594 Planning Guide

95-2443-06

FCC/DOC Compliance Statements:

NOTE: This equipment has been tested and found to comply with the limits for a Class A Digital Device, pursuant to Part 15 of the FCC rules and to DOC Radio Interference Regulations, C.R.C., c1374. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC/DOC compliance requires that all I/O cables used with Perle products be constructed using shielded cable, metal-shelled connectors and conductive backshells.

This equipment is approved in accordance with DIN IEC 380/VDE 0806/08.81. If this unit is installed as an office machine, the installation must comply with the above standard.

Equipment must be used with an appropriately approved power supply cordset.

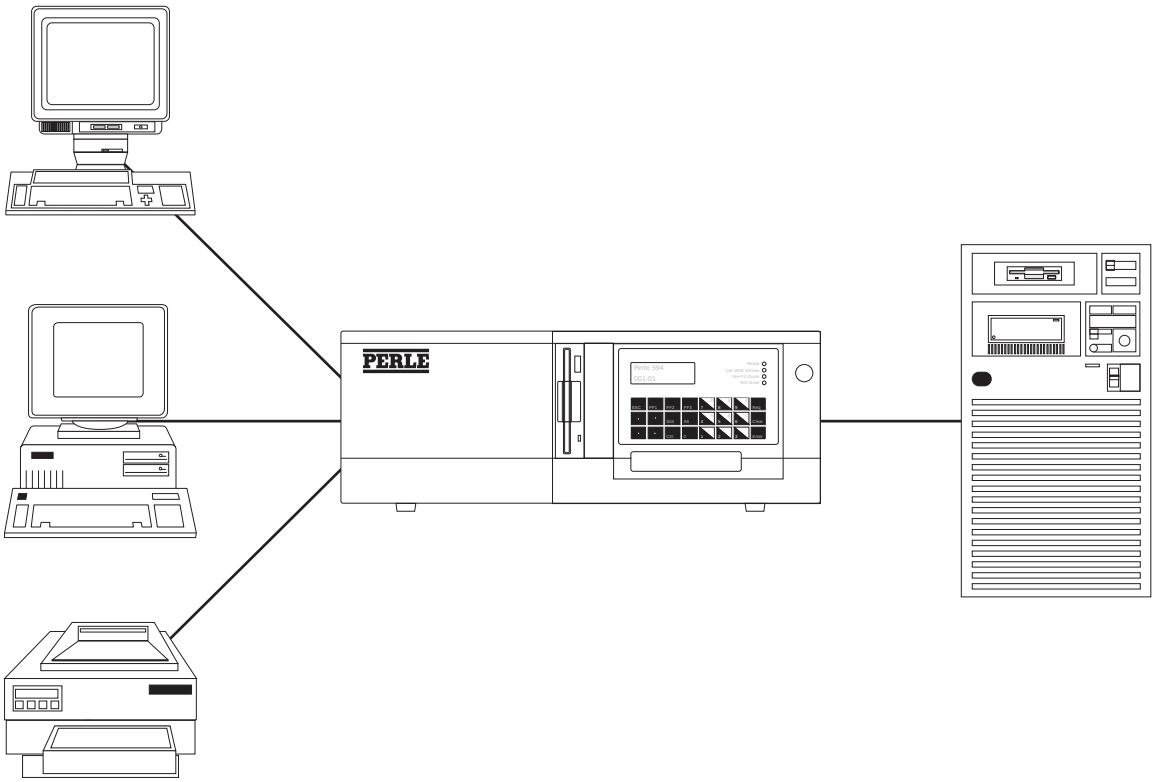
CAUTION: Changes or modifications to a Perle product which are not expressly approved by Perle Systems Limited may void the users authority to operate the equipment.

Table of Contents

Chapter 1. Introduction

Welcome to the Perle 594—the Network Controller that provides powerful solutions for both your AS/400 communication and thin client computing needs! The Perle 594 is an advanced workstation and communication remote controller for the IBM AS/400 environment that facilitates connection of display stations, personal computers (PCs), and printers to an AS/400. As well, the 594's integrated IP routing and Network Computer (NC) server capabilities supports the installation of thin clients at remote sites. The connection can be made through:

- Analog data networks
- Digital data networks
- Packet-switched data networks
- Circuit-switched data networks
- Token-Ring networks
- Ethernet networks
- Direct connection
- TCP/IP networks



Features of the Perle 594 Controllers

Attachment of Remote Workstations

Workstations that are locally attached to the AS/400 must be located near the AS/400. The Perle 594 allows workstations to be located any distance from the AS/400. The Perle 594 communicates with the AS/400 over a communication network.

Nonprogrammable Workstation Support

A nonprogrammable workstation (NWS) must be communicating with an AS/400 or with a controller in order to process information. A printer or display station is a NWS. A PC running 5250 emulation software functions as a NWS.

Workstation Customization

Workstation Customization (WSC) support allows customization of nonprogrammable workstation:

- keyboards
- attached ASCII printers.

A customized Keyboard Translation Table (KTT) can be created on the AS/400 system using the AS/400 Workstation Customization Utility and downloaded to the 594 for use on any NWS.

A customized Printer Definition Table (PDT) can be created on the AS/400 system using the AS/400 Workstation Customization Utility and downloaded to a 3486 or 3487 display, or to a 3477 display (Model HA, HC, HD, or HG).

Refer to the *AS/400 OS/400 Workstation Customization Functions Programmer's Guide and Reference*, for information on workstation customization.

Local NWS Editing Control

The Perle 594 handles field editing functions for each NWS. This reduces the amount of information that must be sent to the AS/400, and improves the response time to keystrokes.

Programmable Workstation Support

An programmable workstation (PWS) can process information independently of an AS/400 or controller, but can exchange information with these systems. An example of a PWS is a PC running IBM AS/400 PC Support.

Automatic Configuration

The addition, removal, or relocation of an NWS or a PWS is automatically detected by the Perle 594. On the AS/400 system, an NWS or a PWS can be automatically reconfigured, if autoconfiguration is enabled on the host.

