Preface

Objectives

This guide supplements the Ethernet hardware and software information included in the following documents:

- *Cisco VCO/4K Hardware Installation Guide*
- *Cisco VCO/4K Software Installation Guide*

These two documents provide the primary source for installation and setup of VCO/4K Ethernet communications. The *Cisco VCO/4K Ethernet Guide* provides only additional material relevant to application code development, and in particular, TCP/IP socket communications.

This document is not intended as an Ethernet or networking tutorial. Readers are encouraged to consult additional reference materials if this information is required.

Audience

This manual is intended for VCO/4K application developers familiar with the VCO/4K system and structured software development.

Document Conventions

This document uses the following conventions:

> **Note** Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

> **Caution** Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.Warnings

⚠ Warning   **Means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translated versions of the warning, refer to the *Regulatory Compliance and Safety* document that accompanied the device.**

Related Documentation

The following documents provide additional information to supplement the material provided in this guide:

Cisco VCO/4K Hardware Installation Guide

Cisco VCO/4K Software Installation Manual

Cisco *VCO/4K System Administrator's Guide*

Cisco *VCO/4K Standard Programming Reference*

Cisco *VCO/4K Extended Programming Reference*

Cisco *VCO/4K System Software Release Notes*

Cisco VCO/4K System Messages

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You can access the most current Cisco documentation on the World Wide Web at the following sites:

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- http://www-europe.cisco.com

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Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

Introduction

The VCO/4K Ethernet communications software supports Ethernet TCP/IP communications between a VCO/4K and one or more host computers.

Note The VCO/4K system is limited to communication within a single Ethernet LAN. It cannot act as an Ethernet gateway, nor can it route messages through an Ethernet gateway.

The hardware for basic VCO systems includes a single thickwire DB-15 port for an Ethernet transceiver. The transceiver converts the VCO interface to thinwire or twisted pair. Cisco Systems recommends that you use an Attachment Unit Interface (AUI) cable between the DB-15 connector and the network transceiver. Your Ethernet network determines the transceiver type. Cisco Systems, Inc. does not provide cables, transceivers, and other link components to implement Ethernet links.

The Ethernet package uses stream-oriented TCP protocol. TCP error handling includes checksum verification of messages, sequential message delivery, and protection against message duplication. TCP is also a connection-oriented protocol, typically involving a connection between a client and a server. The VCO/4K acts as the server in this client/server TCP model.

The VCO/4K Ethernet software supports a single physical link with multiple logical connections (sockets) which are the interface between the Ethernet communications protocol and the application. The VCO/4K supports up to eight simultaneous socket connections.

Ethernet Communication Package Contents

The Ethernet Communication package includes the following components:

- Ethernet Software, 3.5-inch diskette
- *Cisco VCO/4K Ethernet Guide* (this document)

Hardware and Software Requirements

The following are the hardware and software requirements for running Ethernet software.

- VCO Series switch
- Attachment Unit Interface (AUI) cable (ordered separately)
- System Software Version V4.x or later

Firmware Requirements

There are no firmware requirements for Ethernet software other than the firmware required to run the VCO/4K system software. For a list of system software firmware requirements, refer to the *Cisco VCO/4K System Software Release Notes.*

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Ethernet Installation and Configuration

This chapter provides detailed steps for installing the hardware and software components required for VCO/4K Ethernet communications. The installation process includes connecting the appropriate physical cables for host links, installing software, and configuring peripherals for network access.

Additional details pertaining to application-specific Ethernet communications are provided in Chapter 3, "Host Communications."

Connecting the Host Link

The Ethernet host communication link terminates on the Storage/Control I/O Module, which is located at the back of the system. The Storage/Control I/O Module and the Ethernet host communication link are shown in Figure 2-1.

