Installation Guide

Aurora X.25 Protocol Software for Solaris systems

Solaris 2.5 , 2.5.1, 2.6 and Solaris 7
for SPARC, SPARC V9 and Intel Platforms

15-00053-00 Revision B

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PREFACE

About This Guide

This guide describes the planning and installation for Aurora's X.25 protocol software for Solaris workstations. It introduces the Aurora X.25 software, identifies the system requirements for running Aurora X.25 programs, and details the software and hardware installation procedures.

Who Should Use This Guide

This guide was written for system administrators. They can use this manual to determine the necessary resources required for running Aurora X.25 and to take them through its installation. There are two primary, system administrator functions:

- As the local system administrator, you install the Aurora X.25 Server and build its configuration file. You should be familiar with the Solaris operating system, the configuration of device drivers, and the configuration of X.25 devices.
- As the network administrator, if X.25 service is provided by a packet-switched public data network, you are responsible for adding new DTEs and Logical Channel Numbers (LCNs)

to the X.25 configuration.You must coordinate the configuration of the Aurora X.25 Server with the X.25 network configuration.

- As the network administrator building a private X.25 network that may include point-to-point X.25 links, you are responsible for adding new DTEs, DCEs and LCNs to the X.25 configuration.

How to Use This Guide

This guide can be used as a reference for specific Aurora X.25 product planning and installation.

This manual is divided into eight chapters and one appendix. The first two chapters provide introductory and overview information and serve as a general reference for anyone involved in configuring or operating Aurora X.25. The remaining chapters give specific planning requirements and installation instructions for the system administrator specifically. Each chapter is described below:

Chapter 1, “Introduction”, provides a conceptual overview of the Aurora X.25 components. It serves as background for subsequent chapters.

Chapter 2, “X.25 Concepts”, gives an overview of X.25, and summarizes the support provided by Aurora X.25.

Chapter 3, “The Aurora X.25 Server”, describes the functions of the Aurora X.25 server and identifies its components.

Chapter 4, “The Aurora X.25 Clients”, describes the Aurora supplied client programs, including the terminal PAD, the host PAD, the API, and the IP/X.25 router.

Chapter 5, “System Requirements”, specifies the required software to run Aurora X.25.

Chapter 6, “Software Installation for Solaris Systems”, describes Aurora X.25 software installation for Solaris.

Chapter 7, “Software Installation for Solaris Systems”, describes Aurora X.25 software installation for Solaris.

Chapter 8, “Hardware Installation and Configuration”, describes how to install the synchronous communications hardware, and how to configure the Aurora X.25 Server to use the hardware.

Related Documentation

From Aurora

Aurora X.25 Configuration and Use

Aurora X.25 API Reference

Aurora X.25 PAD Reference

From Other Sources

CCITT (ITU) Recommendation X.25, 1984

CCITT (ITU) Recommendation X.3, 1984

CCITT (ITU) Recommendation X.28, 1984

CCITT (ITU) Recommendation X.29, 1984

RFC 877, A Standard for the Transmission of IP Datagrams over Public Data Networks, J. T. Korb, September, 1983

System & Network Administration, Sun Microsystems, 800-1733-10

SPARC Workstation Installation Guide/Hardware Owner's Guide (various)

Installation Library/Information Library Intel Platform Edition (various)

Documentation Conventions

Unless otherwise noted in the text, this manual uses the following symbolic conventions:

`screen text`	ASCII text that the system displays, pathnames, and commands in the text appear in `plain typewriter` font.
screen display	Graphic text that appears on menus and dialog boxes appears in sans serif font.
`literal input`	Bold words or characters in formats and command descriptions represent commands that you must type literally. Literal values are in the **`bold typewriter`** font.
<non-literal input>	Bold, italic, bracketed words or characters in formats and command descriptions represent values that you must supply. Do not type the brackets.
emphasis	*Italics* are used in the text for emphasis, titles, and variables.
✎	This symbol marks procedures.
❒	This symbol indicates the end of the text in a chapter.
	This symbol marks cautionary notes about possible damage to your equipment or data.

Getting Help

If you need to reach us, you can contact us by

- The Web: **www.auroratech.com** for product literature, phone numbers and address.
- Phone service: Mon–Fri, 8:30–6:00 Eastern Time
  For faster service, have your product serial number available.
- FAX: Attn: Customer Service and Support
- Email: **support@auroratech.com**
- Mail: Attn: Customer Service and Support

Warranty Registration

To receive warranty coverage on your Aurora software, you must fill out and mail back the Aurora Warranty Registration Card that is located in the back of this manual. Sending in this card also lets us keep you up-to-date on the complete line of Aurora Technologies' products.

If you have any questions or comments on your Aurora Technologies' product, contact your reseller. If you cannot contact your reseller, feel free to contact us directly. We're always listening to you! ❒

CHAPTER 1 *Introduction*

Aurora's X.25 software enables Solaris workstations on your local area network (LAN) to communicate with terminals and other computers over public and private X.25 networks. This chapter provides an overview of Aurora X.25 and its use.

Aurora X.25

Aurora X.25 is a comprehensive implementation of the October 1984 revision of CCITT (ITU) Recommendation X.25, enabling Solaris workstations on your local area network (LAN) to communicate with terminals and other computers over public and private X.25 networks. The Aurora X.25 product set includes

- X.25 interface. Consists of X.25, HDLC, and physical device drivers implemented in Solaris System V STREAMS.
- IP/X.25 network interface. Provides X.25 network interfaces to the Solaris system Internet layer. A Solaris system with a LAN network interface and the Aurora IP/X.25 network interface can route between the LAN and the X.25 network.
- Aurora X.25 Server. Controls the X.25 interface and provides X.25 network access to its client applications.
- Aurora Terminal PAD. The Aurora X.3/X.28/X.29 terminal PAD implementation.
- Aurora X.29 Host PAD. The Aurora X.29 host PAD implementation.
- Application Programmatic Interface (API). If you want to create your own client applications.

Figure 1 illustrates how Aurora's X.25 Server (and its client applications) may be positioned in an X.25 network. The features are described in the sections that follow.

> **Note:** Application names use the "aura" and "brx" prefixes interchangeably. For example, aurapad and brxpad represent the same application. Both naming conventions are used throughout the manual but generally only one is listed at a time.

