configuration data intact, click on **PAUSE**, then load the desired gateway program and click on **GO**.

Alternatively, you can click on **RESET** to remove the gateway program and all other configuration data from the FastPath gateway's memory, then load new configuration information and (if needed) a new gateway program.

- **Possible cause:** You are trying to load an inappropriate file.

Solution: Make sure the file you are trying to load is really a complete gateway program. For instance, you cannot load the files that are in the example folders on the FastPath Manager disk; they are intended as programming examples only.

Can't Find Gateway

Problem: The FastPath Manager program cannot find the gateway. After you choose a command from the Gateways menu, neither a "Gateway Has Been Reset" window nor a "Configuration" window appears for the gateway.

- **Possible cause:** The FastPath gateway is installed incorrectly.

Solution: Check and correct the installation by reviewing the installation instructions, step by step.

- **Possible cause:** A LocalTalk cable or connector is defective.

Solution: Install a different set of LocalTalk connectors. Swap with another device, if necessary, to find out whether this is the actual cause of the problem, then replace the faulty items.

- **Possible cause:** AppleTalk is not enabled on the Macintosh that is running FastPath Manager.

Solution: Using the Print Chooser, Chooser, or Control Panel desk accessory (depending on the version of System file you are using), select AppleTalk Connected or AppleTalk Active. If you can't enable AppleTalk, contact your Macintosh dealer for more information.

- **Possible cause:** The System's Ethernet setting is wrong.

Solution: Launch the Control Panel and then, in the scrollable area on its left side, select the Network icon. The Control Panel displays two icons. If the Macintosh is attached directly to an Ethernet network, click on the EtherTalk icon. If the Macintosh is attached directly to a LocalTalk or equivalent network, click on the Built-in icon.

- **Possible cause:** The System file is too cluttered.

Solution: Some INIT files, desk accessories, and other System file modifications are incompatible with each other or with other software. Try restarting the Macintosh with the FastPath Manager disk, which includes a complete System folder.

FastPath 4 Gateway

- **Possible cause:** Cannot be determined.

Solution: If you can't determine why the FastPath Manager is unable to find the gateway, try turning the gateway off and then on again. If this doesn't correct the problem, try quitting the FastPath manager and then restarting the Macintosh.

IP Setup Errors

If a gateway is configured for IP Subnetting, it disables IP routing when it detects an IP routing error. At the same time, the gateway sends the following diagnostic message:

IP SETUP ERROR *error_code*

In that message, *error_code* is a hexadecimal number indicating the specific error. The error codes are described in Appendix G.

If you have trouble setting up Internet Protocol (IP) addressing, refer to "IP Setup Error Codes" in Appendix G.

Chapter 5

Network Utilities

This chapter describes how to use the Look and Echo utility programs to help you test your internet. Both programs are included on the FastPath Manager Network Utilities disk.



Look and Echo are not copy-protected. You can install either of them on a hard disk by inserting the FastPath Manager Network Utilities disk and then dragging the Look or Echo icon to the hard disk icon or window.

Look

Look is an AppleTalk network monitor, which you can use to find and correct network problems. Often, this information is all you need to determine the source of many types of network configuration or equipment errors. Through Look, you can

- Monitor the network for possible configuration changes. The information that Look provides about RTMP (Routing Table Maintenance Protocol) packets tells you whether the network is configured correctly and whether all bridges and gateways are functioning properly.
- Troubleshoot the network. The graphic representation of network activity lets you quickly spot variations in normal network traffic. The diagnostic packets that Look collects and displays provide information about problems on the network.
- Debug the network. The diagnostic packets make it easier to debug gateway programs. Look displays any diagnostic messages that you program into the gateway. For information on writing and debugging gateway programs, refer to the *FastPath Programmer's Manual*.

FastPath 4 Gateway

What Look Provides

Look can display three different types of information:

- A graphic representation of the amount of activity on the network
- Information about RTMP packets on the network
- Information about diagnostic packets on the network

Look displays this information simultaneously in three windows—the AppleTalk Traffic window, the RTMP Packets window, and the Diagnostic Packets window—as shown in Figure 5-1.

When monitoring the network, Look does not send packets over the network. Instead, it monitors the network passively, so you can run it without increasing the network traffic load.

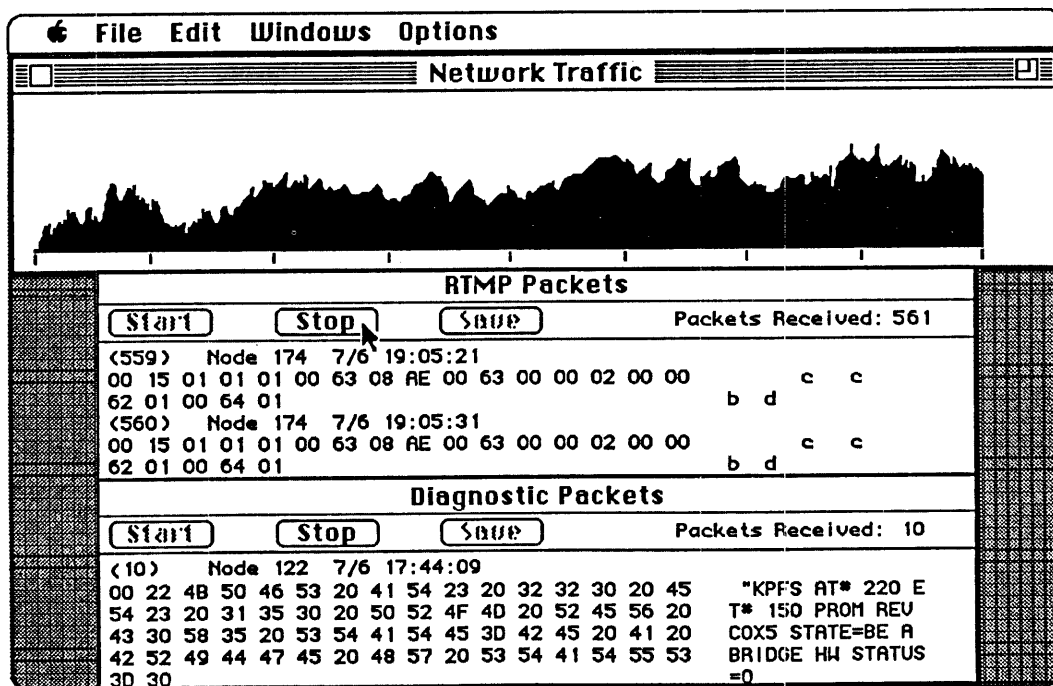


Figure 5-1: Three Windows of Look

How to Start and Stop Look

To start Look, insert the FastPath Manager Network Utilities disk into the Macintosh disk drive and double-click on the Look icon.

You can quit Look at any time by pulling down the File menu and selecting Quit.



It is best not to run any background application, such as AppleShare, on the Macintosh that is running Look. If you do, quitting Look loses the connection to the background application and causes the Macintosh to display a message window telling you that the disk is damaged and cannot be used. If you see this message, do not allow the Macintosh to "repair" or reformat the disk; just reconnect the background application.

Using the Windows in Look

All three windows are standard Macintosh document windows. You can use standard Macintosh techniques to open, close, and change the size of any window.

Look also has a special **Windows** menu that lists the names of all three windows. Selecting the name of a window from this menu opens the window (if it is not open already) and brings the window to the front. A check mark next to the name of the window in the menu indicates which window is currently in front. If you use the **Close** or **Zoom** command, it acts on the front window.

When you first start Look, its windows are sized to let you see all three windows on the screen at the same time, as shown in Figure 5-1. Enlarging the RTMP Packets window or the Diagnostic Packets window and bringing it to the front lets you view more packet information at a glance. Also, you might want to bring the AppleTalk Traffic window in front of the other windows so you can print a screen showing an unusual network traffic pattern.

When you have clicked on the Stop button in a window, to temporarily stop packet collection, you can use the right-side scroll bar to look through packet information that has scrolled past the top of the window.

The AppleTalk Traffic Window

The AppleTalk Traffic window, at the top of the screen, displays a series of network activity samples which, together, graphically represent the traffic on the LocalTalk network.

As Look monitors the network traffic, it computes the total amount of activity over a five-second period. For each five-second sample, Look draws a vertical line whose height is proportional to the monitored activity level. It continues to collect samples and draw lines, progressing from left to right in the window to plot a graph like that shown in Figure 5-1. When the plot reaches the right edge of the window, the picture scrolls to the left, so the display always shows the most recent activity.

All network activity is displayed, even when it is just noise due to a bad connection or an unterminated cable. By observing the differences between the peaks and valleys shown in the AppleTalk Traffic window, you can determine the relative status of the network at a given time.

You can use this information to identify unusual patterns in network traffic. After you become accustomed to the activity readings on your network, you will be able to discern the usual patterns of network traffic and thus will be able to recognize any deviation from normal traffic patterns.

The RTMP Packets Window

The RTMP Packets window, in the middle of the screen, displays all RTMP packets sent over the network. Gateways and bridges use the information in these packets to determine how to route data to any destination on the network.

Window Contents

Figure 5-2 illustrates the contents of this window, which are

- Three buttons at the top left of the window. Information in the RTMP Packets window scrolls up continuously, as Look obtains new information. You can click on the Stop button to suspend the collecting and displaying of new packets, so you can review previous packet information.

Click on the Save button to store the packet information to a file. Click on the Start button to restart the collecting and displaying of new packets. These buttons are discussed in more detail below, in "Controlling Data Collection and Storage."

- The number of packets received, at the top right corner of the window. This number tells you how many packets Look has collected and displayed during this session.
- A packet number, shown in parentheses, for each packet. This is a sequence number that Look assigns to identify each packet. It is not part of the transmitted packet or its envelope.
- A node number to the right of the packet number. This number identifies which Macintosh or other network device sent the packet.
- The date and time the packet arrived. These are shown to the right of the node number.
- The contents of each packet, with each byte shown as a pair of hexadecimal digits.
- ASCII representation of any byte values that correspond to printable ASCII characters. These are shown to the right of the hexadecimal representation.

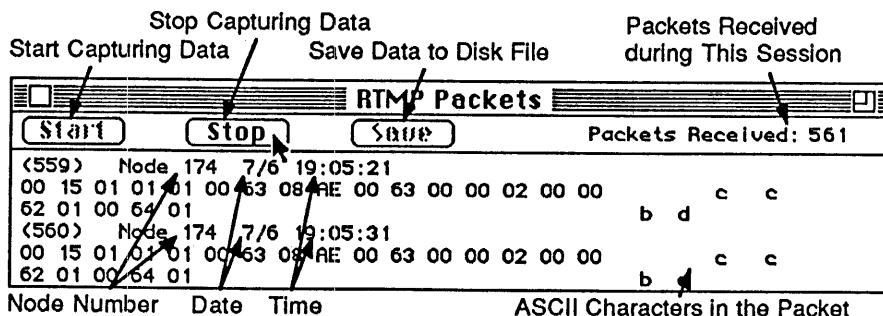


Figure 5-2: Contents of RTMP Packets Window

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Interpretation of RTMP Packets

With the information in the RTMP Packets window, you can determine the general configuration of the network and quickly spot any problems. Use this window to verify that your network configuration is correct.

The information in this window shows the packets sent among bridges and gateways on the network. Look shows each packet's contents in groups of 3 bytes, with each byte represented as a pair of hexadecimal digits. Each 3-byte group describes the existence of one bridge or gateway, and its distance, in hops, from the node that sent the packet. (A hop represents a packet's passage through one network.)

For example, the highlighted group in Figure 5-3 pertains to network 5 (reported as "00 05"). The last byte of the group shows that network 5 is just one hop away from the bridge that sent the packet.

By reading the packet contents, you can identify discrepancies between the way you planned your network and the way it is actually configured. For example, you can identify differences between the network number you assigned to a bridge or gateway and the actual network number used. Also, if a network does not appear in the RTMP Packets window, you can assume that the corresponding bridge or gateway is not operating.