Attachment of Twinaxial Workstations

A Perle 594 Twinaxial Feature Card supports 8 workstations (for the 549T), or 28 workstations (for the 594e). A twinaxial workstation can be either an NWS or a PWS. Twinaxial workstations can be attached to the 594 with either twinaxial cabling or telephone twisted pair (TTP) cabling. Two Twinaxial Feature Cards can be used in compatible mode to support up to 56 twinaxial devices.

Attachment of LAN Workstations

Both the Token-Ring Feature Card and the Ethernet Feature Card can be configured as a LAN gateway. This configuration allows up to 80 Token-Ring workstations to be attached to the Perle 594. Each workstation operates as a PWS, and must be running either IBM AS/400 PC Support or IBM AS/400 Client Access software. In this configuration, the Perle 594 communicates with the AS/400 over a synchronous communication network, as described below

Note: See "Frame Relay Token-Ring Bridge Support" on page 5 or . for information on support of non-SNA LAN workstations

Synchronous Communication Interfaces

The Perle 594 supports the following physical interfaces to the AS/400 system for synchronous communication:

- EIA 232D (V.24/V.28)
- V.35
- X.21

Token-Ring or Ethernet AS/400 Attachment

The Perle 594 and the AS/400 can be configured to communicate over a Token-Ring or Ethernet network. The two systems can be on the same network, or can be on different networks. Other devices may share the network with the AS/400 and the Perle 594.

SNA Subarea Network Support

The Perle 594 can access the AS/400 system over an SNA subarea network using the SDLC protocol. The SNA subarea network may have lower operating costs than other types of networks, and may allow access to a greater number of AS/400 systems.

Access to Alternate AS/400 Systems

The Perle 594 can be pre-configured for up to four alternate AS/400 systems. The Perle 594 stores information about the alternate AS/400 systems so that the operator can end a connection with one AS/400 and easily establish a link with a different AS/400.

594 Utility Program

The 594 Utility program is run on a PWS and is used to enter configuration information. The 594 Utility program is run from a PC, either "stand-alone" or while attached to the Perle 594. The 594 Utility program also provides network link establishment.

Stand-Alone PWS Configuration

Configuration information can be entered from a PWS even though it is not attached to the Perle 594 (i.e., from a stand-alone PWS). The PWS must be running the 594 Utility program. The configuration is stored on a floppy diskette for distribution to remote Perle 594 systems.

On-Line PWS Configuration

Configuration information can be entered from a PWS that is attached to the Perle 594. The PWS may be attached through a Twinaxial Feature Card, or through a either a Token-Ring or an Ethernet Feature Card that is using the gateway configuration. The PWS must be running AS/400 PC Support or AS/400 Client Access and the 594 Utility program. The configuration is stored directly to memory and to the Perle 594 Controller Software diskette.

NWS Configuration (Perle 594e only) [1]

Configuration information can be entered from an attached, twinaxial NWS. This information is stored directly to memory and to the Perle 594's Controller Software diskette.

Internal Configuration Storage

Configuration information is saved in permanent, internal storage on the Perle 594 whenever configuration is done from an attached PWS or NWS. When configuration is done on a stand-alone PWS, the information can be copied to a floppy diskette, and transferred to the Perle 594 for internal storage.

When a new 594 Controller Software diskette with a new software release is received, the old configuration will be copied from internal storage and saved onto the new 594 Controller Software diskette.

Using Backup Configuration from Diskette

The 594 Utility Program in Stand-Alone mode can save your configuration as a Backup configuration. When this Backup configuration is placed on the 594 system diskette and the diskette is used to power on the controller, the Backup configuration is used instead of the configuration in permanent storage.

This enhancement is useful for occasions when your network becomes unavailable and you need to switch to a backup connection. You can now restart the 594 with your backup diskette that has the Backup configuration file on it, and the Backup configuration will be used instead of the configuration in permanent storage. When the original network is restored, replace your backup diskette with your original system diskette and restart the 594. The configuration in permanent storage will again be

[1] This feature is not supported if your 594e is running with the 594e IP Routing Feature.

used.

Diskette-Based Architecture

Each software upgrade is distributed through a new set of diskettes.

Concurrent Host Attachment

The 594 can be configured to communicate concurrently with up to four AS/400 systems over a single physical link. Concurrent host attachment enables NWSs that do not have the use of an AS/400 display station or a printer passthrough to communicate with different AS/400 systems in the communication network. Once concurrent host attachment is configured, printer sharing can be enabled or disabled.

Frame Relay Token-Ring Bridge Support

With the 594 configured for Frame Relay Token-Ring Bridge, the 594 will support source route bridging of token-ring traffic across the frame relay connection to an AS/400 or a bridge partner. Bridge partners must support RFC 1490 Frame Relay bridging. The 594 will operate as a bridge and forward non-SNA traffic such as IP and IPX on the Token-Ring LAN over the frame relay "Virtual LAN".

If the 594 is connected via frame relay to an AS/400, the bridged frame relay connection allows the AS/400 to communicate with a station on the 594's token-ring gateway as if they were on a token-ring locally attached to the AS/400.

European Currency Symbol Support

The 594 EURO symbol support will allow the configuration of new keyboard country codes that contain support for the new European currency symbol.

Enhanced Features of the Perle 594

Emulation of Multiple Controllers

The Perle 594 can be configured so that each Feature Card emulates a separate controller. All emulated controllers communicate with the AS/400 over the same communication line, thereby reducing line costs.

The Perle 594 stores information about alternate AS/400 systems so that the operator can end a connection with one AS/400 and establish a link with a different AS/400. Each emulated controller can be pre-configured to access up to four alternate AS/400 systems.

Attachment of ASCII Workstations (Perle 594e only)

Each ASCII Feature Card allows up to eight ASCII terminals and up to eight ASCII printers per card to be attached to the Perle 594e. Each ASCII terminal operates as an NWS. Users on these NWSs can access the NWS multisessions, as described below.