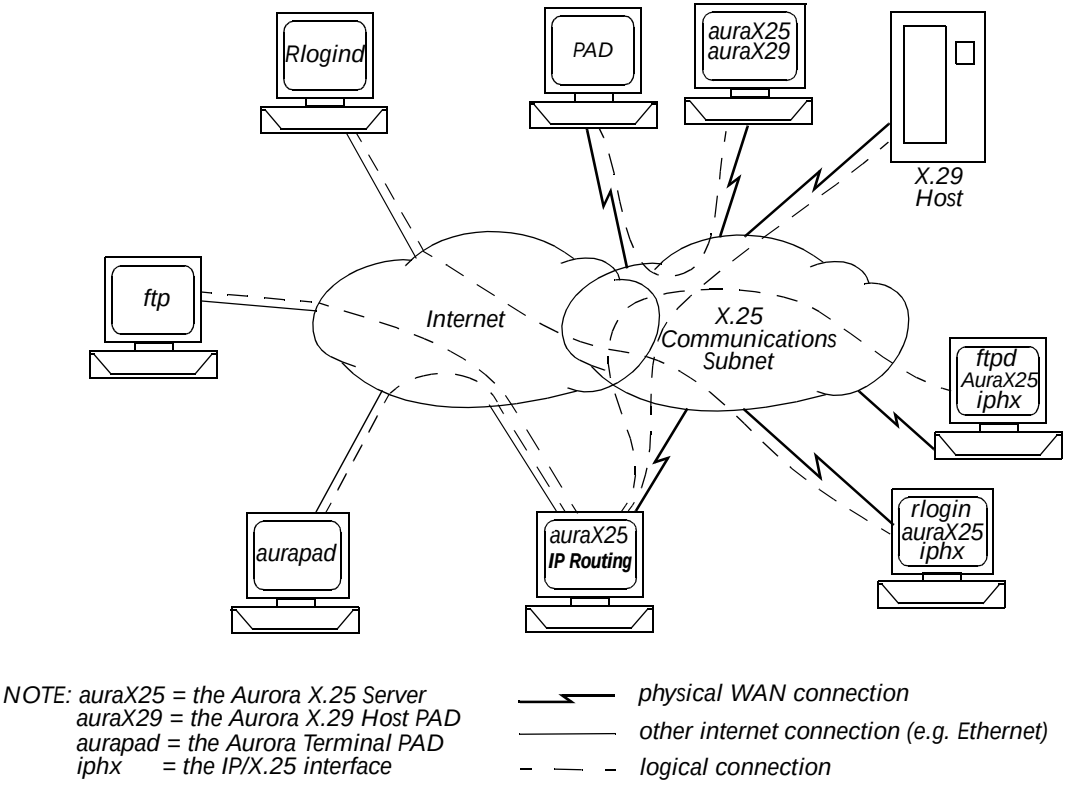

FIGURE 1. *Aurora's X.25 Server in an X.25 network*

1984 X.25 Support

Aurora X.25 implements an X.25 interface to the network that complies with the 1984 CCITT X.25 Recommendation. It supports multiple lines to one or more X.25 networks. Chapter 2 introduces the X.25 concepts and summarizes the level of support provided by Aurora X.25. The interface is configured and controlled by the Aurora X.25 Server, which is described in Chapter 3.

IP over X.25

Aurora X.25 provides integral support for the transport of Internet Protocol (IP) data over X.25. This feature, referred to as IP/X.25, allows you to operate the familiar TCP/IP programs such as rlogin and ftp over the wide area, as well as your own TCP/IP programs. Chapter 4 describes the IP/X.25 feature in more detail.

PAD Support for Asynchronous Devices

The Aurora X.25 product set includes standard (X.3/X.28/X.29) support for asynchronous terminals over X.25. The Aurora Terminal PAD lets you access a remote host on the X.25 network from a terminal emulation window on your workstation, or from an asynchronous terminal connected to your workstation. The Aurora X.29 Host PAD allows remote terminals to access your workstation by using a terminal PAD (such as Aurora's). Aurora's Terminal PAD and X.29 Host PAD are discussed in Chapter 4.

Distributed Processing

The Aurora X.25 Server is a TCP/IP server, providing X.25 network access to client applications running anywhere on the LAN. Client applications may be other Aurora products, such as Aurora's Terminal PAD, or user-written X.25 applications. User applications are written using the Aurora's X.25 Application Programmatic Interface (API). The Aurora's X.25 API is discussed in Chapter 4.

Incoming Call Distribution

The Aurora X.25 Server uses a call database to distribute incoming call requests to user applications. Calls may be distributed by any combination of link, called address, calling address, and user data, as defined by you in the call database.

auraX25 Management

auraX25 is fully configurable at the IP interface, packet, link, and physical levels. You can selectively enable or disable X.25 facilities according to your requirements or the requirements of your network.

The auraX25 Operator provides on-line control and monitoring of auraX25. An on-line message database contains a full description of all system messages. ❒

CHAPTER 2 *X.25 Concepts*

Aurora X.25 implements the October 1984 revision of CCITT Recommendation X.25. X.25 is an international standard for packet-switched data communications. Public data networks (PDNs) conforming to the X.25 standard are operated by the telecommunications providers in most countries of the world. Gateways between these national PDNs allow you to communicate internationally. X.25 support is available, almost without exception, on computers from all manufacturers.

The next section introduces the basic concepts of X.25; skip this section if you are already familiar with X.25. Aurora's implementation of X.25 is summarized at the end of this chapter.

Introduction to X.25

As shown in Figure 2, CCITT Recommendation X.25 actually specifies the *interface* between your computer and the network. Your computer is designated as the DTE (Data Terminal Equipment), and the network's equipment (usually a packet switching node) as the DCE (Data Circuit-terminating Equipment).

Once data enters the network at the DCE, the network uses its own (usually proprietary) protocols to transport the data to the destination DCE/DTE interface.