RTMP Packets		Packets Received: 561	
Start	Stop	Save	
<559>	Node 174	7/6 19:05:21	
00 15 01 01 01 00 63 08 AE 00 63 00 00 02 00 00			c c
62 01 00 05 01			b
<560>	Node 174	7/6 19:05:31	
00 15 01 01 01 00 63 08 AE 00 63 00 00 02 00 00			c c
62 01 00 05 01			b

Network 0005 is one hop away.

Figure 5-3: Gateway Data in an RTMP Packet

RTMP Packet Structure

Figure 5-4 illustrates the format of an RTMP data packet.

The first three bytes are the AppleTalk Link Access Protocol (ALAP) header. They contain the AppleTalk node numbers of the destination and source bridges, along with a number describing the packet type. LAP type 1 indicates a short-form Datagram Delivery Protocol (DDP) packet.

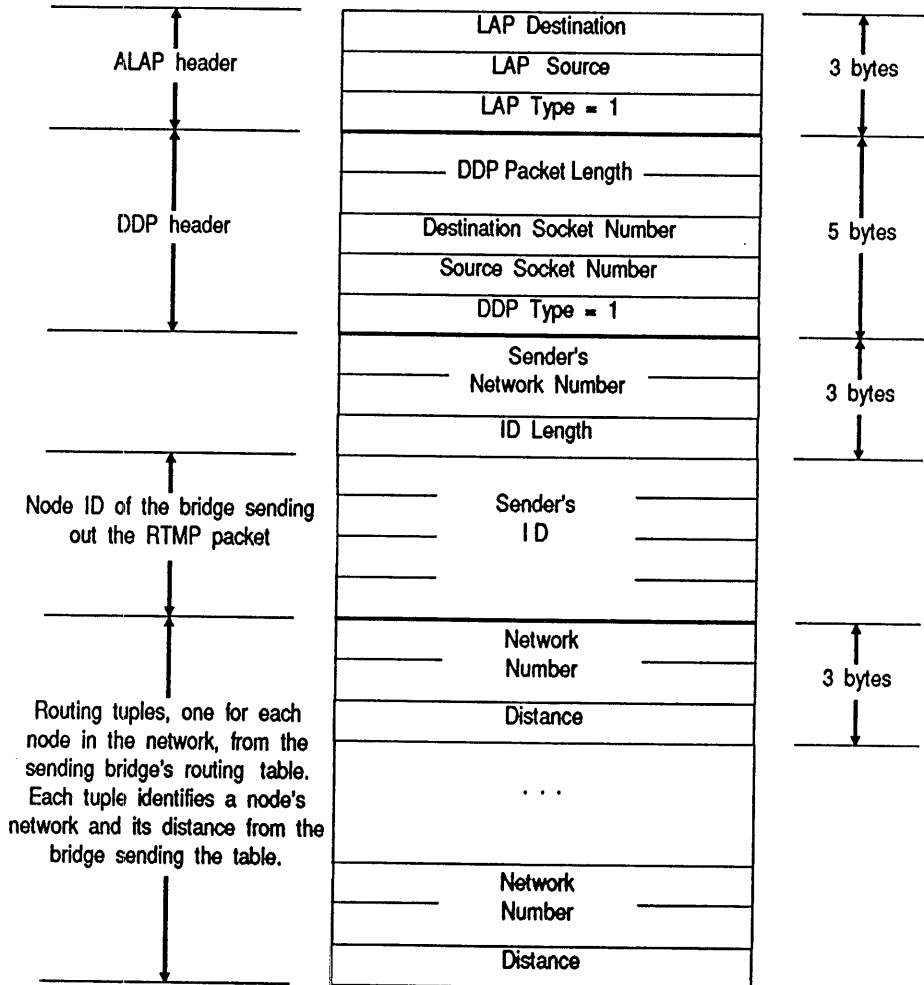


Figure 5-4: Format of an RTMP Data Packet

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The next five bytes are the DDP header. The first two bytes of this header define the length (in bytes) of the packet, starting with the first byte of the DDP header. The third and fourth bytes contain the AppleTalk node numbers of the destination and source bridges. The fifth byte contains a number describing the DDP packet type; DDP type 1 indicates an RTMP data packet.

The remainder of the packet is RTMP information, consisting of three parts: the sender's network number, the sender's node identifier, and the routing tuples.

The first two RTMP bytes represent the network number of the bridge or gateway port through which the packet was sent. This field lets the packet's receiver determine the number of the network through which it received the packet.

The sender's node identifier is the node number of the bridge or gateway port through which the packet was sent. This field is of variable size, to allow for ports that are connected to networks other than AppleTalk networks. The first byte contains the length, in bits, of the whole field. This is followed by the node number itself, with the most significant byte first. If the node number is not an exact multiple of 8 bits long, it is prefixed with enough 0-bits to make it so.

Finally, there are a variable number of routing tuples from the sending bridge's routing table. Each tuple consists of a 2-byte network number followed by a 1-byte distance descriptor (in hops).

If the internet has a large number of networks, the entire routing table might not fit into a single datagram. In that case, the tuples are distributed over as many RTMP data packets as necessary.

The Diagnostic Packets Window

The Diagnostic Packets window, at the bottom of the screen, displays packets containing information about routing or addressing errors and certain types of hardware and software problems. It can also collect and display any message you program into the gateway program. For more information about LAP packets and about creating your own messages, refer to the *FastPath Programmer's Manual*.

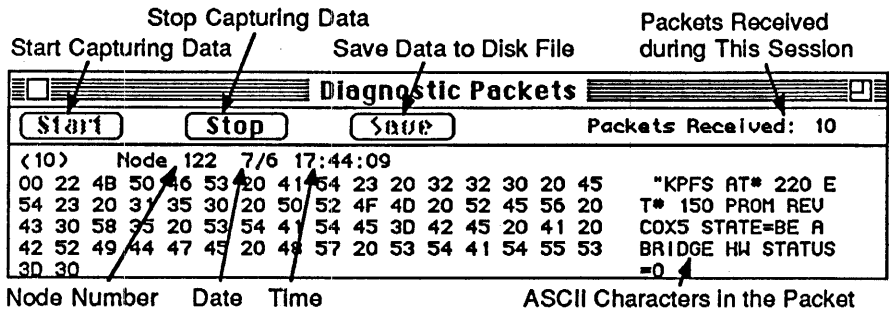


Figure 5-5: Contents of Diagnostic Packets Window

Window Contents

This window, shown in Figure 5-5, is similar in appearance and organization to the RTMP Packets window. The contents are different, however.

The Diagnostic Packets window displays each diagnostic packet in hexadecimal notation. Where the byte values correspond to ASCII characters, those characters are displayed to the right of the hexadecimal display. The ASCII representation usually is a diagnostic message that can help you identify network problems. Appendix H contains a list of the messages you might see in this window.

As in the RTMP Packets window, information scrolls up continuously as Look obtains new packets. You can use the Stop, Save, and Start buttons to control this as discussed below, in "Controlling Data Collection and Storage."

Diagnostic Packet Alarm

Look also lets you set an audible alarm to alert you when a diagnostic packet arrives. Usually, diagnostic messages are rare, so it is helpful to have an audible alert when such a message does show up.

To set this alarm, simply pull down the Options menu and select **Beep on Diagnostic Packets**. A check mark appears beside the command, in the Options menu, to indicate that the alarm is

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on. To turn the alarm off, simply select **Beep on Diagnostic Packets** again.

Trapping a Specific Diagnostic Packet

If you are looking for a specific diagnostic message, you can set a trap to collect and display it.

To set such a trap, pull down the **Options** menu and select **Halt Key**. Look displays a dialog box where you can specify the message text you want to trap, as shown in Figure 5-6. Type the first characters of the packet message, then click on the **OK** button. The key text you enter can be 1 to 64 characters long. The message trap is case-sensitive; that is, it does not match uppercase letters with lowercase letters.

For example, if the key text you type is "Net 23", Look will trap the message "Net 23 went DOWN" (or anything else that begins with "Net 23"). If you type "NET 23," however, Look will *not* trap that message.

Look examines each new diagnostic packet that arrives, to determine whether it begins with the specified string. When the first matching packet arrives, the Macintosh beeps several times, brings the **Diagnostic Packets** window to the front, zooms the window to full screen size, and stops collecting diagnostic

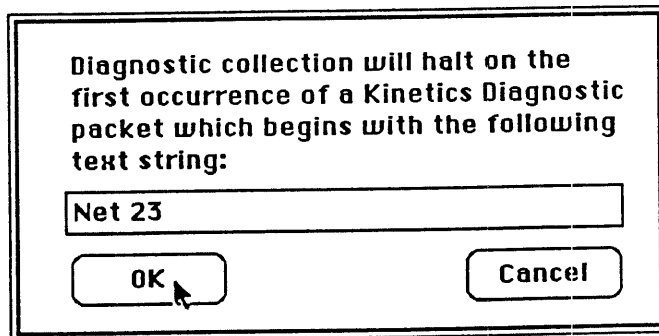


Figure 5-6: Dialog Box for Trapping a Packet

packets. This procedure guarantees that the first matching packet is collected and preserved, no matter what time of day or night it arrives. Since the day and time are displayed with every packet, you can easily determine when the error took place. This lets you track down even the most intermittent errors.

Look does not automatically save a trapped packet, but you can do so yourself, after you have seen the packet.

Controlling Data Collection and Storage

The RTMP Packets and Diagnostic Packets windows each include three buttons—Start, Stop, and Save—that let you control the collection and storage of packet information.

Stopping Packet Collection

When you first start the program, Look automatically begins collecting both RTMP packets and Diagnostic packets. At any time, you can stop the collecting of either type of packet by clicking on the Stop button in the appropriate window. If you happen to do this in the midst of a packet, Look completes the packet before it stops.

Once collection stops, Look adds the right-hand scroll bar to the window so you can view information about previously collected packets. The window keeps the most recent 32 kilobytes of text; if more than 32 kilobytes of information has been collected, the oldest information is lost.

Also, while collection is stopped, you can save packet information in a MacWrite file or copy packet information to the Clipboard, a text file, or a MacPaint file.

Look continues to count the packets that arrive, and increment the packet counter to the right of the buttons, even while collection is stopped.

Saving Packet Information In a Text File

With collection stopped, you can click on the Save button to save the packet information in a MacWrite file. This lets you review the information at a later time or print it from any word-processing program that accepts files in the MacWrite format. If you need to call Kinetics for help, it is very helpful to have a copy of the packet information handy.

When you click on the Save button, a standard Macintosh file-name box appears on your screen. It shows a default name for the file, consisting of the letters RTMP (for the RTMP Packets window) or DIAG (for the Diagnostic Packets window) and the current date in month/day/year format. For example, Figure 5-7 shows the default name for a diagnostics file created on September 30, 1988. The name is selected when the box appears, so you can type a different file name.

You can select a different drive, eject a disk and insert a different one, and select a folder, in the usual way.

If you are satisfied with the default file name, or after you have typed a new file name, click on the Save box to write the file. If you have changed your mind and do not want to save the information, click on the Cancel button.

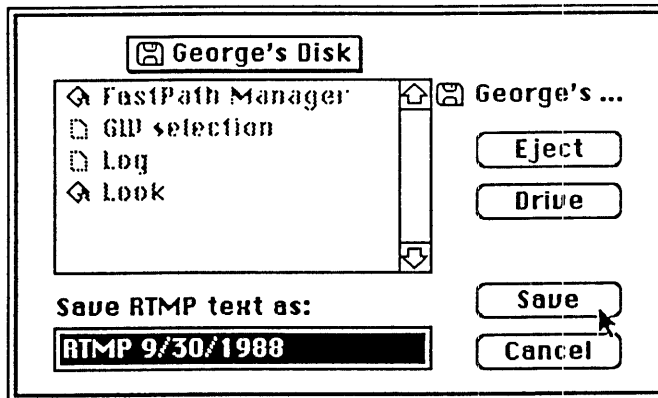


Figure 5-7: Dialog Box for Saving Packet Information

Saving Packet Information in a MacPaint File

With collection stopped, you can save the screen image in MacPaint format by holding down the shift and command keys while you press the 3 key. If an ImageWriter printer is attached to the Macintosh, you can print the screen image by holding down the shift and command keys while you press the 4 key.