Feature Card Expandability (Perle 594e only)

The Perle 594e is field-expandable to a maximum of six Twinaxial Feature cards, of which a maximum of two can be type-48. With six Twinaxial Feature Cards installed, the Perle 594e will support up to 168 twinaxial workstations.

The Perle 594e is field-expandable to a maximum of six ASCII Feature Cards. With six ASCII Feature Cards installed, the Perle 594e will support up to 96 ASCII workstations (i.e., 48 terminals and 48 printers).

In a Token-Ring Gateway configuration, the Perle 594e is field-expandable to a maximum of two Token-Ring Feature Cards. With two Token-Ring Feature Cards installed, the Perle 594e will support up to 160 Token-Ring workstations.

In an Ethernet Gateway configuration, the Perle 594e is field-expandable to a maximum of two Ethernet Feature Cards. With two Ethernet Feature Cards installed, the Perle 594e will support up to 160 Ethernet workstations.

NWS Multisession Support (Perle 594e only)

The Perle 594e can emulate additional controllers called Multisession Controllers. These controllers appear to the AS/400 as real Perle 594e controllers with attached nonprogrammable workstations (NWSs).

Sessions on the Multisession Controllers are available to users of nonprogrammable workstations. The user can access these additional, NWS multisessions by pressing a sequence of keys, called a "hot key". With additional memory installed, the Perle 594e supports up to 1000 NWS multisessions. You may assign as many of these Multisessions to a single NWS as you wish.

NWS Access to Multiple AS/400 Systems (Perle 594e only)

Each Twinaxial or ASCII NWS has access to all Multisession Controllers. Each Multisession Controller can be communicating with a different AS/400 System in an APPN network. Therefore, a NWS can access sessions on several AS/400 systems, simultaneously.

Multisessions on Alternate AS/400 Systems (Perle 594e only)

The Alternate AS/400 Systems feature is available with Multisession Controllers. Each Multisession Controller can be pre-configured for up to four alternate AS/400 systems. The operator can end a connection between a Multisession Controller and one AS/400, and establish a link with a different AS/400.

Direct AS/400 Attachment

If the Perle 594 is close enough to the AS/400, the communication cable from the AS/400 can be directly connected to the Perle 594. This eliminates the need for modems and communication lines. No configuration or cabling changes are required on the AS/400.

Multiple Word Processing Languages

When the Perle 594 is emulating multiple controllers, the Perle 594 can support up to eight different word-processing languages simultaneously.

TCP/IP Host Connection

The Perle 594 supports a TCP/IP host connection that uses full AnyNet functionality to take in SNA traffic and convert it into TCP/IP. At the host, the AS/400 uses AnyNet/400 to convert the TCP/IP back to SNA. This means that any SNA 5250 workstation, printer, or PC client connected to the Perle 594 can communicate with the AS/400 over a TCP/IP enabled network.

A TCP/IP connection can be made over either a Token-Ring or Ethernet network.

Host Roaming Feature

When enabled, the controller will automatically switch, without user intervention, and attempt to establish communication with the next configured host if communication with the currently active host is lost and cannot be reestablished. The controller will continue to try each configured host until an active host is found. If the last configured host is not active, the controller will continue with the first configured host. Up to four hosts can be configured.

Software Download Utilities

Software Download refers to the capability of downloading new controller software to a 594 Controller. The software will overwrite the existing software on the 594 Controller Software Diskette in the controller's floppy disk drive or the Network Controller Software on the 594e hard drive. This is accomplished using the 594 Utility program on a PWS that is attached locally or remotely to a controller.

There are two methods of downloading the 594 Controller Software. Interactive mode uses the 594

Utility program menus to select download files and begin download operation. Status and progress will be displayed on screen. Batch mode uses the 594 Utility with the batch mode option. This allows the software to be downloaded to one or more controllers without user attendance. Status is saved in a log file.

Fast Ethernet Support

The Perle 594 supports up to two Fast Ethernet (10/100 Mbps) Feature cards (Type 49). This card has a **LINK**, **ACT**, and a **100** Mbps indicator LEDs. The physical interfaces supported are:

- 10 BaseT (10 Mbps UTP category 3, 4, or 5 cable)
- 100BaseTX (100 Mbps UTP category 5 cable)

TCP/IP Host Connection over Frame Relay Protocol [1,2]

The configuration of TCP/IP controllers over frame relay protocol will allow the 594 to natively connect to an AS/400, or connect to an AS/400 via an IP router, over a frame relay network, using TCP/IP protocol. Routers that the 594 will be communicating with must support Frame Relay RFC 1490 Routed IP format. This will eliminate the need of an IP router at every remote site that the user wishes to configure a 594 TCP/IP controller.

IP Routing Support [1, 2]

With the 594 configured for IP Routing the 594 will provide basic IP routing, using either dynamic or customized static routes to forward IP datagrams between the LAN interfaces (Token-Ring and Ethernet), the twinax interface, the frame relay interface and the PPP interface. IP routing allows devices, such as AS/400s, Network Computers, and PC's running IP applications, on the LAN, twinax and the frame relay, to send IP datagrams to the 594 with an IP destination address other than the 594's IP address. The 594s at remote sites can now be connected to each other or other IP routers and route IP traffic to interconnect their IP devices. Routers that the 594 will be communicating with over Frame Relay must support Frame Relay RFC 1490 Routed IP format.

IP over Twinax Support

The support of IP devices on the 594's twinax interface allows customers with PCs or Network Computers attached to the 594 via their twinax cabling to gain access to any of their IP networks. One of the benefits of running IP over twinax is that it supports cable distances of up to 5,000 feet of twinax without any kind of repeater. This is longer that many LAN types that require additional hubs to obtain this distance.

With the support of IP over Twinax it is now possible to have non-LAN PCs and Network Computers attached to the 594 Network Controller to access the worldwide web, share printers and files and use workgroup applications.

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[1] For the 594e, this configuration requires that either the 594e IP Rounting Feature or 594e Network Controller Feature be installed. For more information on these features see the 594e User and Reference Guide.