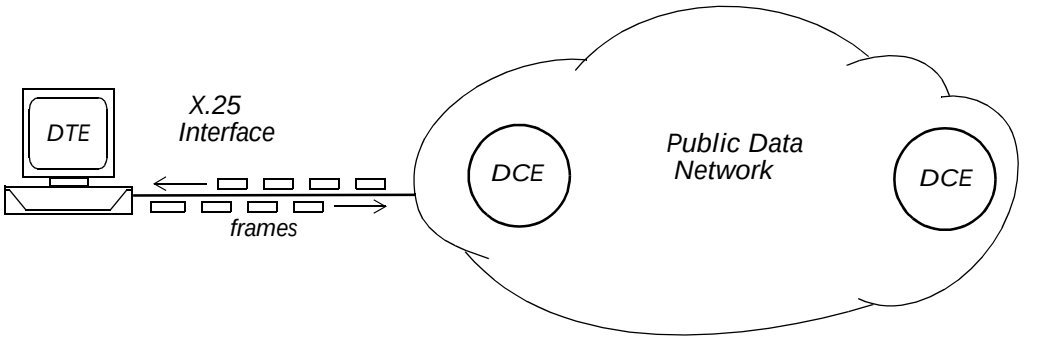

FIGURE 2. *X.25 Interface*

The X.25 DTE/DCE interface is specified in terms of three protocol levels: the *physical level*, the *link level*, and the *packet level*. X.25 provides the first three layers of the ISO 7-layer model for Open Systems Interconnection (OSI). The X.25 protocol levels are illustrated in Figure 3 and described in detail in the sections that follow.

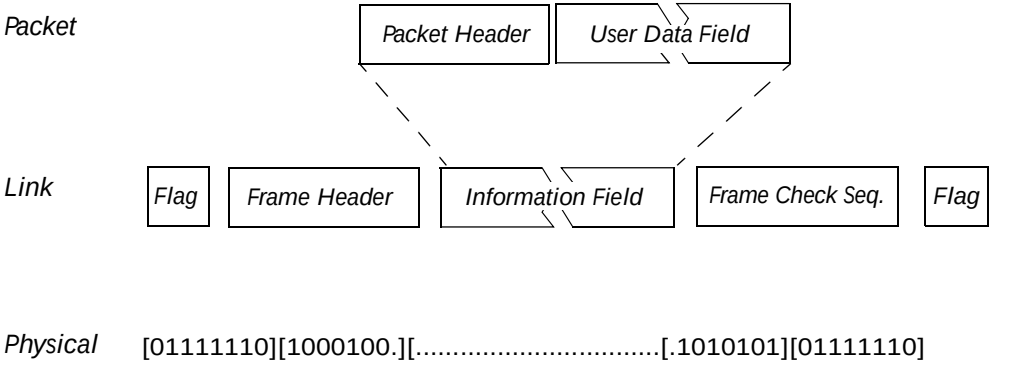

FIGURE 3. *X.25 Protocol Layers*

The Physical Layer

At the lowest level, the physical layer defines the electrical characteristics of the interface. It is concerned with the DTE and DCE transmitting and receiving bits.

The Link Layer

The link layer transmits user data in *frames*, i.e., as (synchronous) streams of bits separated by flags. It provides for the error-free transmission of these frames over the communications link between the DTE and the DCE. X.25 allows the use of Link Access Procedures LAP or LAPB (Link Access Procedures - Balanced) as its link level protocol. The use of LAP, however, is being phased out by the network providers.

The Packet Layer

The packet layer supports *virtual circuits* between DTEs. Virtual circuits are analogous to normal telephone circuits, i.e., they provide an end-to-end connection between two network users. Virtual circuits, like telephone circuits, may be switched or leased.

Switched Virtual Circuits (SVCs) are temporary connections established by a call. The packet level enables you to call a remote DTE, specifying its X.121 "phone number" or network address. Permanent Virtual Circuits (PVCs) are dedicated connections. The packet level can support multiple concurrent virtual circuits over a single communications link.

Aurora's Support for X.25

The network access service provided by Aurora X.25 is a comprehensive implementation of 1984 CCITT Recommendation X.25. Aurora's support for X.25 is summarized in the table at the end of this section.

At the physical level, the communications hardware typically supports RS-232-C. Refer to Chapter 6, “Hardware Requirements,” for specific information. You can use external interface converters to convert RS-232 to other electrical interface standards including RS-449, RS-422, MIL-STD-188, and V.35. Up to 32 links may be supported.

Aurora X.25 uses HDLC framing and X.25 LAPB procedures at the link level. The link level parameters are fully configurable for each link.

At the packet level, Aurora X.25 can sustain a total of 4096 active circuits, depending on available physical memory, aggregated over all links. Both SVCs and PVCs are supported. The characteristics of each virtual circuit are assigned by link.

Aurora X.25 fully supports the use of the Delivery Confirmation bit (D-bit) and the More Data mark (M-bit). The D-bit indicates that a received acknowledgment has end-to-end significance, i.e., that the remote DTE has received the packet. If the D-bit is not set, an acknowledgment has local significance only, i.e., the packet has been received by the local DCE. The M-bit is used to indicate a sequence of more than one packet.

Aurora X.25 provides DTE support for an extensive set of X.25 facilities, as shown in Table 1 (following page). ❒

TABLE 1. *Aurora’s X.25 Support*

Protocol Level	Attribute	Comment
Physical		See Chapter 6, “System Requirements”
Link	Sequence numbering	modulo 8 or 128
	Frame window size	1 to 7 or 1 to 127, depending on the use of standard or extended sequencing, respectivley
	Acknowledgment timer, T1	configurable
	Reply timer, T2	configurable
	Maximum frame size, N1	4K plus 2 bytes for CRC

TABLE 1. *Aurora's X.25 Support (Continued)*

	Retry limit, N2	configurable
Packet	Packet sequence numbering	modulo 8 or 128
	Default packet size	16 to 4096 bytes
	Default window size	1 to 7 or 1 to 127, depending on the use of standard or extended sequencing, respectivley
	Default throughput class	75 to 48000 bps
	T20, T21, T22, and T23	configurable call service timers
	N20, N22, and N23	configurable retry limits
Facilities	Extended packet sequence numbering	modulo 128
	Packet retransmission	reject packet handling
	Incoming calls barred	
	Non-standard default packet size	16 to 4096 bytes
	Non-standard default window size	1 to 7 or 1 to 127, depending on the use of standard or extended sequencing, respectivley
	Flow control parameter negotiation	packet and window size
	Throughput class negotiation	75 to 48000 bps
	Closed User Group (CUG) acceptance	
	CUG selection	
	CUG with Outgoing Access selection	
	Bilateral CUG selection	
	Fast select	with or without restriction
	Fast select acceptance	
	Reverse charging selection	
	Reverse charging acceptance	
	Network user identification	
	RPOA selection	
	Transit delay selection	

CHAPTER 3 *The Aurora X.25 Server*

Aurora X.25 provides a platform for client programs to access the X.25 network. This chapter describes the platform functions, which are controlled by the Aurora X.25 Server, and introduces the Aurora X.25 software components.