Copying Packet Information to the Clipboard

You can copy selected packet information to the Clipboard, if you like. This lets you past the information into a desk accessory, such as the Scrapbook, or into an existing file created by a word-processing program or other Macintosh application. This can be useful when you want to copy only a portion of the information in a window.

With packet collection stopped, use the mouse to select the text you want to copy, then pull down the **Edit** menu and select **Copy**. You can then paste the text into a desk accessory or file in the usual way.

Restarting Packet Collection

You can restart the collecting of packets by clicking on the Start button. Look displays the first packet that arrives after you click on the Start button, and continues until you either click on the Stop button or quit Look.

Although Look continues to count packets that arrive while collection is stopped, it cannot display any other information about those packets.

Echo

Echo is a program that sends out test packets, using the AppleTalk Echo Protocol to test a node's link to the LocalTalk network. It does not send packets across gateways or bridges to other networks in the internet.

You can use Echo to ensure that a newly added node can communicate with all of the other nodes on its network, and to test the integrity of the physical network.

When Echo sends a search packet, using the AppleTalk Echo Protocol, all nodes that are able should reply to it. You then choose one of the responding nodes and initiate a test to validate the AppleTalk link. This test uses the Echo Protocol to exchange a specified number of AppleTalk packets with the chosen node.

Determining when these packets are not echoed, or known nodes are not responding, can help you track down network problems.

Using Echo

To launch Echo, insert the FastPath Manager Network Utilities disk into the Macintosh disk drive and double-click on the Echo icon. You can quit Echo at any time by clicking on the Cancel Test button.

Echo displays a dialog box as shown in Figure 5-8, in which you can specify the node to be tested and the number of Echo packets to include in the test.

Echo then immediately broadcasts an Echo-Request-type packet to the AppleTalk network. It should quickly receive Echo-Reply-type packets in response from:

- Any Macintosh running version 4.1 or later of the System file
- The FastPath gateway
- Any UNIX host that is running both K-Talk and *epd* (Echo Protocol Daemon).

Each reply packet contains the responder's AppleTalk network node number. Echo builds a list of the nodes from which it gets

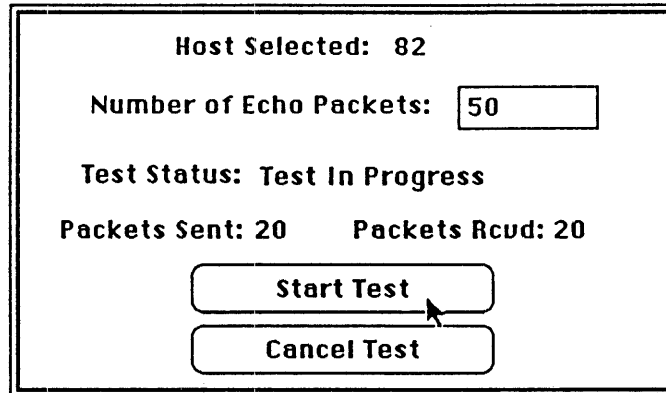


Figure 5-8: Dialog Box for Displaying Echo Results

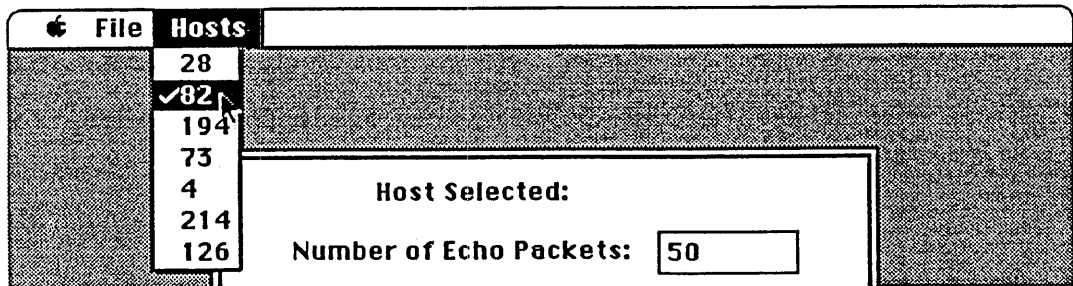


Figure 5-9: Menu List of AppleTalk Node Numbers

such responses. To view this list, just pull down the **Hosts** menu. As shown in Figure 5-9, the node numbers are not necessarily in numeric order; they are listed in the order in which Echo receives them.

Choosing a Node for Testing

Echo can perform an extended test on only one node at a time. To select a node to be tested, pull down the **Hosts** menu and select the corresponding node number.

AppleTalk assigns node numbers on a temporary basis. When a Macintosh is turned off, its node number is canceled; when it is

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turned on again, a new node number is assigned to it. Sometimes, this dynamic assignment can make it difficult to determine node numbers.

Probably the easiest way to identify an AppleTalk node number is through a Telnet program. Kinetics can supply you with such a program if you do not already have one. Launch the program on the Macintosh you want to test, then pull down the **Emulation** menu and select **Show Network Numbers**. The resulting window shows the node's IP address, AppleTalk network number, and AppleTalk node number.

To find the node number of a LaserWriter, you might have to use a process of elimination, by comparing the node numbers of all of the network's Macintoshes with the **Hosts** menu list.

When you know the number of the node you want to test, select it from the list in the Echo program's **Hosts** menu. Echo then displays the node number on the first line of the dialog box. On the second line, enter the number of packets you want Echo to send. If you do not enter a number, Echo assumes a default limit of 50 packets.

To begin the test, click on the **Start Test** button in the dialog box. Echo begins sending Echo Request packets to the specified node and counting the Echo Reply packets that it receives in response from that node.

Echo waits no more than three seconds for a reply to each packet that it sends. As soon as it receives a reply or the time expires, Echo sends the next packet.

Test Results

As the test continues, Echo displays the number of packets sent, the number of packets received, and the current status of the test. The status indicates one of three conditions:

- **Test in Progress.** You have initiated a test and Echo is currently exchanging packets with the selected node.
- **Test Successful.** Echo has sent the number of packets you specified. This does not indicate that the node passed the

test—merely that the test was allowed to finish. If the dialog box shows that Echo received the same number of packets that it sent out, you can assume that the node is securely connected to the network.

- **Test Canceled.** You canceled the test by clicking on the Cancel Test button.

Interpreting the Results of Echo

Two commonly encountered problems are that packets are not echoed or known nodes are not responding. This section suggests some likely causes and solutions for these problems.

Problem: No node numbers appear in the Hosts menu.

Echo broadcasts Echo Protocol packets to search for echo responders. To view the list of responders, pull down the Hosts menu. If no nodes are listed there, the problem might be due to one or more of the following network conditions:

- **Possible cause:** Your Macintosh is not connected to a LocalTalk or EtherTalk network.

Solution: Check carefully to make sure the network connections are secure.

- **Possible cause:** AppleTalk is not enabled on the Macintosh that is running Echo.

Solution: After making the physical connections, you must enable AppleTalk. If the Macintosh is directly connected to Ethernet, you must select EtherTalk from the Control Panel's network option.

To enable AppleTalk, launch the Print Chooser, Chooser, or Control Panel desk accessory (depending on the version of System file you are using) and select AppleTalk Connected or AppleTalk Active. If you can't enable AppleTalk, contact your Macintosh dealer for more information.

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- **Possible cause:** Your network does not have any Echo nodes.

Solution: Make sure the AppleTalk network includes one or more nodes that can respond to Echo Protocol, in addition to the node from which you are running Echo. You should get responses from

- Any FastPath gateway
- Any Macintosh running version 4.1 or later of the System file
- Any UNIX host running K-Talk and the epd daemon.

Problem: The number of packets received does not equal the number of packets sent. This problem might be due to one or more of the following network conditions:

- **Possible cause:** The network connections are not secure.

Solution: Check all of the connectors between the nodes to ensure the integrity of the physical connections. If you don't find a break, run Look to inspect the network traffic. If Look shows below-normal network traffic volume, that could indicate a break in the network.

- **Possible cause:** One or both end nodes are not properly terminated.

Solution: Ethernet or PhoneNET cabling must have terminators installed at each end. LocalTalk connectors do not require terminators, but every cable must be connected at both ends; if you find a cable connected at one end only, remove it.

- **Possible cause:** There is heavy traffic or other interference on the network.

Solution: Run Look to inspect the network traffic. Heavy traffic can cause some packets to be lost.

Appendix A Glossary

address

The uniquely defined destination of a message sent through a communication system.

ALAP (AppleTalk Link Access Protocol)

The underlying protocol for packet transmission between nodes on a single AppleTalk network. ALAP corresponds to the Data Link layer of the ISO-OSI reference model.

AppleTalk

A network architecture developed by Apple Computer and implemented on the Macintosh and other computers and peripheral devices. An AppleTalk network system includes three sets of components: the physical medium; the supporting software; and shared file servers, printers, or other services.

The protocols defined by AppleTalk can run on several kinds of physical media, as discussed in "LocalTalk Connection" in Chapter 1. Specifically, AppleTalk hardware includes any medium that conveys RS-422 signaling as specified in *Inside AppleTalk*.

atalkd

See *daemon*.

AUI (attachment unit interface)

See *transceiver cable*.

backbone

Ethernet cable used to bridge two or more LocalTalk networks.

BNC connector

The type of connector used with thin-Ethernet cable. The FastPath gateway's back panel includes a BNC connector.

bridge

A device used to connect two or more networks at the Data Link layer of the ISO-OSI reference model. The networks can have different physical media. The networks also can use different upper-level protocols, because the bridge only understands addresses. For example, a bridge could conduct an AppleTalk packet from a PhoneNET cable to an Ethertalk cable, but could not transform that packet into one readable by a TCP/IP device. However, another bridge, attached elsewhere on the Ethertalk cable, could conduct the packet to a second PhoneNET cable where AppleTalk devices could read it. Bridges are also useful in connecting networks that use the same medium and protocol; an internet of small networks bridged together can be more manageable than a single large network. See also *gateway*, *repeater*, and *router*.

Chooser

The Macintosh desk accessory that allows a user to select and use devices in any zone of an AppleTalk network or AppleTalk services available on an Ethernet network.

connection box

The small box that is part of a LocalTalk or PhoneNET connection. The box has two connector sockets for the appropriate type of network cable, as well as a connection for the Macintosh port.

datagram

The unit of transmission in the IP protocol. See also *packet*.

DDP (Datagram Delivery Protocol)

The protocol that provides delivery of ALAP packets over an internet. DDP corresponds to the Network layer of the ISO-OSI reference model.

daemon

A process running on a UNIX-based host computer. A special daemon, usually called atalkd, lets the host serve as a network administrator.

Echo

A diagnostic program, provided by Kinetics, that uses the Echo Protocol to measure round-trip delay times or check for the existence of a particular node.

Echo Protocol

The protocol used by the Echo diagnostic program. This is a simple protocol that lets any node send a test packet to any other node on the internet and receive an echoed copy of that packet.

Ethernet

A set of standards defining a type of local area network characterized by a very fast data transmission rate, 10 megabits per second. An Ethernet network can include any of several kinds of physical transmission media, as discussed in "Ethernet Connection" in Chapter 1. See also *thin Ethernet*.

EtherPort II

An internal Ethernet controller board for a Macintosh II computer. This board is a Kinetics product.

EtherPort SE

An internal Ethernet controller board for a Macintosh SE computer. This board is a Kinetics product.

EtherSC

An Ethernet controller device for a Macintosh SCSI interface. This device is a Kinetics product.

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EtherTalk

AppleTalk protocol for communication over Ethernet or thin Ethernet cable. AppleTalk devices can be connected to Ethernet cable directly, through an EtherSC connection box or an EtherPort II or EtherPort SE board; or indirectly, through a gateway.