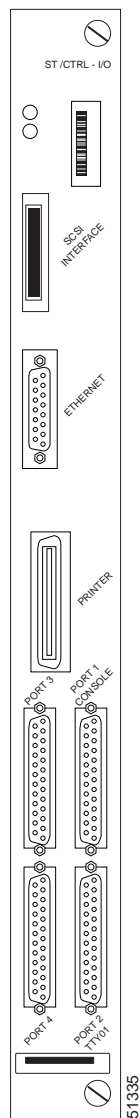*Figure 2-1   Storage/Control I/O Module Front Panel*

Table 2-1 lists the DB-15 connector pinouts, which are the same for the CPU-TM card and the Storage/Control I/O Module.

Table 2-1   DB-15 Connector Pinouts

Pin	Signal	Signal Name
2	C+	Collision + (Input)
3	T+	Transmit + (Output)
5	R+	Receive + (Input)
6	GND	Ground
9	C–	Collision – (Input)
10	T–	Transmit – (Output)
12	R–	Receive – (Input)
13	+12VF	+12 Vdc Power

Use an office Attachment Unit Interface (AUI) cable between the DB-15 connector and the network transceiver. The physical Ethernet network determines the transceiver type.
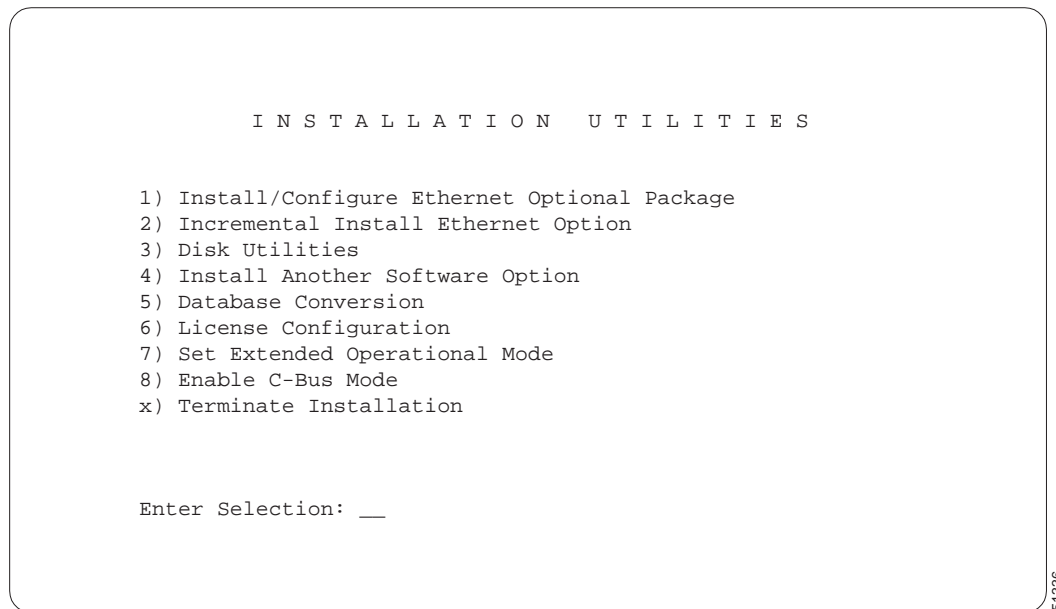
Installing Ethernet Software

For users of system software version 5.1(3) and higher, install and configure Ethernet communications from the System Configuration menu by selecting the Ethernet/NFS/SNMP Configuration option. For information on using this configuration screen, refer to Chapter 4 of the *Cisco VCO/4K System Administrator's Guide*. When the Ethernet/NFS/SNMP configuration is complete, reboot the CPU from the Alarm Arbiter Card.

For users of system software version 5.1(2) or earlier, install and configure the Ethernet optional software by using the following steps. Repeat these procedures for installing software on the B-side.

Step 1   Insert the Ethernet software diskette and press **Enter**.

After the system loads the Ethernet files from the diskette, the Ethernet Installation Utilities menu is displayed. (See Figure 2-2.)