Aurora X.25 Functions

X.25 Interface

The X.25 interface protocol layers are provided by Solaris System V STREAMS drivers. The X.25 packet level driver also supports the IP/X.25 network interfaces.

The Aurora X.25 Server

The Aurora X.25 Server is responsible for managing the X.25 interface, including the physical connections, and for providing the X.25 network access service to its client applications. During

start-up, the Aurora X.25 Server constructs the data streams and configures the X.25 interface for operation.

The system administrator supplies the configuration information in a standard Solaris text file. This file specifies the X.25 interface parameters such as link speed, default packet size, and required facilities. These parameters must be coordinated with those of the network and the remote DTE(s). Additionally, IP/X.25 operation requires a corresponding Solaris network configuration.

Flow Control

The Aurora X.25 Server manages both send and receive flow control. The server flow controls the receipt of data on a virtual call according to parameters established by the user application. The application specifies the total number of data packets that the server is allowed to queue for the application. When this number is reached, no more data is accepted from the network. Only when the number of queued packets falls below the specified low water mark will the server authorize the receipt of more data.

The Aurora X.25 Server controls the data flow from a user application. When the number of packets queued for transmission on a VC reaches a high water mark, the server stops reading data from the application. Application writes will be blocked until the number of queued packets falls below a low water mark.

Incoming Call Distribution

The Aurora X.25 Server is responsible for distributing incoming call requests to user applications and can be configured to start-up an application when necessary. Incoming calls are dis-

tributed to applications according to one or more of the following criteria, which are specified in the Call Database:

- Link
- Called address
- Calling address
- User data, with match criteria specified in hex or ASCII

When an incoming call is received, the Aurora X.25 Server searches the Call Database for an application to service the call. If such an application is on-line and available, the call is distributed to that application. Otherwise, the server will start the application (if you configured it that way).

Link Selection for Outgoing Calls

When multiple links are supported, user applications may select the link for their outgoing call requests or they can request the Aurora X.25 Server to select a link on their behalf. The Aurora X.25 Server distributes calls among available links in a round-robin fashion.

The Aurora X.25 Operator

Control and monitoring is provided by the Aurora X.25 Operator. The Aurora X.25 Operator accepts user commands and displays responses and unsolicited notifications from the Server. The Aurora X.25 Operator allows you to:

- Display status of Server links.
- Activate or deactivate links.
- Report/reset Server statistics.

Message Database

All Aurora products (except LAPB/HDLC) are distributed with an on-line message database, the `BMD`. The message database is an important reference and troubleshooting guide, containing

all the error and information messages output by Aurora software.

Each message contains a unique message number and the reason for the message. Error message entries also describe the impact of the reported condition and the actions you should take to recover. Your first action when an unexpected error report is received, therefore, is to reference the BMD.

Aurora X.25 Components

Figure 4 identifies the Aurora X.25 components and their relationships. The identified components are as follows:

`auraX25`	The Aurora X.25 Server application.
`auraX25op`	The Aurora X.25 Operator application.
`aurapad`	The Aurora X.3/X.28/X.29 packet assembler/disassembler application for terminals.
`auraX29`	The Aurora X.29 host packet assembler/disassembler application.
`auraX25.config`	The Aurora X.25 configuration file.
`auraX25.calldb`	The Aurora X.25 call database.
`BMD`	A directory containing the Aurora X.25 message database.
AURAapi	The Aurora X.25 Application Programming Interface.
iphx25 driver	STREAMS implementation of X.25 packet level and IP/X.25 network interfaces.
HDLC driver	STREAMS implementation of the HDLC/LAPB link level protocol.
Physical device drivers	Handle the hardware that provides the physical HDLC links.