FastPath Manager

A Macintosh application program that loads a gateway program and configuration information into a FastPath gateway. FastPath Manager is a Kinetics product.

fiber optics

A data transmission medium consisting of glass fibers encased in a protective sheath, that can carry enormous quantities of data. Fiber-optic cable is not subject to eavesdropping, electromagnetic interference, or radioactivity.

gateway

A device used to connect two or more networks at the upper protocol layers of the ISO-OSI reference model. The networks can use different protocols and physical media. A gateway can accept a packet in the format of one protocol and retransmit the packet in the form required by a different protocol. See also *bridge*, *repeater*, and *router*.

gateway program

A program that resides in a FastPath gateway to convert packets between AppleTalk and other protocols.

header

Information at the beginning of a data packet, indicating the addressee node and assisting in the message routing.

hop

A measure of distance between network nodes within an internet. One hop consists of passage through one network. For example, consider two LocalTalk networks bridged to the same Ethernet network. A node on one LocalTalk network is

three hops away from a node on the other LocalTalk network, because a packet must travel through all three networks to get from one node to the other. Nodes on the same network are only one hop apart.

host

A computer that provides services to other devices on a network or an internet. With the appropriate software, a host can operate as an AppleTalk node.

internet

A network created by linking two or more smaller networks of the same or different types. An internet can be as small as two LocalTalk networks or it can comprise a combination of several LocalTalk and Ethernet networks joined by gateways.

ICMP (Internet Control Message Protocol)

The part of IP that governs control and error messages. Gateways and other network nodes send ICMP messages for two purposes: to test communication with another node and, if a packet has an error, to report the error to the packet's originator.

IP (Internet Protocol)

A transmission protocol used on Ethernet networks, in conjunction with TCP. IP corresponds to the Network layer of the ISO-OSI reference model.

ISO-OSI reference model

A seven-layer logical structure of protocols, as defined by the Open Systems Interconnection (OSI) model created by the International Organization for Standardization (ISO). Each layer of the model defines a different level of communication. Figure A-1 shows the relationship among these layers.

K-Spool

A LaserWriter spooler for use with both Macintosh and UNIX printing jobs. K-Spool is a Kinetics product.

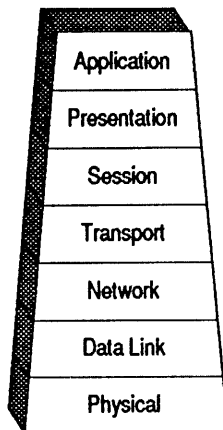


Figure A-1: ISO-OSI Reference Model

K-STAR

KIP-Style Addressing and Routing, a flexible IP addressing scheme for AppleTalk devices. K-STAR software is derived from the Kinetics Internet Protocol (KIP) software devised at Stanford University. K-STAR is a Kinetics product.

K-Talk

An independent implementation of AppleTalk protocols for use with the UNIX operating system. K-Talk is a Kinetics product.

LAP

A link-access protocol. See also *ALAP*.

LocalTalk

A brand of AppleTalk hardware that uses shielded, twisted-pair cable to interconnect Macintosh computers and other AppleTalk devices. LocalTalk kits are manufactured by Apple Computer. Generally, where this manual refers to a LocalTalk connection, you can use any system of cable and connectors that supports AppleTalk protocols to interconnect Macintosh computers and other AppleTalk devices.

mask

See *subnet mask*.

MAU (medium attachment unit)

See *transceiver*.

node

On a network, a point where a device is connected; often used to refer to the device itself. AppleTalk nodes can be Macintosh or Apple II computers, LaserWriter or Imagewriter printers, and FastPath gateways.

OSI reference model

See *ISO-OSI reference model*.

packet

A collection of information sent over a network, comprising a core of data surrounded by the encapsulating information required by the applicable protocols. A packet is the unit of transmission on a physical network; a datagram is the unit of transmission in the IP protocol.

PhoneNET

A brand of AppleTalk hardware that uses unshielded, twisted-pair cable (ordinary telephone wire) to interconnect Macintosh computers and other AppleTalk devices. PhoneNET kits are manufactured by Farallon Computing.

printer port

The port on the back of the Macintosh to which LocalTalk or equivalent connectors are attached.

protocol

A set of rules for communicating data within a network or internet. The protocol specifies the format, timing, and sequence in which information is transmitted. Common protocols include ALAP, RTMP, TCP and IP.

protocol family

A group of related protocols, designed to work with each other. Common protocol families include AppleTalk and TCP/IP.

repeater

A device used to connect two or more networks at the Physical layer of the ISO-OSI reference model. The networks connected to a repeater must use the same physical medium (Ethernet cable, for example). The repeater is insensitive to the protocols used on that medium. The principal use of a repeater is to amplify or regenerate signals, to alter the topology or extend the effective length of a network. See also *bridge*, *gateway*, and *router*.

RIP (Routing Information Protocol)

A protocol that lets an IP bridge or gateway dynamically discover routes to the various IP networks within an internet.

router

A device used to connect two or more networks at the Network layer of the ISO-OSI reference model. Normally, the networks connected to a router must use the same protocol and physical medium. The router must understand the protocol, because it uses information within each packet to determine how to route that packet. See also *bridge*, *gateway*, and *repeater*.

routing table

A collection of routes to the various networks within an internet. Each entry in a gateway's routing table comprises a network's identifying number and the distance (hops) between that network and the gateway. AppleTalk and IP routers periodically send RTMP and RIP packets, respectively, to update routing tables.

RTMP (Routing Table Maintenance Protocol)

The protocol that lets an AppleTalk bridge or gateway dynamically discover routes to the various AppleTalk

networks within an internet. RTMP corresponds to the Transport layer of the ISO-OSI reference model.

subnet

A subset of an IP network's address space. Subnet addressing is discussed in Appendix F, "IP Address Management."

subnet mask

A 32-bit integer that defines which bits of an IP address are to be used as a subnet address. In the mask, each 1-bit corresponds to a subnet-address bit and each 0-bit corresponds to a host-number bit.

TCP (Transmission Control Protocol)

A transmission protocol used on Ethernet networks, in conjunction with IP. TCP corresponds to the Transport layer of the ISO-OSI reference model.

TCP/IP

A protocol family based on TCP and IP. It also includes UDP (User Datagram Protocol), Telnet protocol, and FTP (File Transfer Protocol). TCP/IP was developed by the U.S. Defense Department to connect widely differing computers while providing data correction, security, and protection against line failures.

T-connector

A tee-shaped connector used with thin-Ethernet cable.

terminator

A device, consisting primarily of a 50-ohm resistor, that must be attached to each end of an Ethernet cable. An Ethernet network does not function properly if one or both of its terminators are absent.

thin Ethernet

A variety of Ethernet that differs from standard Ethernet in several ways

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- Thin-Ethernet transceivers are usually internal to the device, but Ethernet uses external transceivers.
- Thin-Ethernet cable is thinner than standard Ethernet cable and its maximum length is shorter.
- At the device, thin Ethernet uses a round BNC connector where standard Ethernet uses a trapezoidal D-connector.

trailer

Information at the end of a data packet indicating the conclusion of the packet.

transceiver

A small box, attached to network cable and connected to a computer or other device, that provides the drive, reception, and collision detection between physical network media, especially on Ethernet networks. A transceiver is sometimes called a medium attachment unit (MAU).

transceiver cable

A cable connecting an Ethernet device to a transceiver, which in turn is attached to the Ethernet cable. A transceiver cable is sometimes called an attachment unit interface (AUI).

UDP (User Datagram Protocol)

The part of IP that lets an application program, on one node of the internet, send a packet (datagram) to another node. A UDP packet includes a protocol port number, so it can be addressed to a specific application process on the receiving node.

zone

A grouping of one or more AppleTalk networks, based on usage patterns rather than physical connections. A single network can belong to no zone or to one zone, but a single zone can include anywhere from 1 to 254 networks.

Zone Information Protocol (ZIP)

The protocol that governs the mapping of AppleTalk networks to zone names throughout an internet.

Appendix B

Technical Specifications

Standards Compliance

The Kinetics FastPath 4 gateway complies with Ethernet standards, Versions 1.0 and 2.0; and with ANSI/IEEE Standard 802.3-1985 (ISO/DIS 8802/3) and subsequent revisions.

Hardware Specifications

The Kinetics FastPath 4 gateway consists of a printed-circuit board and a power supply, enclosed in a metal case with the necessary connectors and switches.

Power

AC input voltage:	Model KFPS4-01: 90 to 135 VAC Model KFPS4-02: 180 to 270 VAC
AC input frequency:	47 to 63 Hz
AC nominal current:	0.2A rms (max.) @ 110 VAC 0.1A rms (max.) @ 220 VAC
AC surge current:	0.8A rms (max.) @ 110 VAC 0.5A rms (max.) @ 220 VAC
AC input power:	20 watts
Battery:	Built-in battery protects built-in RAM from loss of data during power outage, but does not protect the optional expansion RAM. The battery is intended to last for the life of the product.
Fuse:	5x20 mm, 250V, 1A slow-blow fuse; held by a plastic clip between the power switch and the power cord.

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Physical Dimensions

Size: 6 inches x 10 inches x 3.5 inches
Weight: 4 pounds

Environmental Characteristics

Operational temp.: 10° to 40° Celsius
Relative humidity: Less than 90%, noncondensing

Connectors

AppleTalk: 9-socket female, "D"-subminiature, sometimes called "DB-9" (same as Macintosh 512K) for LocalTalk, PhoneNET, or compatible cabling system

Ethernet AUI: 15-socket female, "D"-subminiature (connects to shielded transceiver cable) for standard Ethernet

Ethernet 10BASE2: BNC (connects to T-connector) for thin Ethernet

A LocalTalk, PhoneNET, Fiber Optic System, or equivalent connector kit with a nine-pin male "D"-connector is required. An Ethernet transceiver or T-connector, and standard or thin Ethernet cable, are also required. All items should meet the specifications of their respective networks.

Primary Components

CPU: 68000 microprocessor, running at 8 MHz
Bus: 16-bit, dual-ported to RAM
EPROM: 128K bytes
RAM: 256K bytes of static RAM, with provision for an additional 256K bytes

Appendix C

Decimal-Hexadecimal Conversion

Table C-1 given below shows hexadecimal numbers from zero (0) through FF, with equivalent decimal numbers.

Table C-1: Decimal to Hexadecimal Conversions

<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>
00	00	32	20	64	40	96	60
01	01	33	21	65	41	97	61
02	02	34	22	66	42	98	62
03	03	35	23	67	43	99	63
04	04	36	24	68	44	100	64
05	05	37	25	69	45	101	65
06	06	38	26	70	46	102	66
07	07	39	27	71	47	103	67
08	08	40	28	72	48	104	68
09	09	41	29	73	49	105	69
10	0A	42	2A	74	4A	106	6A
11	0B	43	2B	75	4B	107	6B
12	0C	44	2C	76	4C	108	6C
13	0D	45	2D	77	4D	109	6D
14	0E	46	2E	78	4E	110	6E
15	0F	47	2F	79	4F	111	6F
16	10	48	30	80	50	112	70
17	11	49	31	81	51	113	71
18	12	50	32	82	52	114	72
19	13	51	33	83	53	115	73
20	14	52	34	84	54	116	74
21	15	53	35	85	55	117	75
22	16	54	36	86	56	118	76
23	17	55	37	87	57	119	77
24	18	56	38	88	58	120	78
25	19	57	39	89	59	121	79
26	1A	58	3A	90	5A	122	7A
27	1B	59	3B	91	5B	123	7B
28	1C	60	3C	92	5C	124	7C
29	1D	61	3D	93	5D	125	7D
30	1E	62	3E	94	5E	126	7E
31	1F	63	3F	95	5F	127	7F

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Table C-1: Decimal to Hexadecimal Conversion (continued)