The cursor is located in the Enter Selection data entry field.

Figure 2-2   Ethernet Installation Utilities Menu

```
                    I N S T A L L A T I O N    U T I L I T I E S


        1) Install/Configure Ethernet Optional Package
        2) Incremental Install Ethernet Option
        3) Disk Utilities
        4) Install Another Software Option
        5) Database Conversion
        6) License Configuration
        7) Set Extended Operational Mode
        8) Enable C-Bus Mode
        x) Terminate Installation



        Enter Selection: __
```

Step 2   Type **1** and press **Enter** to begin the Ethernet software installation process.

The following message is displayed:

```
Do You Wish To Back-Up The System Data Base? (Y/N) =N?_
```

Step 3   Press **Enter** (this defaults to N).

You will not be backing up the database at this time.

The Ethernet Configuration menu is displayed. (See Figure 2-3.)

Figure 2-3   Ethernet Configuration Menu

```
                 E T H E R N E T    C O N F I G U R A T I O N


        1) Install Ethernet Options
        2) Edit Ethernet Parameters
        3) Edit SNMP Management Station Parameters
        4) Edit NFS Parameters
        5) Edit Gateway Routing Table Parameters
        6) Exit Ethernet Configuration



        Enter Selection: __
```

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Installing Ethernet Options

Type **1** and press **Enter**. The following message is displayed:

```
Copy A:/BOOT/ETHERMGR.EXE
1 file(s) copied
Ethernet Option Enabled
```

Note   If you do not need to edit Ethernet parameters (system Ethernet address and/or subnet mask), SNMP management station parameters, NFS parameters, or gateway routing parameters, type **6** and press **Enter** to exit the Ethernet installation. Otherwise, continue with the next section.

If you installed an updated CPU as part of this upgrade, you must edit Ethernet/NFS/SNMP parameters.

Editing Ethernet Parameters

Step 1   Type **2** (Edit Ethernet Parameters) and press **Enter**.

The following message is displayed:

```
System Internet Address = 107.3.254.98?
```

Note   The Ethernet and Internet address numbers that you see in the screen messages in this section are only examples. In your system these numbers are replaced by numbers that represent your system addresses.

Step 2   Set the Internet address of this system and press **Enter**.

The following message is displayed:

```
Set System Internet Address To 107.3.254.98 (Y/N) =Y?
```

Step 3   If you change the address, you are prompted to confirm your new address. Type **Y** to confirm your selections.

The following confirmation message is displayed:

```
System Internet Address Configured
```

Step 4   Set the system subnet mask, or press **Enter** to accept the displayed value.

After you complete this step, you can connect a remote console to your system via Telnet.

Editing SNMP Management Station Parameters

Step 1   Type **3** and press **Enter** to set the SNMP management station Internet address.

The following message is displayed:

```
SNMP Management Internet Address = 0.0.0.0?
```

Step 2   Set the Internet address to the address of the system that you are using as the NMS (Network Management System), and press **Enter**. If you are not using SNMP and a NMS, then set this address to the address of your host.

The following message is displayed:

```
Set SNMP Management Internet Station Address To [internet address] (Y/N) =Y?
```

Step 3   Type **Y** to confirm your selections.

The following confirmation message is displayed:

```
SNMP Management Station Internet Address Configured
```

After you complete this step, the system reports SNMP trap messages to the NMS that you selected.

•   If you *are not* going to boot your system over the network, go to the "Completing Ethernet Configuration" section on page 2-9.

•   If you *are* going to boot your system over the network, continue with the next section.

Editing NFS Parameters

Step 1   Create a directory for log and trace files on your NFS server and set the appropriate access permissions.

Step 2   Make an entry in the /etc/exports file on your NFS server that indicates the path for the NFS mount point. This allows the file to be shared.

Step 3   Type **4** to set the Network File System (NFS) server parameters.