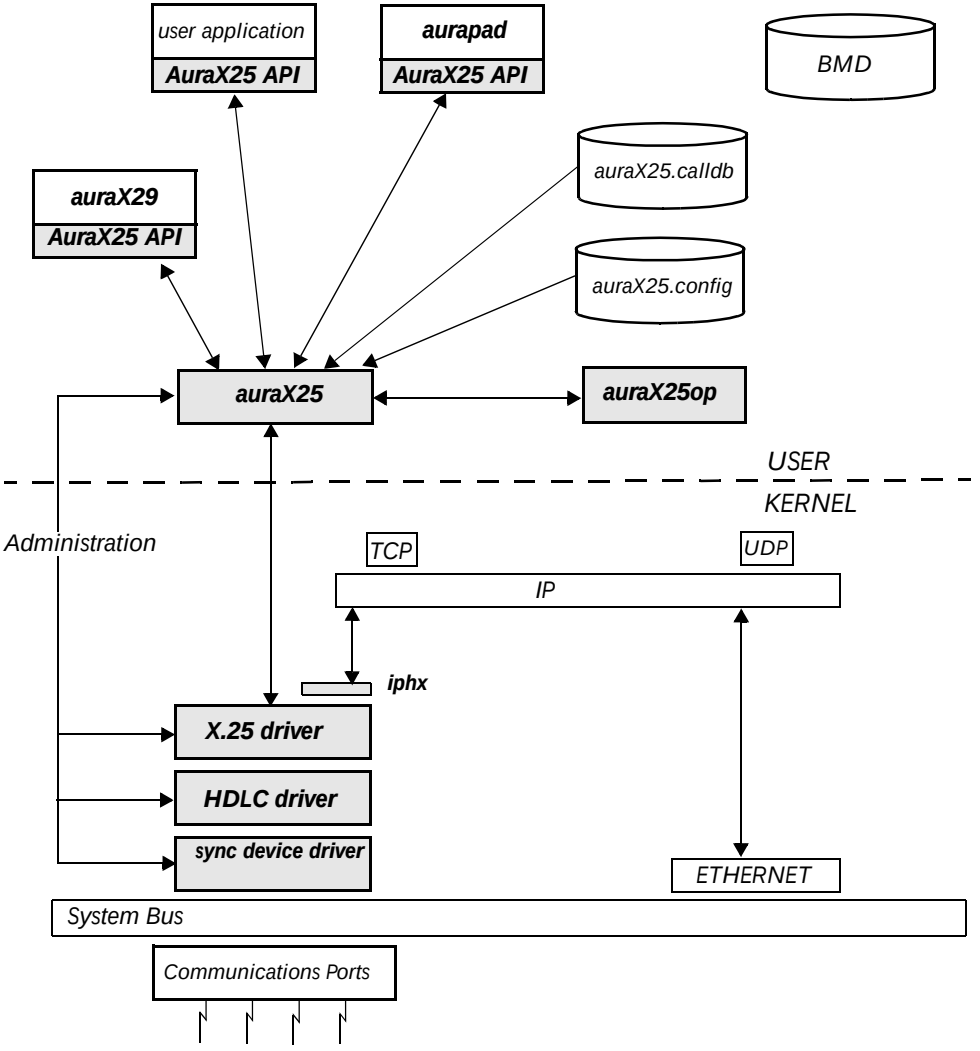

FIGURE 4. *Aurora X.25 Components*

CHAPTER 4 *Aurora X.25 Clients*

As a TCP/IP server, the Aurora X.25 Server provides an X.25 network access service to its client applications running anywhere within the TCP/IP internetwork. Client applications use TCP sockets to communicate with the server. The Aurora X.25 Server can service up to 255 separate client applications, subject to SolarisSolaris system limits and configured virtual circuit resources. The Aurora X.25 Server clients are:

- `aurapad`, the Aurora X.25 Terminal PAD
- `auraX29`, the Aurora X.29 Host PAD
- Aurora X.25 API, the application programming interface the Server

The IP/X.25 router is also considered an Aurora X.25 Client. Although not a TCP client of the Aurora X.25 Server, the IP/X.25 router uses the X.25 network service.

The IP/X.25 Router

Transport of the Internet Protocol (IP) over X.25 is an integral feature of Aurora X.25. The Aurora implementation is compatible with RFC 877, which specifies a standard for the transmission of IP datagrams over X.25 networks.

Aurora X.25 maps configured IP network interfaces to X.25 SVCs. An SVC is opened when the first IP datagram is received at a network interface for transmission. Up to 255 interfaces can be configured.

IP/X.25 enables the standard and user-written TCP/IP socket-based applications to operate seamlessly over the X.25 network. Thus, for example, you can rlogin to a Solaris host on the PDN the same way you rlogin to another workstation on your local ethernet LAN. Using the X.25 as a network interface layer is as transparent to the applications, or to IP, as any other point-to-point network medium.

The Terminal PAD

`aurapad` is a full Solaris implementation of the 1984 CCITT X.3, X.28, and X.29 Recommendations. The `aurapad` lets you access a remote X.29 host on the PDN from a window on your workstation or from an asynchronous terminal connected to your Solaris system.

The X.29 Host PAD

`auraX29` is an X.29 Host PAD. `auraX29` allows asynchronous terminals, using a local PAD (such as `aurapad`), to access your workstation over the PDN.

The Aurora X.25 API

Client applications are written using the Aurora X.25 API, which is a library of function calls bound into the client application process. The client application issues function calls to the API, which validates and formats the user requests, and forwards them to the Aurora X.25 Server. Server responses are received by the API and delivered to the application. The API allows you to do the following:

- Place and accept calls with full control and access to user facilities.
- Send and receive reset and interrupt packets.
- Send and receive data packets, with control of the X.25 Q-bit, M-bit, and D-bit.
- Optionally receive notification when data packets are acknowledged.
- Optionally control the acceptance of packets from the network.

Aurora supplies both a base-level API and a higher-level API. The base-level API is completely asynchronous in nature. User programs are responsible for maintaining the X.25 state of each virtual circuit that they control. The higher-level API is designed to provide a more convenient interface for user programs by providing some synchronous operations, e.g., connect, reset, and clear. ❒

CHAPTER 5 *System Requirements*

This chapter describes the software and hardware you need to run Aurora X.25 on Solaris systems.

Software Requirements

Client programs running on a Solaris system can access an Aurora X.25 Server running on the local system. Alternatively, clients can use a Aurora X.25 Server running on some other computer in the TCP/IP network, which may or may not be a Solaris system.

The Solaris system has four software components:

The Aurora X.25 Server and the IP/X.25 Router. The IP/X.25 router is integrated into the X.25 STREAMS driver. It is only necessary to run the Aurora X.25 Server to have access to this feature.

- The Aurora Terminal PAD. The Terminal PAD operates as a TCP/IP client of the Aurora X.25 Server.

- The Aurora X.29 Host PAD. The Host PAD operates as a TCP/IP client of the Aurora X.25 Server.
- The Aurora X.25 API. Client applications written using the Aurora X.25 API operate as TCP/IP clients of the Aurora X.25 Server.

Hardware Requirements

This chapter describes the hardware requirements to support connectivity to an X.25 network from the Aurora X.25 system. Supported SPARC and Intel architecture computers, telecommunications, local serial port cabling, and SBus and PCI communications board cabling are discussed.

Aurora X.25 supports the entire line of Sun Microsystems SPARC systems, including:

- SPARCclassic
- SPARCstation LX
- SPARCstation 2
- SPARCstation 5
- SPARCstation 10
- SPARCstation 20
- Ultra SPARC 1000, 2000, 3000, 4000, 5000, 6000, 10000

Also, Aurora X.25 supports the Intel architecture PCI workstations.

For a current list see Aurora's web site at www.auroratech.com.

Aurora X.25 communications software uses Aurora expansion ports to connect to the X.25 network.

Connecting to the X.25 Network

There are many different ways to connect to the X.25 network. Figure 5 illustrates two possibilities.