[2] For the 594T, this configuration requires that the Perle 594T IP Routing Feature be installed. For more information on the 594T IP Routing Feature see the 594T User and Reference Guide.

Dynamic Routing Support (RIP V1 and V2)

The support of Dynamic Routing allows the 594 to exchange route or link information from which the best paths to reach destinations in the internetwork are calculated. With Dynamic Routing enabled, you will no longer be required to configure static route entries in the 594 and adjacent IP routers, as long as the adjacent IP routers support RIP V1 or V2.

BOOTP Relay Agent [1, 2]

The 594 BOOTP relay agent will relay a BOOTP or DHCP request from a client locally connected to a 594 LAN interface across the corporate WAN to specific BOOTP or DHCP Servers. Up to 4 BOOTP or DHCP servers can be configured for the 594.

Network Computer Boot Server (Perle 594e only) [3]

The 594e has the capability to store a Network Computer's (NC) operating system and appliciation files on it's hard disk drive. This allows the locally connected NCs to download this software from the 594e and avoid the significant delays that would be involved with downloading the the large software files from a Boot Server across the corporate WAN.

NCs can download these files using the File Transfer Protocol (FTP) or Trivial File Transfer Protocol (TFTP).

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[1] For the 594e this configuration requires that either the 594e IP Routing Feature or 594e Network Controller Feature be installed. For more information on these features see the 594e User and Reference Guide.

[2] For the 594T, this configuration requires that the Perle 594T IP Routing Feature be installed. For more information on the 594T IP Routing Feature see the 594T User and Reference Guide.

[3] For the 594e this configuration requires that the Perle 594e Network Controller Feature be installed. For more information on the 594e Network Controller Feature see the 594e User and Reference Guide.

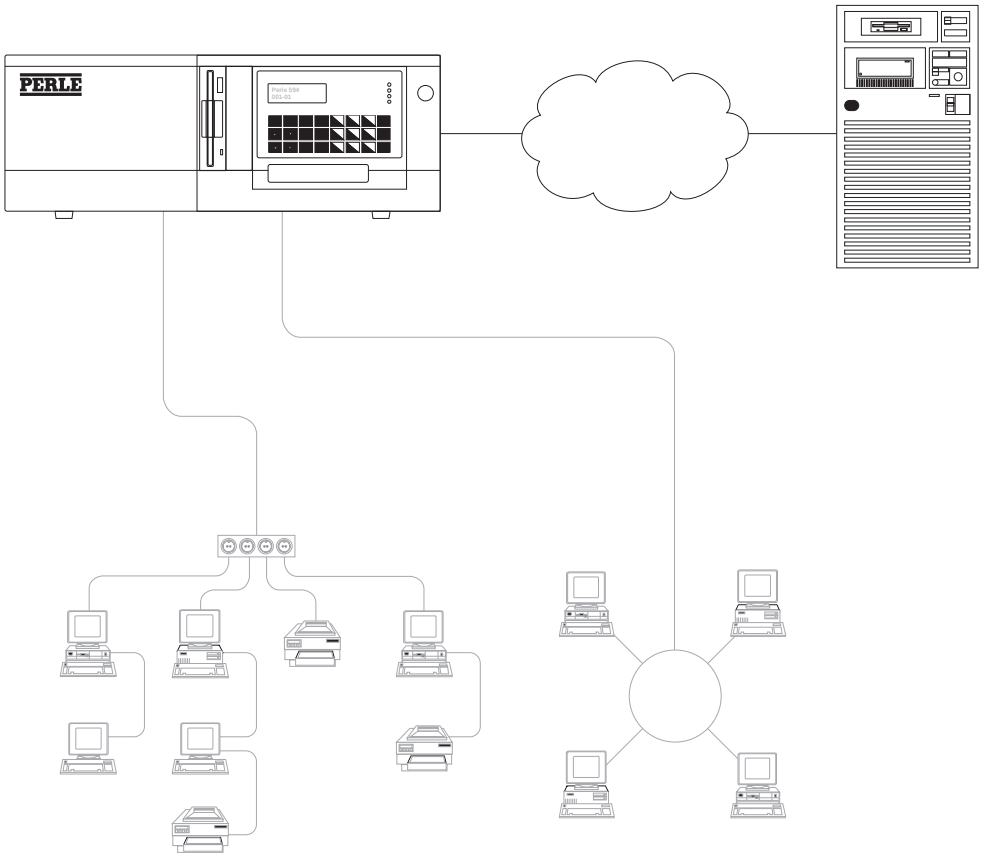
Configurations of the Perle 594e

Host Attachment methods in compatible mode (Perle 594e only)

- Synchronous Data Link Control (SDLC)
- X.21 Switched
- X.21 Leased
- X.25
- Ethernet or Token-Ring

  When using an Ethernet or Token-Ring AS/400 connection all workstations are attached Twinaxially to the Perle 594e.