<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>	<u>Decimal</u>	<u>Hexa- decimal</u>
128	80	160	A0	192	C0	224	E0
129	81	161	A1	193	C1	225	E1
130	82	162	A2	194	C2	226	E2
131	83	163	A3	195	C3	227	E3
132	84	164	A4	196	C4	228	E4
133	85	165	A5	197	C5	229	E5
134	86	166	A6	198	C6	230	E6
135	87	167	A7	199	C7	231	E7
136	88	168	A8	200	C8	232	E8
137	89	169	A9	201	C9	233	E9
138	8A	170	AA	202	CA	234	EA
139	8B	171	AB	203	CB	235	EB
140	8C	172	AC	204	CC	236	EC
141	8D	173	AD	205	CD	237	ED
142	8E	174	AE	206	CE	238	EE
143	8F	175	AF	207	CF	239	EF
144	90	176	B0	208	D0	240	F0
145	91	177	B1	209	D1	241	F1
146	92	178	B2	210	D2	242	F2
147	93	179	B3	211	D3	243	F3
148	94	180	B4	212	D4	244	F4
149	95	181	B5	213	D5	245	F5
150	96	182	B6	214	D6	246	F6
151	97	183	B7	215	D7	247	F7
152	98	184	B8	216	D8	248	F8
153	99	185	B9	217	D9	249	F9
154	9A	186	BA	218	DA	250	FA
155	9B	187	BB	219	DB	251	FB
156	9C	188	BC	220	DC	252	FC
157	9D	189	BD	221	DD	253	FD
158	9E	190	BE	222	DE	254	FE
159	9F	191	BF	223	DF	255	FF

Appendix D

AppleTalk Considerations

AppleTalk is a network architecture developed by Apple Computer, Inc., and implemented on the Macintosh and other computers and peripheral devices. The protocols defined by AppleTalk can run on several kinds of physical media, including

- Shielded twisted-pair wire (as in LocalTalk connector kits, manufactured by Apple Computer)
- Unshielded twisted-pair wire (as in PhoneNET connector kits, manufactured by Farallon Computing)
- Fiber-optic cable (as in Fiber Optic System for AppleTalk, manufactured by DuPont)

The AppleTalk architecture includes a protocol, called EtherTalk, to convey packets on Ethernet cable. Ethernet networks are described in Appendix E.

Any network transmission medium imposes limits on the size of its network. Table D-1 shows these limits for various media. Each transmission medium also has relative advantages and disadvantages in performance, cost, and security.

Fiber-optic cable is small in diameter, lightweight, and immune to electromagnetic interference, moisture, and static discharges. Also, it does not radiate a signal and is therefore more immune

Table D-1: AppleTalk Network Size Restrictions

Transmission Medium	Maximum Number of Nodes	Maximum Network Length*
Fiber Optic System	100 or more	1,500 meters (4,900 feet)
PhoneNET	32	900 meters (3,000 feet)
LocalTalk	32	300 meters (1,000 feet)

* Length between repeaters or bridges, or per branch of a PhoneNET star configuration.

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to eavesdropping. It is, however, the most expensive medium for AppleTalk communication.

PhoneNET hardware uses ordinary telephone wire between nodes, making it easy and inexpensive to expand. In many installations, it can connect nodes through the building's existing telephone wiring system.

LocalTalk cabling is the only medium that is manufactured and supported by Apple Computer.

Appendix E

Ethernet Considerations

This appendix describes some limitations and procedures for establishing, expanding, and combining Ethernet networks.

Restrictions

An Ethernet network must conform to a few restrictions on size and connectivity:

- A computer in the network can be physically located anywhere, within the cable-length limits discussed below. In fact, you can disconnect an installed computer and reconnect it somewhere else in the network without making any changes in the network software.
- The network must be in a single line, with no branching, and it must not form a loop (see Figure E-1). You can ensure this by (1) making sure both terminators are installed and (2) never attaching a network cable to the center connector of a thin-Ethernet T-adaptor. If your circumstances require that you have a branched network, you can use a repeater to interconnect two networks as described in "Combining Networks" below.

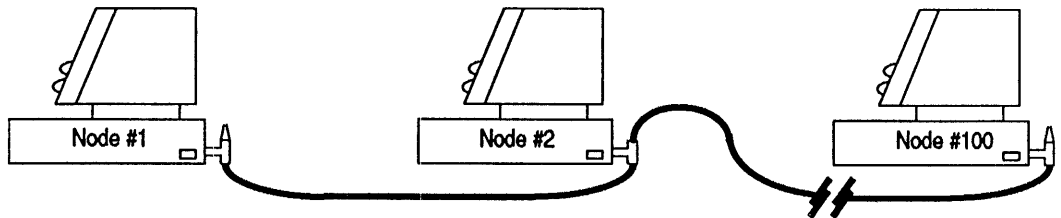


Figure E-1: A Network with No Loops or Branches

- A network with only standard-Ethernet hardware can include a maximum of 500 meters (1640 feet) of cable. An entirely thin-Ethernet network with no external transceivers can include a maximum of 300 meters (984 feet) of cable.
- Between any two adjacent computers, you must provide at least 0.9 meters (3 feet) of thin-Ethernet cable or 2.3 meters (7.5 feet) of standard-Ethernet cable. If you need more than one cable length between two computers, connectors are available for joining cables together. Contact your Kinetics representative for additional cables or connectors.
- You can connect as many as 100 devices in a single standard- or thin-Ethernet network.
- To include a mainframe, minicomputer, or other computer in a thin-Ethernet network, use a transceiver¹ with a BNC connector. Connect the computer's network controller board to the transceiver, then attach network cables to the transceiver as if it were a T-adapter.
- Whether the Ethernet cable is grounded or not does not affect signal transmission. Where grounding is required by local electrical codes, you should ground the cable at only one point along its length. If two networks are joined through a repeater, each should independently have the required grounding.

Network Expansion

Before you add a node to an existing network, make sure no one is using the network. When you disconnect any terminator or network cable, the entire network stops working. You can, however, remove a T-adapter or transceiver cable from a computer's controller board without disrupting the rest of the network.

1. Use a transceiver such as Excelan part number 9901110-03, available through your Kinetics representative.

At the End of a Network

To attach a new node at the end of an Ethernet network,

1. Remove the terminator from the desired end of the network.
2. Attach a new length of network cable to the terminator's former position and to one end of the new computer's transceiver or T-adapter.
3. Attach the terminator to the other end of the new computer's transceiver or T-adapter.

In the Middle of a Network

To attach a new node in the middle of an Ethernet network,

1. Disconnect the cable from one end of an existing computer's transceiver or T-adapter.
2. Attach that cable to one end of the new computer's transceiver or T-adapter.
3. Attach a new cable between those two transceivers or T-adapters.

When attaching a new node in the middle of the network, be sure not to introduce any branches or loops in the network.

Combining Networks

A standard-Ethernet network can include a maximum of 500 meters (1640 feet) of cable. A completely thin-Ethernet network with no external transceivers can include a maximum of 300 meters (984 feet) of cable, because its thinner cable has a higher degree of signal loss. If any external transceivers are attached to a thin-Ethernet network, the network's maximum length becomes 185 meters (607 feet). When you combine the two kinds of networks, calculation of the maximum network length becomes more complicated.

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The maximum total length of all cable of both types in the combined linear network is defined by

$$E = 500 - (2.70 \times T)$$

where

T = the total length of thin-Ethernet cable, in meters

E = the total length of standard-Ethernet cable, in meters

Table E-1 shows several combinations of thin-Ethernet and standard-Ethernet network lengths that meet the combined maximum cable lengths. For example, the table shows that you can connect a network having 100 meters (328 feet) of thin-Ethernet cable with no more than 230 meters (754 feet) of standard-Ethernet cable.

You can combine thin-Ethernet and standard-Ethernet networks end to end, using only a "BNC female to N-series female" connector, as shown in Figure E-2. To make this connection, follow the procedure described below:

1. Remove one terminator from the thin-Ethernet network and one terminator from the standard-Ethernet network. Inspect the combined network's remaining terminators to make sure that one and only one of them is grounded.

Table E-1: Maximum Cable Lengths for Combined Networks

Thin-Ethernet Cable		Standard-Ethernet Cable	
Meters	Feet	Meters	Feet
0	0	500	1640
25	82	432	1418
50	164	365	1197
75	246	297	975
100	328	230	754
125	410	162	532
150	492	95	310
175	574	27	89
185	607	0*	0*

* A network becomes a combined network when any node is attached through an external transceiver, even if no standard-Ethernet cable is used.

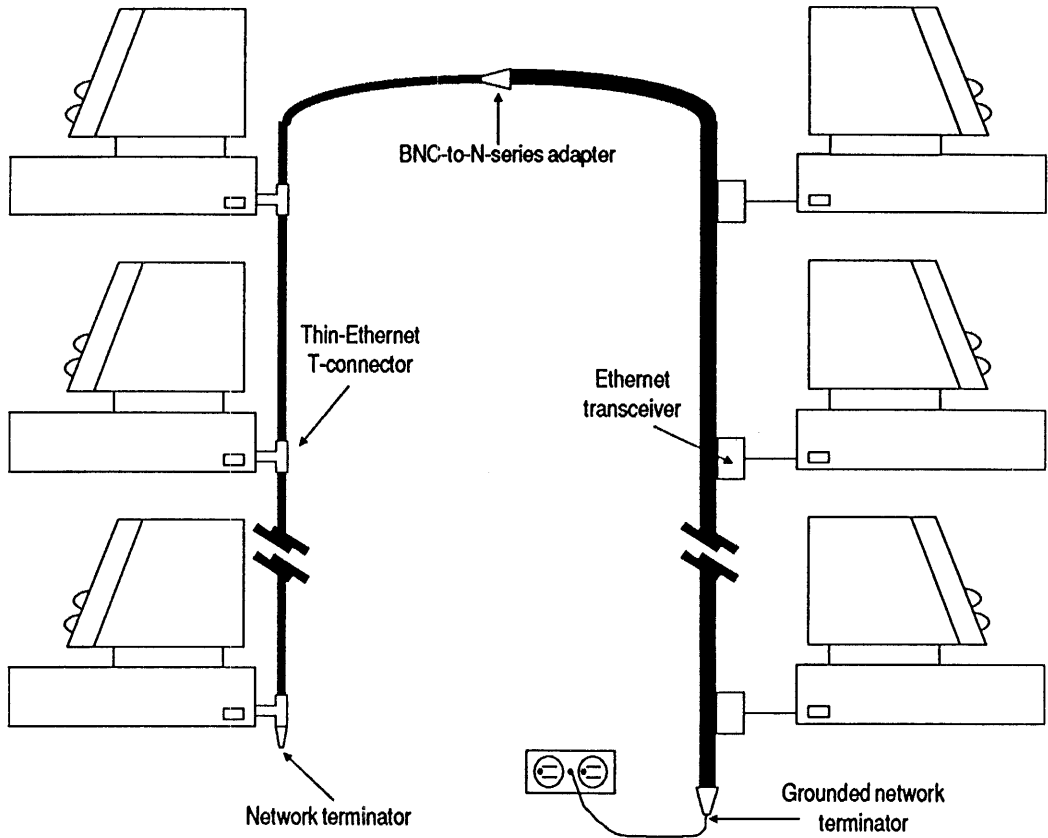


Figure E-2: Interconnecting Ethernet and Thin-Ethernet

2. Attach the BNC end of the adapter to the thin-Ethernet cable.
3. Attach the N-series end of the adapter to the standard-Ethernet cable.