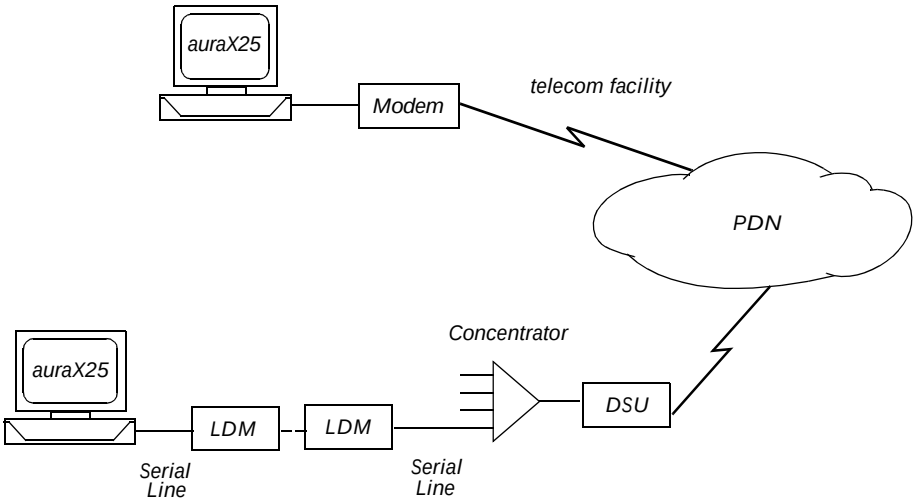

FIGURE 5. *Two ways to connect to the X.25 network*

The most common way to connect to an X.25 network is via a leased line connection to the network provider's switch location. If you are subscribing to a PDN, the provider will arrange for the circuit to be installed in your premises. The circuit will be terminated by a modem or, in the case of a digital facility, a data set unit or DSU. You will be responsible for cabling your system to the modem.

If your system is located far enough from the modem or network DCE that signal degradation is a problem, Limited Distance Modems (LDMs) may be used. If your site has a large requirement for network access, it is probable that some form of multiplexor will be used, in which multiple low speed lines

are multiplexed over higher speed connections to the network. This multiplexor could well be an X.25 concentrator or even a packet switching node. Both LDMs and multiplexors, however, usually look like modems to your system, i.e., they are physical DCEs.

A straight-through, 11-conductor cable, terminated with DB-25 connectors will generally connect the Aurora X.25 system to a standard V.24 (RS-232-C) modem. (In a straight-through cable, conductors connect pin 1 to pin 1, pin 2 to pin 2, etc.) The gender of the cable connectors depends on the gender of the communications ports on the system and the modem.

The RS-232-C standard dictates a maximum cable length of 50 feet. Use of (more expensive) shielded, low capacity cable can extend this distance up to about 200 feet. The cable length, however, should not exceed the length suggested by the modem manufacturer.

Interface Adapters

For higher speed link connections (greater than 38.4 Kbps), an interface adapter may be required. Adapters, for example, can convert an RS-232-C interface (V.24) to a V.35 interface. Refer the manufacturer's documentation when selecting an adapter for your installation.

Modems

Modems, LDMs, and modem eliminators control physical level communications between the Aurora X.25 Server system and the network DCE. If you are responsible for selecting and installing these devices, do the following:

Choose modems that meet the criteria stated in the Modem Requirements table.

Where applicable, ensure that the modems are compatible with those used by the network provider.

- Ensure that the modem parameters/switches are correct. Refer to the modem documentation and the Modem Requirements table.
- Check that the distance from each modem to the connected device is less than the maximum cable length specified by the modem manufacturer.

TABLE 2. *Modem Requirements*

Parameter/Switch	Requirement
Mode	Synchronous
Link	Point-to-Point
Data Flow	Full duplex
Speed	minimum 2400 bps
Interface	V.24, RS-232-C. Any other interface will require an interface adapter.
Data Encoding	NRZ or NRZI

Serial Communications Hardware

Aurora serial communications hardware is available in a number of forms. Single-board Communications Controllers reside inside the Solaris workstation cabinet.

The higher capacity LANMultiServers and WANMultiServers consist of a system bus interface card that resides in the Solaris workstation and daisy-chains to some number of separate expansion units. All of these Aurora products provide expanded, high-speed serial communications connectivity. The cards interface with the Solaris workstation through the system bus architecture internal to the workstation platform.

Refer to the user manual shipped with your Aurora communications hardware for a description of its performance, use, and cabling. ❒

CHAPTER 6

Software Installation for Solaris Systems

This chapter describes the software installation procedure for the Aurora X.25 product set on Sun Microsystems Solaris server or Solaris workstation platforms. Installation is performed using the standard `pkgadd(1M)` utility. If you prefer, the software can also be installed using the Software Manager (`swm`) utility or the Software Manager Tool (`swmtool`) utility. Refer to the chapter "Adding and Removing Packages" in the *Solaris 2.4 Configuration and Installation Guide* for more information on the various ways a software package may be installed.

"Software Deinstallation" later in this chapter describes how to remove the Aurora software using the `pkgrm(1M)` command.

Before Installing the X.25 Software

The Aurora synchronous driver must be loaded before the X.25 software can be run. Be sure to load the Aurora driver when you install your Multiport card. If this driver wasn't loaded when your Aurora card was installed, you will have to load it

before using X.25. You can continue with this installation, but X.25 will not run until the driver is loaded.

Note that the Aurora X.25 software will be installed into `/opt/AURAx25` and optionally `/opt/AURAapi` and `.opt/AURApad`.

Before beginning the installation, please record the requested product information on the "Product Information Worksheet" at the back of this *User's Guide*, and mail your Product Registration Card, found in the back of this manual.

Installation

Experienced installers may find enough information in this section that they will not need to read further. Before beginning the installation, please record the requested product information in the back of this manual and mail your Product Registration Card.

There are three X.25 packages on the CD-ROM. AURAx25 is the basic X.25 softare. You may optionally install AURAapi and AURApad.

Preparatory Steps to Installation

1. Verify that the Aurora synchronous driver is loaded.
2. Remove existing Aurora X.25, PAD and API packages using `pkgrm`.
   (Disable processes on ports if necessary.)
3. To properly install the driver you need to know three attributes of your system. If you can answer the following questions you are ready to install the driver.
   1 Is Volume Manager (`vold`) running on your system? Your possible answers are Yes or No.

2 What is the system architecture? Your possible answers are SPARC or x86.

4. What Solaris operating system version of the driver do you need to install? This release supports Solaris 2.5, 2.5.1, 2.6 and Solaris 7 (32-bit only). Therefore, to install the driver your answer is limited to those listed.

If the Solaris volume management daemon `vold` is running on your system, it automatically mounts the Aurora CD-ROM when you insert it in the CD-ROM drive. If `vold` is not running, you will have to mount the CD-ROM manually.

To check if `vold` is running, type:

```
system# ps -elf | grep vold
```

If you see a line with '`/usr/sbin/vold`' in the far right column, `vold` is running on the system.