The following selections appear one at a time. Enter the information for your system. For more information concerning these selections, refer to Table 2-2.

```
Enable NFS Access (Y/N) =Y?
NFS Server Internet Address = 000.0.000.000?
NFS Server Name =xxx?
NFS Mount Directory Point #?
Target System Name =
Target System User Id =
Target System Group Id =
Target System Umask =
Update NFS Configuration With Above Data (Y/N) =Y?
```

Table 2-2   NFS Parameters

Parameter	Definition	Options	Recommended Value
NFS Server Internet Address	Internet address assigned to the device (usually the host computer) on which the log and trace files are to be stored.	Valid internet address in standard dot notation (e.g., 0.9.153.155).	Value supplied by NFS administrator.
NFS Server Name	Name assigned to the device (usually the host computer) on which the log and trace files are to be stored.	—	Value supplied by NFS administrator.
NFS Mount Directory Point	Name of the mount directory device into which the log and trace files are to be stored.	Valid directory specification created for system log and trace files.	Value supplied by NFS administrator.
Target System Name	Name assigned to the VCO by the system administrator.	This name can not include underscore characters. For configurations that include NFS, this name must also be included in the NFS server's /etc/hosts file.	Value supplied by VCO administrator.
Target System User Id	UNIX user ID associated with the directory (log or trace files) of the NFS system.	Valid user ID in decimal notation.	Value supplied by NFS administrator.

Table 2-2   NFS Parameters (continued)

Parameter	Definition	Options	Recommended Value
Target System Group Id	UNIX group ID associated with the directory (log or trace files) of the NFS system.	Valid group ID in decimal notation.	Value supplied by NFS administrator.
Target System Umask	User mask associated with the NFS server.	Valid user mask in hex notation. This must match the permission on the NFS server. No other value is acceptable.	—

Step 4   After you update the NFS configuration with the new data, the following message is displayed:

```
NFS Configuration Updated
```

You can now save the log files and database to a remote location.

Editing Gateway Routing Table Parameters

Step 1   Type **5** to set Gateway Routing Table parameters.

The following selections appear. Enter the information for your system.

```
Route No. 1
    Destination Subnet Address =0.0.0.0?
    Gateway System Internet Address =0.0.0.0?
Route No. 2
    Destination Subnet Address =0.0.0.0?
    Gateway System Internet Address =0.0.0.0?
Route No. 3
    Destination Subnet Address =0.0.0.0?
    Gateway System Internet Address =0.0.0.0?
Route No. 4
    Destination Subnet Address =0.0.0.0?
    Gateway System Internet Address =0.0.0.0?
    Update Gateway Routing Table Configuration With Above Data (Y/N) =Y?_
```

Step 2   Type **Y** to update the gateway routing table configuration with the data changes.

If you type **N** at the final prompt, the following message is displayed, and the Ethernet Configuration screen is displayed:

```
Gateway Routing Table Configuration Aborted
```

Note   The Destination Subnet Address refers to the destination subnet address field in the Gateway Routing Configuration screen. The Gateway System Internet Address refers to the gateway IP address field in the Gateway Routing Configuration screen.

Completing Ethernet Configuration

Step 1   Type **6** (Exit Ethernet Configuration), and press **Enter**.

The Installation Utilities menu is displayed. (See Figure 2-2.)

Step 2   Remove the Ethernet diskette from drive A.

Step 3   To install additional optional software, type **4** (Install Another Software Option).

Configuring a VCO/4K on a Host LAN

To configure a VCO/4K on a UNIX-host LAN, follow these steps:

Step 1   Define the station name and Ethernet address in the '/etc/ethers' file as follows:

uu:vv:ww:xx:yy:zz VCO_Name

The **uu:vv:ww:xx:yy:zz** value is the hex Ethernet address printed on the system CPU and the **VCO_Name** is a user-defined name for the system. Each CPU in a redundant system has a unique Ethernet address and should also have a unique name.