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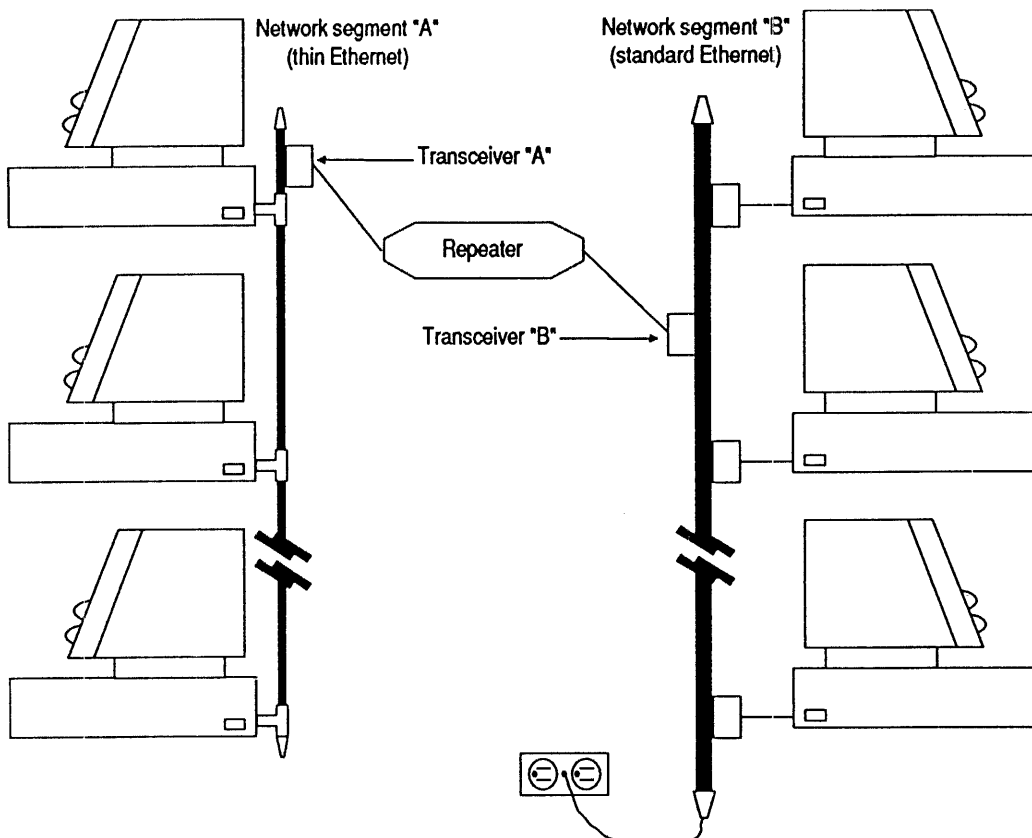


Figure E-3: Connecting to the Middle of a Network

Connecting one network to the middle of another network (that is, between two computers) is more expensive, because it requires a repeater and two transceivers.¹ Figure E-3 shows one end of a thin-Ethernet network connected to the middle of a standard-Ethernet network. You can also use a repeater and two

1. Use a repeater such as Excelan part number 9901120-00 and transceivers such as Excelan part numbers 9901111-01 and 9901111-03, all of which are available through your Kinetics representative.

transceivers to connect the middle of one network to the middle of the other network.

To make the interconnection shown in Figure E-3, follow the procedure described below: Remove the terminator from the thin-Ethernet network end that you want to connect to the standard-Ethernet network. Attach transceiver "A" to the terminator's former position.

Attach the terminator to transceiver "A." Attach transceiver "B" into the middle of the standard-Ethernet network, as if you were going to add a single new computer to that network. Using appropriate transceiver cables, connect transceivers "A" and "B" to the repeater as shown in Figure E-3. Make sure that each component network still has terminators at both ends.

In Figure E-3, note that the repeater electrically isolates the two *segments* of the overall network. The network in Figure E-2, on the other hand, has only one segment—even though that segment includes both kinds of cable. Segment "A" of Figure E-3 is all thin Ethernet and segment "B" is all standard Ethernet. In such cases, the maximum mixed cable lengths listed in Table E-1 apply to each segment.

The combined networks shown in Figures E-2 and E-3 can be treated as segments themselves and, as such, can be joined in any combination.

Appendix F

IP Address Management

The addressing mechanisms of AppleTalk and IP networks each use a unique combination of network number and host or node number to identify each device.

Both AppleTalk and IP networks use static ("permanent") network numbers. A network keeps the same number, regardless of its other internet connections, unless someone intentionally changes the number.

Under IP, each node is assigned a static host number to identify it within its network. Under AppleTalk, node numbers are assigned dynamically. Thus an IP device always has the same address, but an AppleTalk device is likely to have a different address after it has been turned off and on.

With K-STAR addressing, a FastPath 4 gateway can assign IP host numbers dynamically for devices on an AppleTalk network.

Address Notation

The usual format for specifying an IP address is in decimal notation, with four byte values separated by periods. Sometimes, however, a single hexadecimal number is used. For example, two ways of expressing the same IP address are 89.189.21.122 and 59BD157A ($89_{10} = 59_{16}$, $189_{10} = BD_{16}$, $21_{10} = 15_{16}$, and $122_{10} = 7A_{16}$).



In this manual, the first (leftmost) byte is referred to as the most significant byte of the address.

Network Classes

An IP address consists of a network portion and a host portion, but the length of each portion can vary. Three address classes define these portions. A Class A network has a 1-byte network portion, a Class B network has a 2-byte network portion, and a Class C network has a 3-byte network portion. In each case, the host portion is the remainder of the four bytes, as illustrated in Figure F-1.

Thus, Class A networks have relatively small network numbers but large host numbers, while Class C networks have relatively large network numbers but small host numbers. This means that an internet can include relatively few Class A networks but many Class C networks.

The class designation is specified in the first bits of the address, as shown in Table F-1. If the first bit is 0 (zero), the address is Class A and the next 7 bits complete the network number. If the

Table F-1: Network Class Indicators

First Bits	Value of First Byte	Network Class	Possible Number of Networks
0xx	0-127	Class A	128
10x	128-191	Class B	16,384
110	192-223	Class C	2,097,152

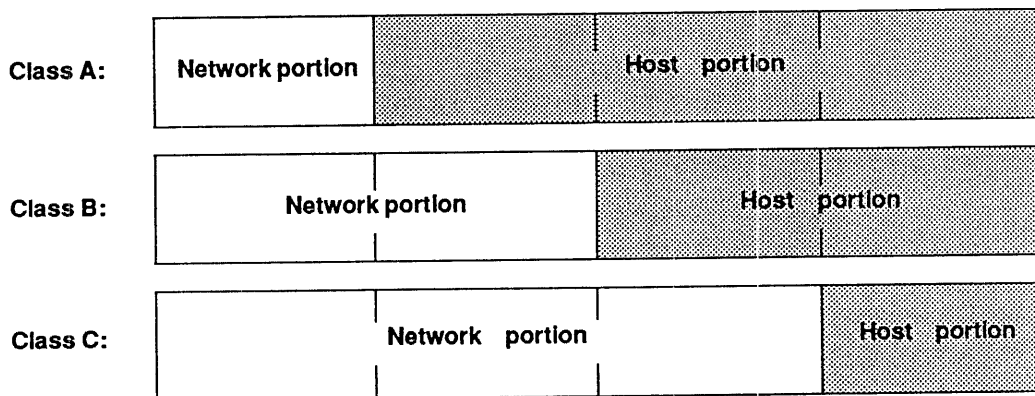


Figure F-1: Network and Host Portions of an IP Address

first two bits are 10, the address is Class B and the next 14 bits complete the network number. If the first three bits are 110, the address is Class C and the next 21 bits complete the network number. Addresses in which the first three bits are 111, sometimes called Class D addresses, are reserved.

For example, 89.0.128.3 is a Class A address because the value of its first byte (89) is between 1 and 127. The network portion of this address is 89 and the host portion is 0.128.3.

Address 128.4.5.6 is a Class B address whose network portion is 128.4 and whose host portion is 5.6.

Address 195.10.14.12 is a Class C address whose network portion is 195.10.14 and whose host portion is 12.



In any IP address, at least one byte of the host portion must be nonzero and at least one byte must be less than 255. Addresses with all host bytes set to 255 are reserved for IP broadcast addressing.

All devices in the same IP network have the same network number and unique host numbers. Thus, in an internet, each 4-byte IP address points to a distinct device. Two devices on different networks can have the same host number, because their IP addresses have different network numbers.

Routing Schemes

When a number of networks are connected to form a complex internet, some method of routing is required, to guide message packets to their intended destinations.

In an IP internet, one approach involves dividing large network address spaces into smaller areas, called *subnets*. Another approach uses fixed routing.

Subnetting

An IP subnet is a logical subsection of a single IP network. In some configurations, the FastPath gateway uses the "subnet portion" of an IP address to determine when to forward IP data

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from an AppleTalk network to an Ethernet network, or vice versa.

Defining a Subnet

In an IP address, a subnet is defined by selecting a part of the host portion to specify the subnet, leaving the remaining part as the subnet host number.

With FastPath Manager, you can specify the subnet by a *subnet mask*. This is a 32-bit integer, as is an IP address. Without subnetting, the bits corresponding to the network portion of the address are set to one and the bits corresponding to the host portion are set to zero. If subnet addressing is in use, some bits of the host portion are set to one to indicate the subnet number.

For example, consider address 18.192.127.51, in a network using a mask of 255.255.0.0 (1111 1111 1111 1111 0000 0000 0000 0000 in binary notation). The value of the first byte (18) indicates that this is a Class A network. Therefore, without subnetting, the network number would be 18 and the host number would be 192.127.51. However, the subnet mask has all of the first and second bytes set to ones, indicating that the corresponding two bytes of the address comprise the subnet number, 18.192. This leaves a subnet host number of 127.51. Figure F-2 illustrates this example, showing the decimal value and the binary value of each byte in the host portion.

For a Class B example, consider address 137.4.207.163, with a mask 255.255.255.0. The mask has the first 3 bytes all set to ones, so the subnet number is 137.4.207, leaving a subnet host number of 163.

The host portion of a Class C network is only 1 byte, so subnetting requires calculations on the bit level. Consider address 210.167.18.250, with a mask of 255.255.255.192 (1111 1111 1111 1111 1111 1111 1100 0000 in binary notation). The first 2 bits of the address's last byte are part of the subnet number. Only the last six bits comprise the subnet host number. Therefore, the subnet number is 210.167.18.3 and the host number is 58. Figure F-3 illustrates this example, showing both the decimal value and the binary value of the 1-byte host portion.

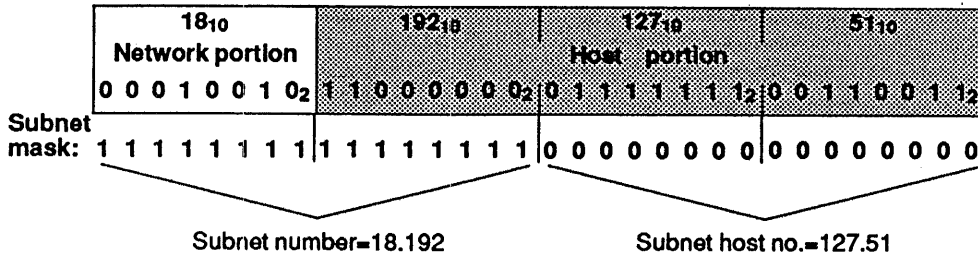


Figure F-2: Subnetting in a Class A Address

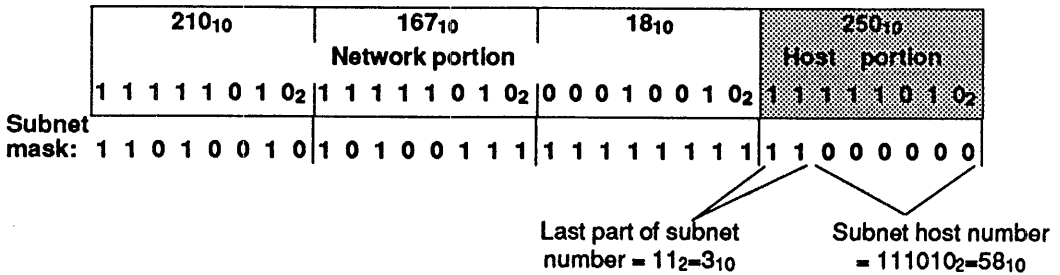


Figure F-3: Subnetting in a Class C Address

The essential thing to remember is that the 4-byte IP address is unique for every host node in an internet.