If you do not see a line with '`/usr/sbin/vold`' in the far right column, `vold` is not running on the system.

Installation

1. Login as, or become, root:

```
system% /usr/bin/su
Password: <root_password>
```

2. Insert the CD-ROM into the CD-ROM drive.

3. Install using with or without Volume Manager running.

- If Volume Manager (`vold`) **IS** running, then type:

  ```
  system# volcheck
  ```

  Mount the CD-ROM as `/cdrom/x25_4_00_ed1. Proceed to step 4.`

- If your system does not have Volume Manager (`vold`) enabled, you must mount the disk manually. To do this, you must know the device pathname for the CD-ROM drive. On SCSI-

connected SPARC systems, it is typically `/dev/dsk/c0t6d0s0`. If you do not know your CD-ROM pathname, see your system administrator. To proceed when Volume Manager **IS NOT** running, create the mount point.

1 Type:

```
system# mkdir /mnt
```

2 Mount the CD-ROM:

```
system# mount -rF hsfs <cdrom-device-name> /mnt
```

Where `<cdrom-device-name>` is the device name of your CD-ROM drive. For example:

```
system# mount -rF hsfs /dev/dsk/c0t6d0s0 /mnt
```

See the `mount(1M)` man page for additional information. If you are unable to mount the CD-ROM, ask your System Administrator for help.

4. To install the driver, use the following command template as appropriate.

```
system# pkgadd -d <MOUNTPOINT><ARCHITECTURE><SOLARIS_OS>
```

where <MOUNTPOINT> is one of:
- /cdrom/x25_4_00_ed1 when VOLD is running
- /mnt when VOLD is not running

where <ARCHITECTURE> is one of:
- /sparc for SPARC 32-bit architecture
- /sparcv9 for SPARC 64-bit architecture
- /i386 for x86 architecture

where <SOLARIS_OS> is one of:
- /SunOS5.5 for Solaris 2.5
- /SunOS5.51 for Solaris 2.5.1
- /SunOS5.6 for Solaris 2.6
- /SunOS5.7 for Solaris 7

As an example, to install the *Solaris 2.6* driver on a 32-bit *SPARC* system with *Volume Manager running* use the command:

```
system# pkgadd -d /cdrom/x25_4_00_ed1/sparc/SunOS5.6
```

See the `pkgadd(1M)` man page for additional information.

5. When you are prompted for the specific X.25 components implementation, choose AURAx25 and optionally AURAapi and AURApad.

6. To verify that the driver is properly installed, type:

```
system# pkginfo -l <PKG>

where <PKG> is one of:
•/AURAx25 for the basic X,25 package
•/AURAapi for the X.25 API package
•/AURApad for the X.25 PAD package
```

7. To detach from the cdrom device, type:

```
system# cd /
```

8. If Volume Manager **IS NOT** running, you must unmount the CD-ROM. Type:

```
system# umount /mnt
```

See the `umount (1M)` man page for additional information.

9. Eject the CD-ROM.
   - If Volume Manger **IS NOT** running, press the eject button
   - If Volume manager **IS** running, type:

```
system# eject x25_4_00_ed1
```

10. Obtain and install your EOS string. See “Obtain and Install License Key” on page 35.

11. Mail or FAX in your Product Registration Form.

Miscellaneous Installation Procedures

Use the procedures in this section to install the X.25 software on workstations running the qualified Solaris version. The first procedure removes old versions of X.25, PAD and API (if you

are installing X.25 for the first time you can skip this procedure). The second procedure installs the new X.25 software.

Removing an Old Version of X.25

If there is an old version of Aurora X.25 software already installed on the workstation, you must use the following procedure to remove it before installing the new ones. If you are installing the X.25 software for the first time, skip this procedure and go on to *Obtain and Install License Key* on page 35.

✎ *To remove existing X.25 packages*

1. Log in as root by typing
   ```
   login: root
   password: <root_password>
   ```
2. Check for existing Aurora packages by typing
   ```
   system# pkginfo | grep AURA
   ```
   The system will display all the Aurora packages it finds. Look in the list for one of the following packages:
   ```
   AURAx25
   AURAapi
   AURApad
   ```
   If the system does not find either of these packages, skip the rest of this procedure and go on to "Obtain and Install License Key" on page 35, below. Otherwise continue with Step 3.
3. Disable all processes on the communications controller ports.
4. Type the appropriate command, based on what `pkginfo` finds:
   ```
   system# pkgrm AURAx25
   ```
   or
   ```
   system# pkgrm AURAapi
   ```

or

```
system# pkgrm AURApad
```

5. Type `y` in response to the resulting prompts.

Obtain and Install License Key

Aurora X.25 requires a license key in the form of an EOS string for correct operation.

To obtain a license, fill out and mail (or FAX) the Aurora Warranty Registration Card located in the back of this manual. Or contact Aurora Customer Support using the information provided in this manual's Preface.

When you contact Customer Support you will need to provide:

- Your Aurora X.25 serial number (from the box in which this manual was packed)
- The `hostid` of the system on which you have installed Aurora X.25

You can enter this information in the Product Information Worksheet on the last page of this manual.

Post Installation

Aurora provides a post-installation script for each package. This script is automatically run by `pkgadd` once it has extracted and installed the package files.

Aurora X.25 Services. The following table lists the TCP services required for Aurora X.25 operation.

TABLE 3. *TCP services for Aurora X.25*

Service	Server	Clients
auraX25_serv	`brxX25`	`brxX25op`

TABLE 3. *TCP services for Aurora X.25*

auraX25_cntrl	brxX25	brxpad
		brxX29
		Aurora X.25 API applications

The Aurora post-installation scripts update the system's /etc/services as necessary for each product. Before doing so, however, the script saves a version of the services file to be updated, for example, /etc/services.brxX25. It also marks any new lines it adds to the file with explicit comments. The post-installation scripts attempt to create /etc/services entries with known port numbers. This is not always possible since a port number may already be assigned to another service. If you are installing clients on systems remote from the Aurora X.25 Server, verify that the installed service port numbers are the same as those on the Aurora X.25 server's system.

Manual Procedures. If you are running Network Information Service (NIS, also known as YP), updating the /etc/services file is not enough. You must manually update the services map on the NIS master host and yppush(8) the map from the NIS master host to the NIS slaves.