- Frame Relay
- SNA Subarea Network

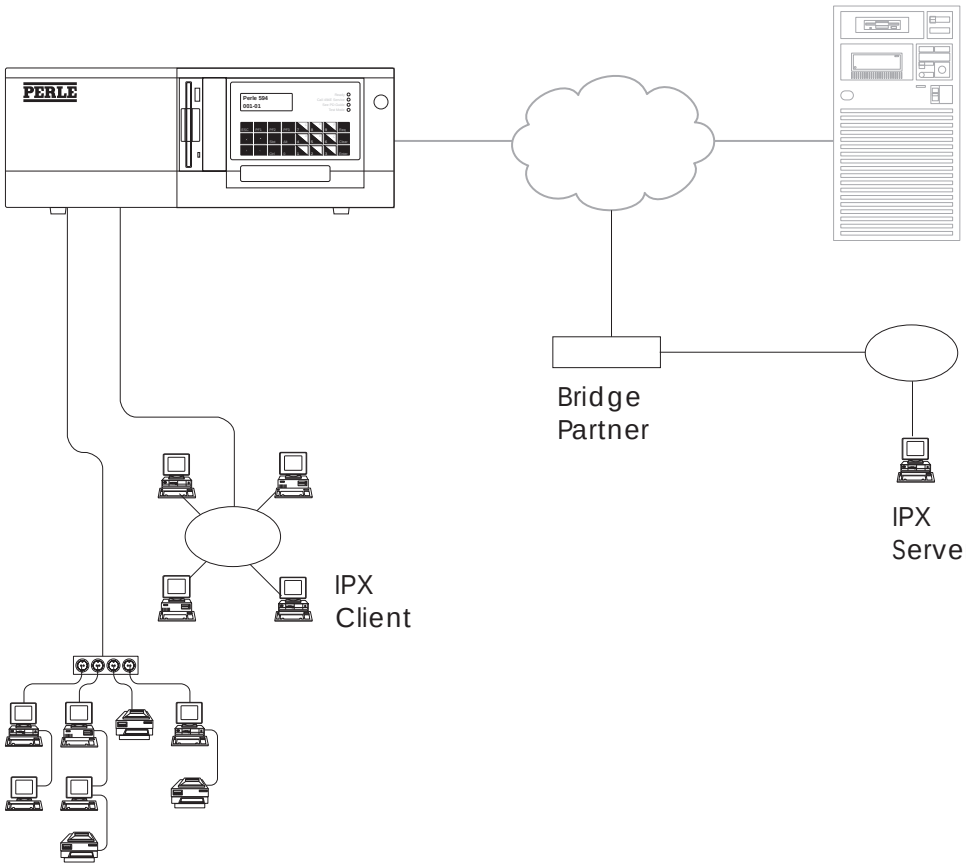


The Perle 594e (in compatible mode) appear to the AS/400 as single IBM 5494 controllers.

Workstation Attachment methods in compatible mode (Perle 594e only)

- Twinaxial
- Ethernet or Token-Ring
- Non-SNA Token-Ring

When workstations are attached to the Perle 594e through an Ethernet or Token-Ring network, the Perle 594e communicates with the AS/400 over a synchronous communication network.

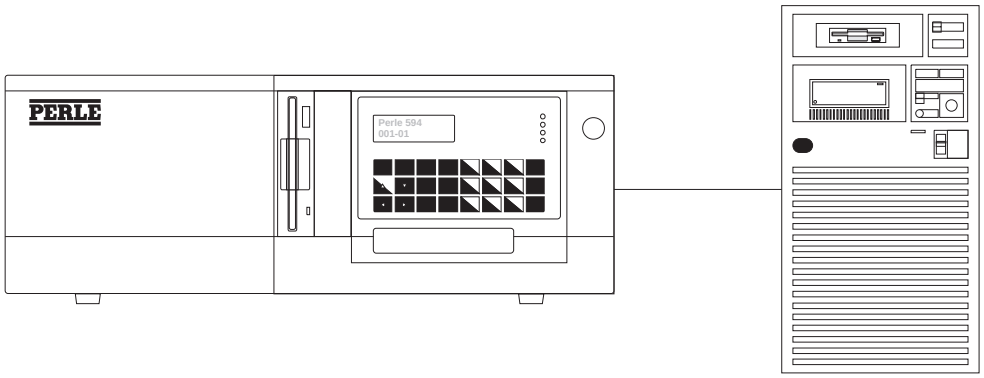


The Perle 594e may be configured with:

- One or two Twinaxial Feature cards for support for up to 56 twinax devices.
- One or two Twinaxial Feature cards, and one Ethernet or Token-Ring Feature card, for support for up to 56 twinaxial devices and up to 80 LAN devices for a maximum of 80 devices.

Direct AS/400 Attachment

Direct AS/400 Attachment can be used when the Perle 594 and the AS/400 system are located near one another. The two systems are connected by a single cable, without the use of modems or a data network.

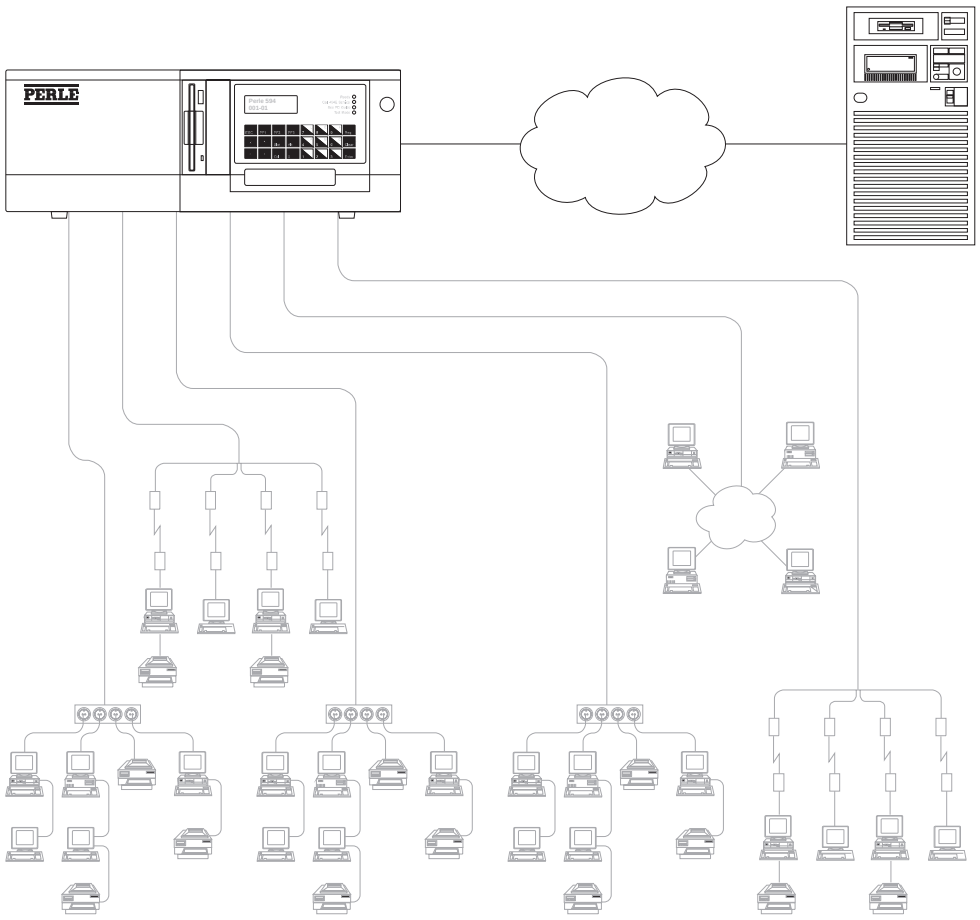


This configuration can be used if the cable connecting the two systems does not exceed the maximum distance specified in the standards for the cabling being used.