Step 2   Define the station name and Internet address in the '/etc/hosts/' file as follows:

www.xxx.yyy.zzz VCO_Name

The **www.xxx.yyy.zzz** value is the Internet address specific to the LAN on which the system resides and **VCO_Name** is the same as that specified in Step 1.

Network Security

Because network file support enables Internet access to the system, network security is required to limit Internet hosts from connecting to the system.

From the Host Configuration screen, you can use the following NFS parameters to tailor Ethernet network security:

*   *Loc. Port, Rem.Inet.Addr, and the Rem. Port fields*—Lets you limit the access of a specified interface to only the host(s) that the port and IP address value identify. Cisco Systems strongly recommends setting the Rem. Port field to 0. For more information about these fields, refer to the *Cisco VCO/4K System Administrator's Guide.*

*   *Connect Password field*—Lets you define a specific password (up to 16 ASCII characters) for each socket. When a host connects to a system socket, the system requests that the host supply the password. If the host fails, the link is shut down. The password feature can be disabled using the System Features menu. For more information about the System Features menu, refer to the *Cisco VCO/4K System Administrator's Guide*.
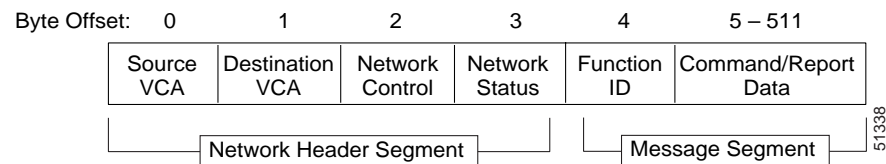
Host Communications

This chapter provides an overview of the Ethernet implementation used by the VCO/4K for communications with host applications. (Administration and NFS communications are described in Chapter 2, "Ethernet Installation and Configuration.")

VCO/4K System Message Structure

Depending on the command or report, a VCO/4K system message can contain 6 to 512 bytes of information. Figure 3-1 illustrates the system message structure.

Figure 3-1   System Message Structure

Byte Offset:	0	1	2	3	4	5 – 511
	Source VCA	Destination VCA	Network Control	Network Status	Function ID	Command/Report Data

Network Header Segment — Message Segment

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Each system message consists of a network header segment and a message segment. The network header segment contains routing, control, and processing status information used by application processes in the host and system. The message segment contains the system command or report. For more information about these segments, refer to the *Cisco VCO/4K Extended Programming Reference* or *Cisco VCO/4K Standard Programming Reference*.

> **Note** The following special considerations pertain when using Ethernet for system host communication:
>
> Because of the Transmission Control Protocol (TCP) stream orientation, all VCO Commands and Reports must be preceded by a 2-byte length count.
>
> Messages are transmitted in network byte order (also called Big Endian), with the most significant byte (MSB) being transferred first. This is opposite from the byte ordering expected by most PC Ethernet implementations.

Communications Interfaces

TCP/IP protocol standards do not require a specific interface between the application programs and TCP/IP; therefore, the interface may vary from system to system. Because the TCP/IP protocol software resides in the operating system, the operating system must determine the interface requirements.

The VCO/4K supports connections established by the host operating system's socket interface. Socket interfaces typically provide host applications with library routines for network functions, including:

- Manipulation of IP Addresses
- Accessing the domain name system
- Performing network byte order conversion
- Obtaining host, network, protocol, and network service information

The socket interface provides the structure for the application's communication link with the VCO/4K. This interface controls the system sockets that provide end-points for TCP/IP's Transport Layer communications. All TCP communication links are active socket-to-passive socket connections:

- TCP establishes a connection between the active socket of a host and a passive socket of the VCO server application.
- Up to eight host-link, passive sockets can be configured for the single cable connection (through the CPU-TM's DB-15 port) to the Ethernet network, each host connection with its own port number.

Note   In addition to the host application socket connections, the VCO/4K also supports TCP/IP connections with a host computer through the Telnet protocol.

Figure 3-2 shows a conceptual view of the communication path between the VCO/4K and a controlling host computer.