Kinetics Subnet Routing

If a FastPath gateway is configured for IP routing, it has separate IP addresses for the Ethernet interface and the AppleTalk interface. When you configure the gateway for subnet IP routing, you specify the same mask for both interfaces. This subnet definition is the basis for the way the gateway routes IP packets. First, it compares the packet's destination IP subnet

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number with the IP subnet number of the AppleTalk side of the gateway. Then it applies the following rules:

- If the two IP subnet numbers match, the gateway routes the packet to the AppleTalk network.
- If the two IP subnet numbers are different, the gateway routes the packet to the Ethernet network.

The subnet routing scheme requires that you carefully follow these configuration rules:

1. The Ethernet subnet number must be different from the AppleTalk subnet number.
2. Calculate the subnet address of each established IP host on the Ethernet network, even if the host is not subject to subnet addressing. If these calculations yield multiple subnet numbers, then none of these subnet numbers can conflict with the subnet number of the gateway's LocalTalk port.

Violating this rule can cause misrouting on the Ethernet network. If a host address can be interpreted as belonging to the same subnet as the gateway's LocalTalk port, the gateway can absorb packets intended for that host.

3. Subtract the major network number from the IP subnet number of the LocalTalk cable. This difference must be the same as the AppleTalk network number for the LocalTalk cable. Also, it must be between 1 and 65,535, inclusive. For example, suppose the LocalTalk cable has subnet address 128.36.28.*nn*. As a Class B address, its major network number is 128.36, so the difference is 28. The rule is satisfied you assign AppleTalk network number 28 to this LocalTalk port..



This rule makes the scheme incompatible with the gateway's automatic configuration feature, because it requires you to assign a specific network number.

When an IP packet is bound for the AppleTalk network, this rule lets the IP module create the packet's AppleTalk destination address without using the AppleTalk routing

module. This effectively allows the two modules to operate independently.

Berkeley Internet Subnetting

A subnet is a logical subsection of a single internet. "Internet Standard Subnetting Procedure" (NIC RFC950) describes a method for implementing subnets and is the basis for the 4.3BSD UNIX subnetting scheme of the University of California at Berkeley. FastPath gateways can use the same subnetting scheme. This section describes the UNIX utilities *ifconfig* and *route*, then describes two methods for integrating a FastPath 4 gateway and an AppleTalk network subnet into a 4.3BSD subnet.

The UNIX Command *ifconfig*

Adding subnetting to a 4.3BSD UNIX internet requires use of the UNIX command *ifconfig*. Using this command's *netmask* parameter, the system administrator can specify a subnet field within the IP address of a specific network interface, or port, on the host where *ifconfig* is run.

The *netmask* value is a hexadecimal number that specifies a mask. The mask, which indicates the combined network and subnet portion of an IP address, is applied to each outgoing internet address to determine whether the address is on a known subnet.

For example, if a subnet is to be based on the second byte of a Class A network's addresses, the *netmask* value would be 255.255.0.0 (FFFF0000 in hexadecimal notation). If the destination address is 89.10.128.1, the upper two bytes of *netmask* (255.255) mask the major network number (89) and the subnet field (10), leaving the unmasked 128.1 as the subnet host number. The host, then, can route packets with 89.10.*n.n* addresses to the proper subnet destination.

The UNIX Command *route*

You can use the UNIX command *route* to manually add an AppleTalk subnet to each host's routing table. Each host then acts as a subnet router for the AppleTalk network.

For example, consider the situation shown in Figure F-4, where the subnet mask is 255.255.255.0 (FFFFFF00). The network on the

Ethernet cable (which includes the UNIX host) is subnet number 128.137.1 and the network on the LocalTalk cable is subnet number 128.137.2. To update the host's routing table, you can run the following UNIX command on the host system:

```
route add 128.137.2 128.137.1.192 2
```

This command updates the routing table of the UNIX computer. Whenever the host sees a packet whose destination is subnet 128.137.2 (the LocalTalk network), the host will reroute it to address 128.137.1.192, which is the FastPath 4 gateway.

The last field in the *route* command, and therefore in the table entry, indicates that two hops separate the UNIX computer and the nodes of the subnet.

The *route* command affects only one entry in one computer's routing table, so you must issue a separate command to each host for each AppleTalk subnet that has to communicate with that host.

Routing Methods

With these commands, you can use either of two methods to integrate an LocalTalk subnet and FastPath 4 gateway into a 4.3BSD UNIX subnet.

Method 1:

With the first method, you use *ifconfig* in a straightforward manner, with a *netmask* value of 255.255.255.00 (FFFFFF00) to identify the LocalTalk network as a complete subnet. You then use the *route* command to add an entry explicitly to each UNIX host's routing table, as shown in Figure F-4. Then, whenever such a host encounters a packet addressed to a node on the LocalTalk subnet, it will route the packet to the FastPath 4 gateway.

Method 2:

With the second method, you give the 4.3BSD UNIX host and the gateway two different views of the subnet scheme. Use an *ifconfig netmask* value of 255.255.240.00 (FFFFFF00). This tells the UNIX host that the subnet address portion of the mask is only 2 1/2 bytes long.

Note that the third byte of the Ethernet network's address is 01 and that of the LocalTalk network is 02. Therefore, the *netmask*

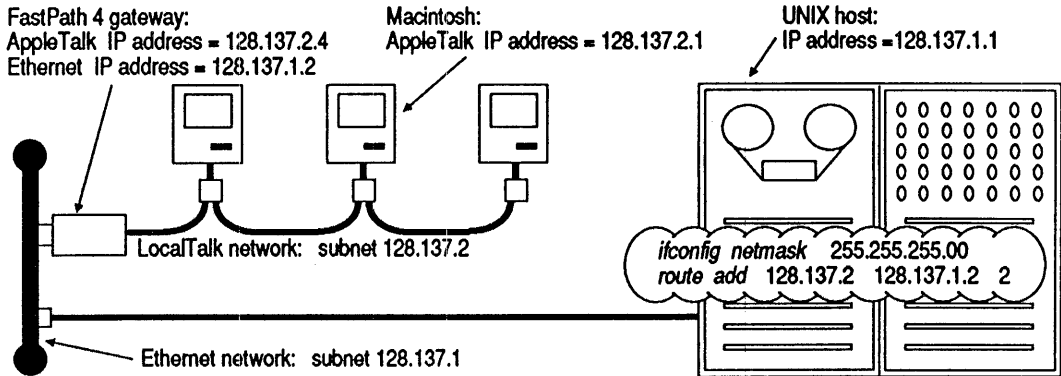


Figure F-4: Using *ifconfig* and *route*

value of 255.255.240.00 (FFFFF000) yields the same subnet address, 128.137.0, for both networks. From the UNIX host's point of view, all IP addresses in the local Ethernet and on the LocalTalk network are in the same IP subnet. When the host encounters a packet addressed to 128.137.2.*nn*, it routes the packet to what it sees as the local subnet, which includes the LocalTalk cable.

The gateway, however, still considers the mask to be 255.255.255.0 (FFFFFF00). From its point of view, the local Ethernet and LocalTalk networks are in different IP subnets (128.137.1 and 128.137.2). When the gateway encounters a packet addressed to 128.137.1.*nn*, it routes the packet to the Ethernet network, as usual.

Fixed Routing

The alternative to subnetting is fixed routing, under which you assign the AppleTalk and Ethernet networks different network numbers under the normal Class A, B, or C scheme. The two networks can even have different address classes.

Fixed routing requires each IP host on the Ethernet network to maintain explicit routing information for communication with IP hosts on LocalTalk cable. This avoids the complexity and restrictions imposed by subnetting.

Appendix G

FastPath Diagnostic Messages

This appendix lists all diagnostic messages that are generated by the FastPath 4 gateway. These messages are contained in the gateway's PROM and in the K-STAR gateway program.

In the messages, strings shown in *italic type* are replaced by appropriate values by the gateway. Numerical values are in decimal notation unless otherwise noted.

A vertical bar between two or more items within braces indicates that only one of those items appears in the message. For example, {ATALK | ETALK} indicates that the message says either ATALK or ETALK, but not both.

ALL NODE NUMBERS IN USE ON ETHERNET

During initialization, the FastPath 4 gateway has tried all possible EtherTalk addresses and found them in use. This prevents the gateway from activating its AppleTalk bridge function.

The limit for EtherTalk nodes is 254. In addition, any server node, such as a gateway, printer, or AppleServe serve, must have a node number in the range 128 through 254. See if the network is indeed near the limit or the addresses in the server-node range are all used.

If the network is not near the limit, then one or more nodes might be responding incorrectly to the gateway's address inquiry packets. Attach an Ethernet monitor, such as the Excelan LANalyzer system, to inspect the response packets.

FastPath 4 Gateway

Auto-configured (ATALK | ETALK) net number *decimal* (0x *hex*)

Through automatic configuration feature has assigned the specified network number.

decimal Decimal value of the AppleTalk or EtherTalk network number.

hex Hexadecimal value of the AppleTalk or EtherTalk network number.

Bad RTMP format, port (ATALK | ETALK)

One or more gateways or hosts, on an AppleTalk or EtherTalk network, is running bridge software that pre-dates Apple's introduction of EtherTalk.

port The port that is connected to the network containing the erroneous gateway or host.

Duplicate hardware address: *Ethernet_address*
Fatal user configuration error

During initialization of the EtherTalk interface, the address resolution module has detected an Ethernet address attributed to two nodes. The FastPath 4 gateway restarts continually until the misconfigured address is corrected.

Ethernet_address

The duplicated address, in hexadecimal "dot notation."

Duplicate IP address *IP_address*, sent from: *Ethernet_address*

The address resolution module has detected an IP address attributed to two different nodes. The two nodes are probably the one reporting the error and the one that sent the packet that caused the error message.

IP_address The duplicated address, in hexadecimal notation.

Ethernet_address

The Ethernet address, in hexadecimal "dot notation," of the node that sent the packet containing the duplicated address.

Ethernet transmission error: *code*

An attempt to transmit on Ethernet was aborted, for the reason described below:

<i>code</i>	Status code indicating an Ethernet error condition. Some common status numbers and their meanings are:
8020	Excess collisions (for a transceiver without the "heartbeat" test). This probably indicates a very high traffic rate on Ethernet, perhaps a network test in progress. This should be a rare message. If it is frequent, it can indicate a problem with the transceiver or transceiver cabling.
8060	Excess collisions (for a transceiver with the "heartbeat" test). See status 8020.
8400	Nocarrier. This probably indicates that the transceiver cable is disconnected or loose.
8420	Excess collisions and no carrier (for a transceiver without the "heartbeat" test). This probably indicates that the Ethernet cable is not terminated or not connected to the transceiver.
8460	Excess collisions and no carrier (for a transceiver with the "heartbeat" test). See status 8420.

FastPath AT node *node*, ET node *node*, memory bytes memory, version *version*, {SUBNET | FIXED} IP routing {ON | OFF}, options= *variable*

This is the startup message that the gateway sends when the gateway program begins execution. It usually follows the message that begins "KFPS AT#...", which is described below.

AT node *node*

The AppleTalk node number of the gateway's LocalTalk port.

ET node *node*

The AppleTalk (EtherTalk) node number of the gateway's Ethernet port.

memory

The total amount of memory, in bytes, available for packet buffers in the gateway.

FastPath 4 Gateway

<i>version</i>	The version number of the currently loaded gateway program.
<i>variable</i>	The current value of the options variable, in hexadecimal notation. Most of the time, this is 0 (zero).

Fatal user configuration error

See "Duplicate hardware address" message.

i82586 NOT RESPONDING

The gateway software cannot communicate with the gateway's Ethernet controller chip. Check the slide switch on the back panel to make sure that it is set to the connector that is actually attached to an Ethernet cable. Also, check that the Ethernet cable is properly terminated.

i82586 TRANSMITTER HUNG

The gateway's Ethernet controller chip cannot transmit. Check the slide switch on the back panel to make sure it is set to the connector that is actually attached to an Ethernet cable. Also, check that the Ethernet cable is properly terminated.