> **Note:** Aurora X.25 supports loadable device drivers. The associated devices listed in the following table are created during installation. Some of the devices in the /dev directory are symbolically linked to devices in the /devices/pseudo directory. Check to see if any of these devices conflict with device names in your /dev directory or /devices/pseudo directory. If there is a conflict, contact Aurora Technical Support.

TABLE 4. *Aurora X.25 Device Drivers*

Device or Pseudo Device	/dev directory	/devices/pseudo directory
X25 Driver	brxX25	clone:brxX25

TABLE 4. *Aurora X.25 Device Drivers*

HDLC Driver	`hdlc`	`clone:hdlc`
IP/X25 Driver	`iphx`	`clone:iphx`
IP/X25 Interfaces	`hx`	
Scope Driver	`scoped`	`clone:scoped`
SBus or PCI Board Ports 0-3	`sync/0–sync/3`	
SBus or PCI Board Ports 0-7	`sync/0–sync/7`	

Troubleshooting

This section describes the actions to take if you encounter problems during the software installation procedure.

`pkgadd` installation progress is output to the terminal or window. Aurora post-installation scripts log their output to a `log.AURAx25` file in the installation directory. If the installation process fails, determine where in the installation procedure the error was encountered. Rectify the error and rerun the `pkgadd` command.

TABLE 5. *Common Installation Problems*

Problem	Probable Cause	Corrective Action
File System full	Not enough disk space for specified directory.	Install software on file system with 2 MB free space: use `df` or `df -k` command for utilization. Or, free space on file system.
Bad file number	Media corrupted.	Contact Aurora Technical Support.

TABLE 5. *Common Installation Problems*

I/O Error	Media corrupted.	Contact Aurora Technical Support.
Permission denied	User name is not root.	Log in as root before installing.

Software Removal

To remove the Aurora software packages, use the following procedure.

✎ *To remove the Aurora X.25 software packages*

1. Log in as superuser (root)
   ```
   system% su
   ```
2. Execute the `pkgrm` command.
   ```
   system# pkgrm AURAx25
   ```
3. Type **y** to confirm your intention.
   ```
   Do you want to remove this package [y,n,?,q] y
   ```

If you remove the software package, you may reinstall it later using the same disk you used the last time you installed the package.

4. You will be alerted that superuser scripts will be executed. Once again, confirm your intention.
   ```
   Do you want to continue with the removal of this
   package [y,n,?,q] y
   ```
5. When the package removal is complete you will see the following message:
   ```
   Removal of <AURAx25> was successful. ❒
   ```

CHAPTER 7

Hardware Installation and Configuration

Aurora X.25 runs over the ports provided by Aurora's serial communications cards.

Installation

Installing the Aurora communication board is a relatively straightforward procedure and is described in user's manual shipped with your Aurora hardware. Once the hardware and the X.25 device driver are installed, you must configure the Aurora X.25 Server to use the hardware.

The Aurora X.25 Server Configuration

Aurora X.25 resources are defined in a single configuration file. The *Aurora X.25 Configuration and Use* manual describes the configuration directives and the configuration process in detail. This chapter identifies the elements of the configuration that are hardware-specific.

Card Installation

Refer to your Solaris workstation installation guide (or hardware owner's guide) and the Aurora user manual that was shipped with your serial card for installation instructions. Be sure to install the Aurora device drivers as well.

HDLCLINE parameters

The Aurora X.25 configuration directive, HDLCLINE, is used to define the physical characteristics of an HDLC line and associate it with one of these devices. The following table summarizes the use of the HDLCLINE parameters for the Aurora communications card.

TABLE 6. *Serial Port HDLCLINE Parameters*

Parameter	Value	Description
DEVICE	/dev/sync/[0-n]	Specifies the Solaris pathname of the device special file for the selected communications port.
CLOCK	EXTERNAL | INTERNAL	Specifies the clock source for the synchronous line. When EXTERNAL clock is provided by the modem, the SBus ports can operate at rates up to 128000 bps. For direct connections, INTERNAL clock may be generated at rates up to 256 Kbps.
NRZI	YES | NO	Defines the data encoding on the line. NRZI encoding is only supported at data rates of 9600 bps.
CD_MONITOR	YES | NO	The Carrier Detect (CD) signal is not available on Aurora's 400S+ and 800S+ serial cards. However, it is available on the 401S+ and WANMultiServer series.
SPEED	n	Defines the clock rate, in bits per second, to be generated when clock is INTERNAL. The SBus ports can generate clock at rates up to 256 Kbps.

Example

```
HDLCLINE Name=LINE01,          // User defined name
DEVICE='/dev/sync/0',          // Unix path of
                                   synchronous port
CLOCK=external,                // Modem clock
NRZI=NO,                       // NRZ encoding

SPEED=56000;                   // Speed commentary
```

APPENDIX A *Warranty*

Warranty Information

Hardware

All Aurora Technologies, Inc. hardware products are warranted against defects for two years from the date of delivery. Buyer agrees that if this product proves defective, Aurora Technologies, Inc. is obligated only to repair, replace or refund the purchase of this product at Aurora Technologies, Inc.'s discretion. The warranty is void if he product has been subjected to alteration, neglect, misuse or abuse; if any repairs have been attempted by anyone other than Aurora Technologies, Inc.; or if failure is caused by accident, acts of God, or other causes beyond the control of Aurora Technologies, Inc.

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Return Address:
Attn.: RMA Department
Aurora Technologies, Inc.
646 Summer Street
Brockton, MA 02302
USA

90 Day Technical Support

Products must be registered with Aurora Technologies, Inc.'s Customer Service and Support (CSS) organization to receive the 90 Day Technical Support. You must fill out and mail or FAX the warranty card that is included with the product before receiving technical assistance.

What you get during the 90 Day Technical Support

90 Day Technical Support is provided by e-mail, FAX, or by telephone. Customers calling in for technical support on current Aurora technologies, Inc. products will receive a response within four (4) business hours. Customer's e-mails or faxed requests will receive a response within twenty-four (24) business hours.

The Technical Support hours in Massachusetts are

> 8:30 a.m. - 6:00 p.m. Eastern Time,
> Monday through Friday, excluding holidays.

Services provided under the 90 Day Technical Support Plan are:

- Help on installation and configuration
- Help diagnosing problems with Aurora hardware and standard released Aurora device drivers.
- Help navigating and locating existing Aurora documentation
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