Figure 3-2   Socket Interface Conceptual Diagram
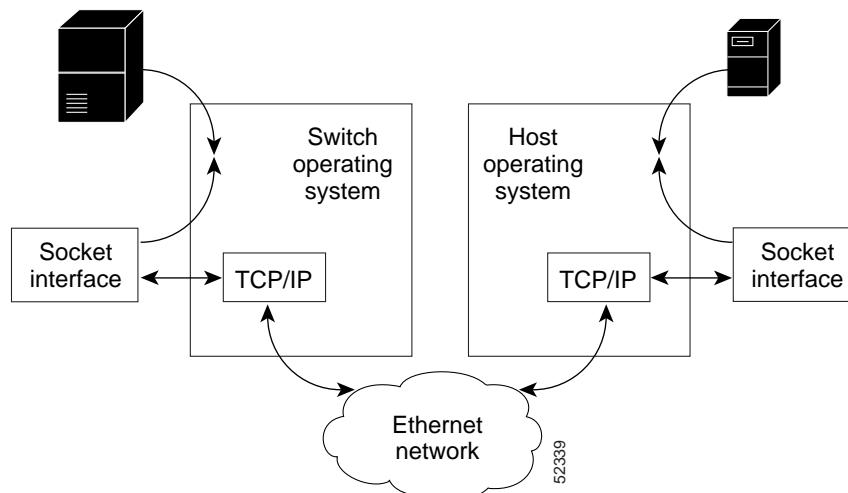
Socket Connections and Host Programming

Sockets are logical connections that provide the end points for all Transport Layer protocol communication links. For TCP transport protocol socket-to-socket connections, sockets are either passive (i.e., located at the server end of the connection) or active (i.e., located at the client end of the connection). The VCO/4K is a server in all of its TCP socket-to-socket links and uses only passive sockets for those links. A passive socket cannot initiate a connection; it uses a Listen state to inform TCP when it is ready to connect with the active socket of the client application.

The VCO/4K uses the following types of sockets for its Ethernet network communication links:

- Stream sockets—Used with the TCP Transport Layer's links, with a host, for command and report data communications. The VCO/4K also supports the Telnet protocol.
- Datagram sockets—Used with the UDP Transport Layer's NFS protocol links with a file server.

Figure 3-3 shows a conceptualized view of the system host-link socket connections to the Ethernet network through the CPU-TM DB-15 port. These host-link stream sockets are bound to TCP port address values which, in turn, are bound to the specific IP address value for the CPU-TM's DB-15 Ethernet network connection. The TCP port and the IP address values together define a host connection.

Note   The port and IP address values shown in Figure 3-3 are for illustration purposes only. The actual address values differ from system to system.

Figure 3-3   Multiple Socket Connection to an Ethernet Network
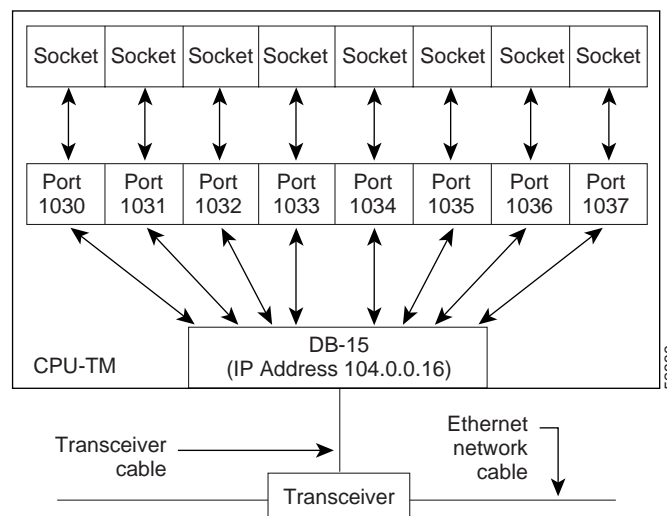
Socket Interface Library Routines

Library routines can be bound into an application program for any of the following functions:

- Host information access
- Network information access
- Network service information access
- Protocol information access

- Network byte order conversion

- IP address manipulation

- Domain system access

Host Socket Application Example

The following sections discuss a pseudocode example that creates a C-socket application for a VCO/4K connected to a UNIX-based host. Other operating systems use similar Ethernet system calls; therefore you can modify this example for different Ethernet hosts.