If this error recurs despite a correct switch setting and proper network termination, contact Kinetics as described in Appendix H.

iecmd: command command failed, STATUS=*status*

A fatal error has occurred. If it recurs, contact Kinetics as described in Appendix H.

status Character string indicating the nature of the error.

ieframein – corrupted pbufs

A fatal error has occurred; the gateway's memory might be corrupted. If this error recurs, contact Kinetics as described in Appendix H.

ieframein lost a buf!

A fatal error has occurred; the gateway's memory might be corrupted. If this error recurs, contact Kinetics as described in Appendix H.

IP setup error *error*

There is an error in the IP routing configuration, so the gateway has disabled IP routing.

<i>error</i>	A hexadecimal number indicating one or more specific errors. This number is the ORed product of the applicable error codes described below:
0010	You have chosen an illegal IP network number. The first byte of the address cannot be zero or 255.
0020	You have chosen an IP broadcast address for either the LocalTalk or the Ethernet side of the gateway. The host portion of the address cannot be all zeros or all ones.
0040	The IP subnet address does not agree with network number of the LocalTalk side.
0080	The IP subnet mask is too large. It cannot be more than 16 bits long.
0100	You have defined an illegal subnet. The subnet mask cannot extend its zeros into the network portion of the IP address.

KPFS AT# *node*, ET# *node*, PROM REV *revision* STATE={BE A BRIDGE | BOOTME | DOWNLOAD VALID | PAUSE}
HW STATUS= *status*

This is the startup message that the gateway sends when its PROM code begins executing.

AT# *node*

The AppleTalk node number of the gateway's LocalTalk port.

ET# *node*

The AppleTalk (EtherTalk) node number of the gateway's Ethernet port.

FastPath 4 Gateway

<i>revision</i>	The revision number of the gateway's PROM.
BE A BRIDGE	Working as an AppleTalk router; running PROM code, not a downloaded gateway program.
BOOTME	Waiting to be booted. This state occurs only when you have configured the gateway with the Remote Boot software switch on.
DOWNLOAD VALID	Will run a downloaded gateway program after 25 seconds.
PAUSE	Waiting for further configuration action. This state occurs only when you have clicked on the Pause button in the main configuration window. To resume gateway operation, click on the button .
<i>status</i>	A hexadecimal number indicating the status of the gateway. This number is the ORed product of the applicable status codes described below: 0001 The AppleTalk controller chip is bad. 0002 The Ethernet controller chip is bad. 0004 The voltage level of the built-in battery is low. 0008 Expansion RAM is installed. 0010 The fuse is blown. 0020 The latest memory test failed.

Loop found. Restarting auto-config for {ATALK | ETALK}

Another bridge or gateway, on the same network, has reported a network number, zero hops away, that conflicts with a network number that FastPath Manager was trying to assign. This indicates that your hardware configuration includes a loop, giving the gateway two paths to the same network. Such a loop is permissible with manual configuration, but not with the automatic configuration feature.

Mismatched network numbers, local=*network_number*,
other_number reported on {ATALK | ETALK}

The gateway received a routing packet from a bridge or gateway that disagrees about the network number on the indicated interface. This indicates a configuration error. All bridges and gateways on the same network must agree about the network number.

network_number

The network number of the AppleTalk or EtherTalk network, according to the FastPath 4 gateway that sent this message.

other_number

The network number received in the routing packet.

Net *network* went down

The local gateway has not received recent routing table update information for the indicated network. This implies an absence of communication between the remote network and the local network, unless there is an alternate route. It can indicate a broken or disconnected cable.

network The number of the network that is served by the nontransmitting bridge or gateway.

Check the remote bridge or gateway to see if it is turned off, reconfigured, disconnected from the internet, or down due to a hardware fault. If none of these is the fault, check the local gateway to see if it is disconnected from the network or is no longer receiving packets due to a cabling or transceiver problem.

not enough buffers for receive buffers!

A fatal error has occurred; possibly, the gateway's memory is corrupted. If this error recurs, contact Kinetics as described in Appendix H.

FastPath 4 Gateway

```
nrfds=decimal nbufs=decimal scbptr=0hexadecimal  
tbdptr=0hexadecimal xmit=0hexadecimal  
&rfd[0]=0hexadecimal &rfd[nrfds]=0hexadecimal  
&rbd[0]=0hexadecimal &rbd[nbufs]=0hexadecimal  
rfd pointer out of range!
```

A fatal error has occurred; possibly, the gateway's memory is corrupted. Write down all of the numbers reported in this message, then contact Kinetics as described in Appendix H.

REBOOT

You have clicked on the **Restart** button in the main configuration window. After a 25-second delay, gateway operation restarts with the current configuration data.

RESET

You have clicked on the **Reset** button in the main configuration window. All configuration data in the gateway have reverted to the default state. After a 25-second delay, gateway operation restarts.

Restarting auto-config for {ATALK | ETALK}

The automatic configuration software has found a conflict with a network number that it was trying to assign. The software increases the tentative number by one and restarts its conflict-checking procedure.

set86: ISCPBUSY never cleared!

A fatal error has occurred. If it recurs, contact Kinetics as described in Appendix H.

set86: STAT_CX not set (0x error)!

A fatal error has occurred. If it recurs, contact Kinetics as described in Appendix H.

error Hexadecimal number indicating the error that occurred.

UNKNOWN i82586 STATUS: scb_status

A fatal error has occurred; possibly, the gateway's memory is corrupted. If this error recurs, contact Kinetics as described in Appendix H.

SCB_status Character string indicating the nature of the error.

WARNING: download module exceeds memory map

You have loaded a gateway program that is too large.

WARNING: received zip reply with invalid character in zone name

Another bridge or gateway has sent a ZIP (Zone Information Protocol) packet with an illegal zone name. Use the Control Panel desk accessory to check the zone names that are in use on your internet.

WARNING: zip bringup found invalid character in zone name

A node has disabled a zone and, in re-enabling it, has sent a ZIP (Zone Information Protocol) packet with an illegal zone name. Use the Control Panel desk accessory to check the zone names that are in use on your internet.

FastPath 4 Gateway

WARNING: {ATALK | ETALK} has not yet acquired a net number

No "seed bridge" is present on the AppleTalk or EtherTalk network. At least one bridge or gateway on a network must be configured with an AppleTalk network number and zone name. That device can act as a seed bridge for a nonconfigured device; that is, it can supply the information to the nonconfigured device.

When the FastPath 4 gateway automatically configures itself, it effectively serves as its own seed bridge.

Appendix H

Support Information

Before it is shipped, each Kinetics FastPath gateway is thoroughly tested and exercised, both at the component level and at the system level. It is not possible, however, to simulate every possible situation that might exist on the network. If you encounter a problem with the gateway, and you are unable to solve it yourself, call the authorized Kinetics dealer from whom you purchased the gateway.

If you cannot get help from the authorized Kinetics dealer, call the Kinetics support group at one of the following numbers:

When calling from outside California: (800) 433-4608

When calling from within California: (415) 947-0998

For prompt assistance, the Customer Support Response Center requires the information listed below. Please include it when you write or have it ready when you call.

- A complete description of the problem, including what happens, when it happens, and what you have done to diagnose the problem
- Your company name
- Your technical contact
- Your company address
- Your telephone number
- The product name and serial number
- Your purchase order number or service contract number

The Customer Support staff will then discuss the problem you are experiencing. They will help you to isolate the problem and fix it, if possible.

FastPath 4 Gateway

When necessary, Kinetics will send you a disk containing diagnostic test programs, to help you test a gateway. Use the FastPath manager program to load a diagnostic test just as you would load a gateway program. Any additional information needed to run a specific test will be provided with the test.

If the problem cannot be resolved through discussion and the test programs, the support staff will provide you with a Return Materials Authorization (RMA) number. You should then securely pack the unit in its original or similar packing and return it to Kinetics, as directed by the Customer Support staff.



Do not return the FastPath gateway to Kinetics without first calling Kinetics, discussing the problem, and obtaining an RMA number.

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RELEASE NOTE

FastPath 4 Gateway

The Kinetics FastPath 4 gateway connects Ethernet and LocalTalk networks, thereby allowing information to be passed between the two networks. The FastPath 4 gateway converts information from each type of network into a form that the other can understand.



You should not use this release of the FastPath Manager II to configure FastPath Model 2 and FastPath Model 3 gateways.



You may not need to use the *Installation Guide* if all the traffic through the FastPath gateway uses only the AppleTalk protocols. In this case, you can simply connect the FastPath 4 gateway to your Ethernet network (moving the slide switch towards the Ethernet connector you are using) or to your LocalTalk network. Then, just plug it in and turn it on. The FastPath gateway will then identify itself to the network, determine the addresses it needs to maintain, and begin operation.

If you are using the thin-wire BNC connector, make sure to use a T-connector to connect the FastPath gateway to the Ethernet network. Also make sure that the Ethernet network is terminated.

If you are using the FastPath 4 gateway on a more complex Internet network (that is, one with more than one Ethernet backbone), you need to use the FastPath Manager II software. Refer to the *FastPath 4 Installation Guide* for configuration information.

If you have any questions or comments, please contact

Technical Support
Kinetics, Inc.,
2540 Camino Diablo
Walnut Creek, CA 94596
(415) 947-0998
(800) 433-4608

COMPONENTS

The FastPath 4 gateway consists of the following components:

- This release note (Part No. 4230330-00, Revision A)
- Two 3-1/2", 800-Kbyte disks (a third disk is optionally included)
- *FastPath 4 Installation Guide*, (Publication No. 4200094-00, Revision A)

FEATURES

The following are the major features of the FastPath 4 gateway:

- Requires no configuration to work on networks that use only AppleTalk protocols
- Can be configured from either the Ethernet or LocalTalk network
- Provides K-STAR (KIP-Style Addressing and Routing), the Kinetics implementation of KIP (Kinetics Internet Protocol) that was developed by Stanford University. K-STAR replaces all previous versions of the gateway code
- Provides an upgraded FastPath Manager that adheres to all Macintosh interface standards and includes easy-to-use data entry screens, online help, and the ability to print a copy of the FastPath gateway configuration

- Remembers its configuration, even when the power has been off
- Is programmable, making it adaptable to different environments
- Supports AppleTalk protocols, thus allowing any program designed to work on a LocalTalk network to work, via the FastPath gateway, on an Ethernet network
- Conforms to AppleTalk and Ethernet hardware and software standards

FastPath 4 FILES

The FastPath 4 gateway software is distributed on two disks. A third disk is optionally included with the software. The contents of these disks are listed below.

Contents of FastPath Manager Disk

- K-STAR Download
- FastPath Manager II
- AppleTalk Examples folder
 - Bridge1 SEED BRIDGE
 - Bridge2 Non-seeded
 - Bridge2 Seeded
 - Bridge3 Non-seeded
 - Bridge3 Seeded
- K-STAR Examples folder
 - K-Star Configuration
- Subnet Examples folder
 - Class A Subnet
 - Class B Subnet
 - Class C Subnet
 - Class C to A Fixed Route
 - Strict Subnet Route Option

Contents of FastPath Manater Network Utilities Disk

- CLICK ME FIRST
- Look
- echo

The third disk, which is optionally included with the FastPath 4 distribution, contains NCSA TELNET.

KNOWN ANOMALIES

The following list enumerates the known anomalies in this release of the FastPath 4 gateway software:

- The Diagnostics window of FastPath Manager II does not display packets when it is being run from an Ethernet network. This is because FastPath 4 does not generate diagnostic packets on an Ethernet network.
- Online help is not provided for some menu fields. Refer to the *Installation Guide* for information about these fields.
- The ALAP implementation in this release of the FastPath 4 PROM is the same as that in the older FastPath gateways. The current ALAP code is based on an older Apple version of ALAP.
- When printing the FastPath configuration, the zone name for both the Ethernet and AppleTalk sides are shown to be the same regardless of their actual names.
- When specifying option 3 on the Options table (as described in Chapter 3 of the *FastPath 4 Installation Guide*), you must also specify the subnetwork mask in the Option Parameters table. For example, if the mask is 255.255.0.0, you must enter the value FF FF 00 00 into the table.
- Currently, you cannot enter ASCII codes in the Option Parameters table.