Configuration of the Perle 594

Host Attachment methods in Enhanced mode

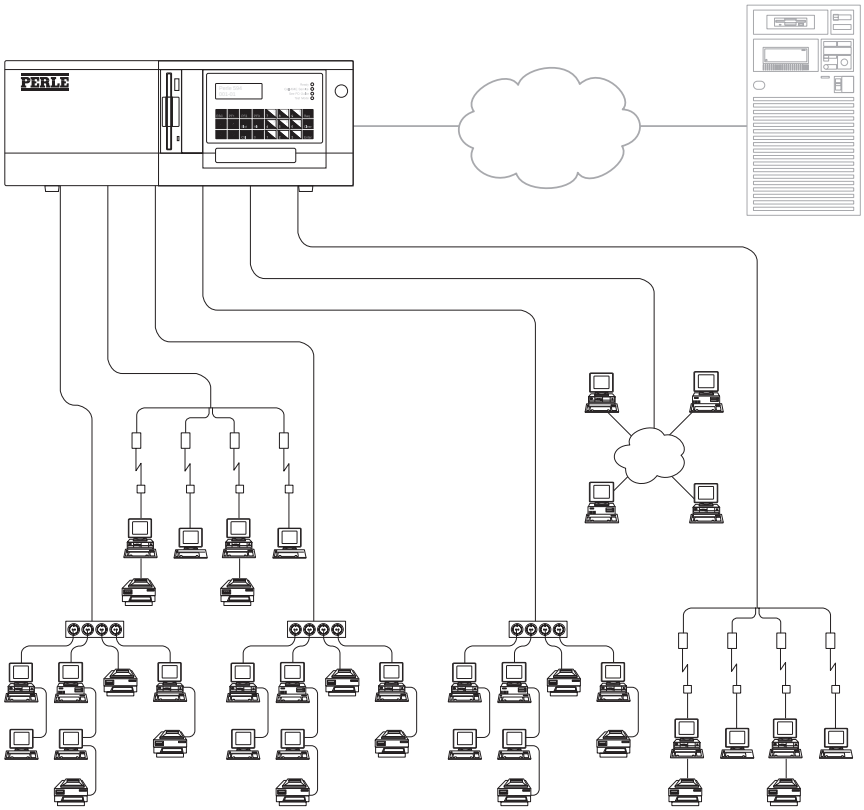
- SDLC
- X.21 Switched
- X.21 Leased
- X.25
- Token-Ring, 4 or 16 Mbps
- SNA Subarea Network
- Ethernet, 10 or 100 Mbps
- Frame Relay
- TCP/IP for Ethernet, Token-Ring, Frame Relay or PPP connections.



In Enhanced Mode the Perle 594e appears to the AS/400 as many IBM 5494 controllers sharing a multi-point communication line.

Workstation Attachment methods in Enhanced mode

- Twinaxial
- Token-Ring, 4 and 16 Mbps
- Ethernet, 10 and 100 Mbps
- Non-SNA Token-Ring (via Frame Relay Token-Ring Bridging)
- IP Token Ring, Ethernet or Twinaxial (via IP Routing)
- ASCII (Perle 594e only)[1]



Perle 594e Controller

In Enhanced Mode the Perle 594e supports a maximum of six (6) Feature cards. The maximum may be made up of any arrangement of feature cards, while not exceeding individual feature card limits. In Enhanced Mode each Feature Card installed in the Perle 594e appears to the AS/400 as a separate IBM 5494 controller. The Perle 594e may be installed with:

- Up to six (6) Twinaxial Feature cards for support of up to 168 devices. Each Twinaxial Feature Card supports 28 devices.
- Up to two (2) Token-Ring Feature cards for support of up to 160 devices. Each Token-Ring Feature card supports 80 devices.

[1] This feature is not supported if your 594e is running with the 594e IP Routing Feature.

- Up to two (2) Ethernet Feature cards for support of up to 160 devices. Each Ethernet Feature card supports 80 devices.
- Up to six (6) ASCII Feature cards for support of up to 96 devices. Each ASCII Feature card supports up 16 devices.

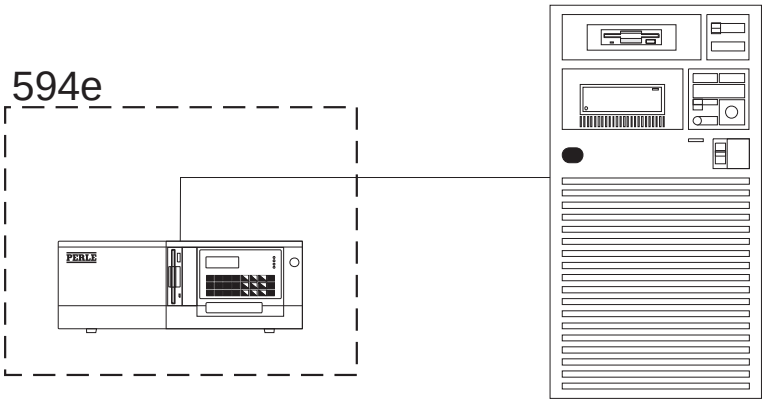
Perle 594T Controller

In Enhanced Mode the Perle 594T supports a maximum of Two (2) Feature cards. Each Featrue Card installed in the Perle 594T appears to the AS/400 as a separate IBM 5494 controller. The Perle 594T may be installed with:

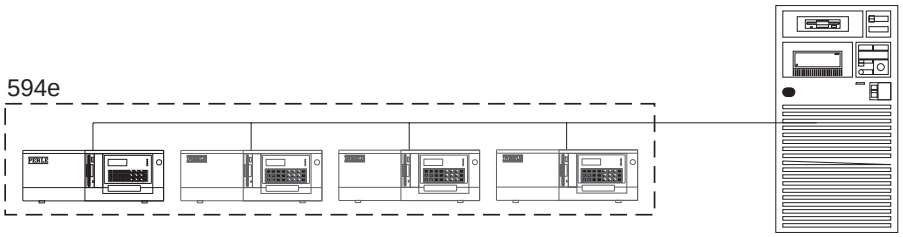
- One (1) Twinaxial Feature card for support of up to 8 devices
- One (1) LAN Feature card (Ethernet or Token-Ring) for suport of up to 80 devices

NWS Multisessions (Perle 594e only)

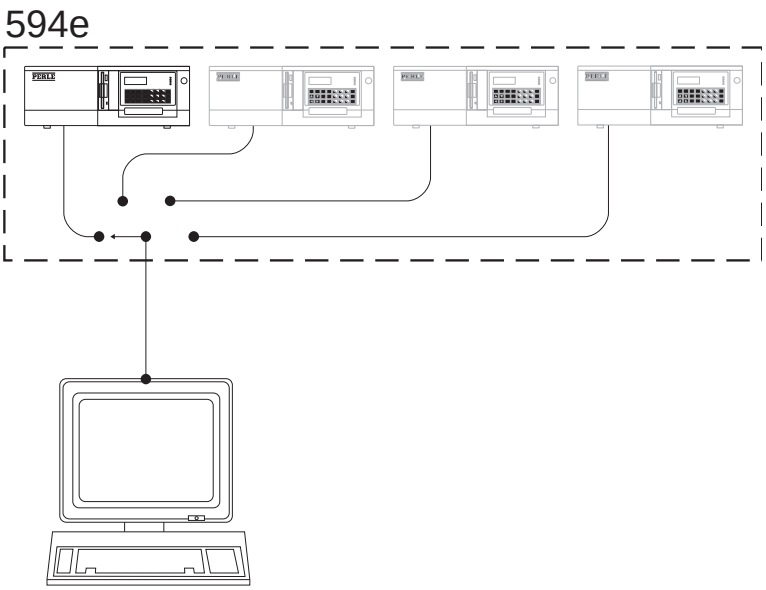
A Twinaxial or ASCII Feature Card in the Perle 594e appears to the AS/400 as a single controller. The system configuration will have the following appearance from the point of view of the AS/400:



The Perle 594e can also emulate additional controllers without the need for additional Twinaxial or ASCII Feature Cards. The additional controllers are called Multisession Controllers. The system configuration will have the following appearance to the AS/400:

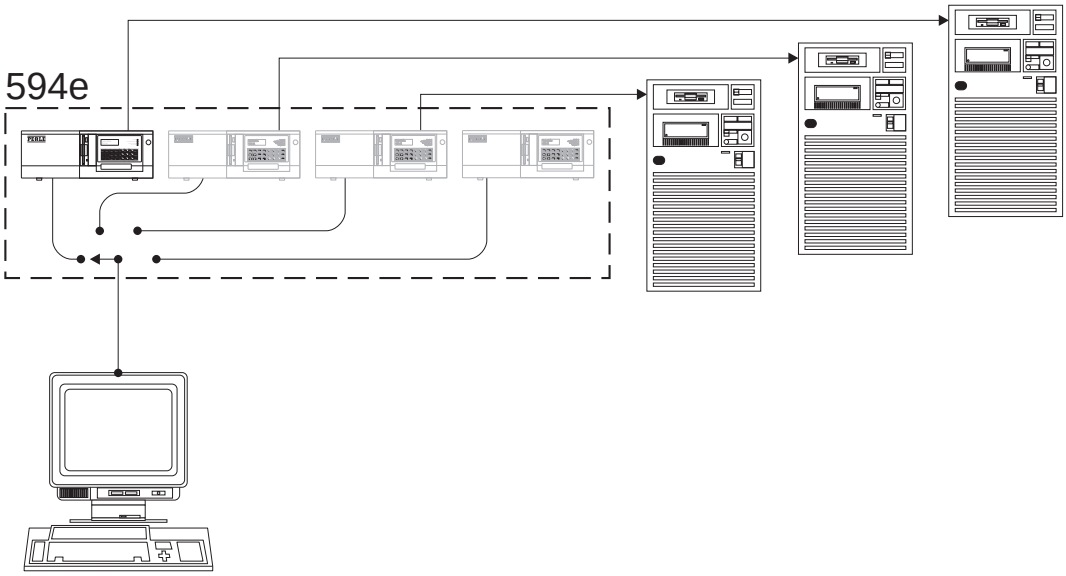


Each NWS will always have a session on the Twinaxial or ASCII Feature Card. This is called the "primary session". Multisession Controllers are used to provide extra AS/400 sessions to each existing NWS. These concepts are illustrated in the following diagram:



The Perle 594e can be configured to allow any NWS to access any session on any of the Multisession Controllers. The Perle 594e allows the user to switch the NWS from one session to another by pressing a "hot key" sequence.

When the AS/400 is logically attached to other AS/400s via an APPN network, Multisession Controllers can communicate with any AS/400 in the APPN network. An NWS can access different AS/400s by accessing different Multisession Controllers.



The Perle 594e will support a maximum of 1,000 NWS multisessions. The number of multisessions that will actually be supported by the network depends upon the following factors:

- the number of multisessions that have been defined for each NWS in the Perle 594e's configuration.
- the number of device descriptions available on the AS/400.
- the amount of memory available on the Perle 594e controller. Each multisession consumes memory on the motherboard of the Perle 594e. Additional memory modules can be installed on the motherboard to increase the amount of memory available for multisessions.