Opening a Connection with the VCO/4K

The VCO/4K provides the option to require a host password before establishing a socket with the host. For more information about the enabling a host password, refer to the *Cisco VCO/4K System Administrator's Guide*. The following example shows how to open a socket with a password.

> **Note** If password connection fails, the VCO/4K issues an error message and closes the socket. Subsequent host attempts to write a message to the socket are rejected.

```
VCO_Open
(VCO_Name,VCO_Port,Local_Port)
{

        VCO_Entry = gethostbyname (VCO_Name)
        Connected = FALSE
        while Not Connected
        {
                Create a socket using 'socket()'
                Connect to the VCO using address from VCO_Entry and
                VCO_Port
                if error
                {
                        Close the socket.
                        if( error !=ETIMEDOUT && error != EADDRINUSE )
                                return the error
                        else
                                Wait and try again.
                }
                else
                {
                        if doing password verification
```

{

    Receive "Password: " string using 'recv()'

    note: no message length sent by VCO

    if error

        return error

    Send Password as specified in

    VCO Host Config

    using 'send()' *note:do not send*

    message length

}

}

Connected = TRUE

}

Save opened socket descriptor for program usage.

return success

Reading from a Socket Connected to a System

Single UNIX **recv()** calls can read a single system message, part of a system message, or multiple system messages. The following pseudocode illustrates how to handle each of these situations.

Note This example assumes a variable called *Rx_Stream* that holds data already read from the socket, but not yet processed by the application.

VCO_Recv (message)

{

    if data in Rx_Stream

    {

        Get length of next message, first 2 bytes of data –

        Convert to machine byte order as required.

        if all of next message is in Rx_Stream

        {

            Copy next message from Rx_Stream to message

            parameter

            Remove message from Rx_Stream

            return message length.

```
                }

        }

        Append data to Rx_Stream using'recv()' call.

        if error

                return error.

        return VCO_Recv(message) – Recursive call
        to parse stream data.


}
```

Writing a Message on a System Socket

The following pseudocode illustrates the process of writing a message on a system socket.

```
VCO_Write(message,message_len)
{
        Convert message length to network byte order.

        Transmit message length using 'send()'.

        if error

                return error.

        Transmit message using 'send()'.

        if error

                return error.

        return success.
}
```

System Socket—Host Application Structure

The following example illustrates the basic software model for a host application, based on sockets using the subroutines created in the previous examples.

```
main()

{

        VCO_Open("VCO_1",2000,2001)

        Forever

        {

                Connected = TRUE

                while Connected
                {
                        VCO_Recv(message)

                        if no errors
                        {

                                Application specific processing.

                                if need to respond to message
                                {
                                        VCO_Write(response,response_length)
                                        if error
                                                Connected = FALSE
                                }
                        }
                        else
                                Connected = FALSE
                }

                Close VCO socket.
                Reopen the socket, VCO_Open("VCO_1",2000,2001)
        }
}
```

Reestablishing Host Connections

To minimize delays when reconnecting to a VCO socket after a connection has been torn down, do not use the "bind" function in your host application code. In addition, perform the following steps.

Step 1   From the Master Console, type **C** from the System Configuration menu to access the Host Configuration screen.

Step 2   Set the Rem Port value to 0.

Step 3   Set the Reset Time value to 1 second.

System Error Messages

Error messages are written to the VCO/4K system log file. For more information and a list of all error messages, refer to *Cisco VCO/4K System Messages.*