The following tables provide a general guideline of how many multisessions will be available based on the type of software the 594e is running, the type of NWS display attached and the amount of installed 594e memory.

594e Running Base Controller Software

NWS Display Type	Installed 594e Memory					
	8	**12**	**16**	**20**	**24**	**32**
SBCS	10	100	200	300	400	600
DBCS	0	0	40	80	120	200

594e Running, 594e Network Controller Software or 594e IP Routing Controller

NWS Display Type	Installed 594e Memory			
	16	**20**	**24**	**32**
SBCS	10	100	200	400
DBCS	0	0	40	120

Note: Certain devices and hardware configurations can yield a greater number of sessions than listed in this table. For example, if all attached twinaxial devices are non-ECB and non DBCS then up to 1000 NWS multisessions can be supported.

The Perle 594e can be configured for up to 40 controllers. These controllers can be emulated by actual feature cards or by NWS Multisession Controllers.

Communication Line Types

With "Remote" and "Direct" AS/400 Attachment, the Perle 594 supports the following communication protocols:

- SDLC

  The following types of lines use the SDLC protocol:

  - SDLC Leased Line
  - SDLC Switched Line
  - X.21 Leased Line
  - X.21 Switched Line
  - SNA Subarea Network

    Note: A circuit-switched SDLC or circuit-switched X.21 line can only support communication with a single controller.

  SDLC protocol is supported over the following physical interfaces:

  - EIA 232D
  - X.21
  - V.35

- X.25

  An X.25 line will be one of the following types:

  - Permanent Virtual Circuit (PVC)
  - Switched Virtual Circuit (SVC)

  X.25 protocol is supported over the following physical interfaces:

  - EIA 232D
  - X.21
  - V.35

- Token-Ring, 4 and 16 Mbps
- Ethernet, 10 or 100 Mbps
- Frame Relay

  Frame relay protocol is supported over the following physical interfaces:

  - X.21
  - V.35

- TCP/IP (enhanced mode only)

  TCP/IP is supported over the following networks:

  - Token-Ring
  - Ethernet.
  - Frame Relay
  - PPP

Chapter 2. Site Selection and Preparation

Site Preparation Checklist

The following is a checklist of recommended tasks should be completed before the installation of the Perle 594. Some items on the list may not apply to your installation, and you may wish to add new items.

__ Identify and contact the following individuals:

- __ Network supplier
- __ Modem supplier
- __ Remote installation planner
- __ Cabling supplier

__ Analyze the site's electrical requirements (see page page 22):

__ Analyze the site's environmental requirements (see page page 22):

- __ Temperature and humidity levels
- __ Electrostatic conditions
- __ Electromagnetic sources
- __ Atmospheric contaminants

__ Determine the future location of the Perle 594 will meet the placement needs of the unit (see page page 23).

__ Create a floor plan to show the location of all system components, and the routing of all cables.

__ Determine your cabling needs for:

- __ Twinaxial workstation cabling (see page page 26)
- __ Token-Ring cabling (see page page 29 or page 34)
- __ Ethernet cabling (see page page 30 or page 34)
- __ ASCII workstation cabling (see page page 28)
- __ Synchronous AS/400 communication cabling (see page page 32).

__ Order the required workstations, modems, cabling and other hardware components of your system.

__ Order the communication network facilities (see page page 37).

__ Ensure that the AS/400 communication equipment (Token-Ring, Ethernet, or synchronous) is installed.

__ Ensure that electrical outlets have been installed and are properly grounded.

Electrical Requirements

Electrical Specification	Voltage Selector Switch	
	115	**230**
Voltage	100 - 125 VAC	200 - 240 VAC
Phases	1	1
Current	4 A (Maximum)	2 A (Maximum)
Power	500 W (Maximum)	500 W (Maximum)

The Perle 594 controller should not share electrical circuits with equipment that can cause electrical noise and interference.

Environmental Requirements

Temperature and Humidity Levels

The Perle 594 controller is designed to operate in a normal office environment. The following conditions must be met and maintained.

Condition	Temperature Range	Relative Humidity
Operating	10 ° - 40° C 50° - 104° F	8% - 80%
Idle	10 ° - 50° C 50° - 125° F	8% - 80%
During Storage	1 ° - 60° C 34° - 140° F	5% - 80%
During Shipment	-40 ° - 60° C -40° - 140° F	5% - 100%

Electrostatic Conditions

Static electricity can cause problems for electronic equipment. To minimize static:

- Avoid high-resistance floor surfaces.
- Use antistatic mats, or install antistatic carpeting.
- Keep humidity levels within the required range.

Electromagnetic Sources

Do not place the Perle 594 in an area of high conducted or radiated electromagnetic interference. This includes areas within 500 meters (1650 feet) of radio frequency sources such as transmitting antennas for AM, FM, TV, two-way radio or radar. This also includes areas within 50 meters (165 feet) of industrial machines such as induction heaters or arc welders, or within 50 meters (165 feet) of high-energy power lines. Also avoid other sources of electromagnetic interference such as transformers, power distribution panels and electrical heating systems.

Atmospheric Contaminants

Do not place the Perle 594 in environments where the atmosphere may be contaminated by liquids, gases or suspended particles. Prolonged exposure to such contaminants can cause failure of the system's hardware components.

Placement

The Perle 594 does not require special cooling, but sufficient clearances must be maintained in front of and behind the unit to allow proper airflow to the internal fans.

Locate the controller in an area where:

- Power cords and cables are out of traffic areas.
- The front panel display is easily visible.
- Floppy diskettes can be inserted into and removed from the diskette drive.

Chapter 3. Cable Planning

Workstation Cabling

Workstation cabling will be one or more of the following types. The type of cabling you require will depend on the type of workstation you are using.

- Twinaxial

  This type of cabling is used with network computers, personal computers which are equiped with twinaxial communication cards and twinaxial displays and printers.

- Token-Ring

  This type of cabling is used with network computers, personal computers and printers which are equipped with Token-Ring communication cards.

- Ethernet

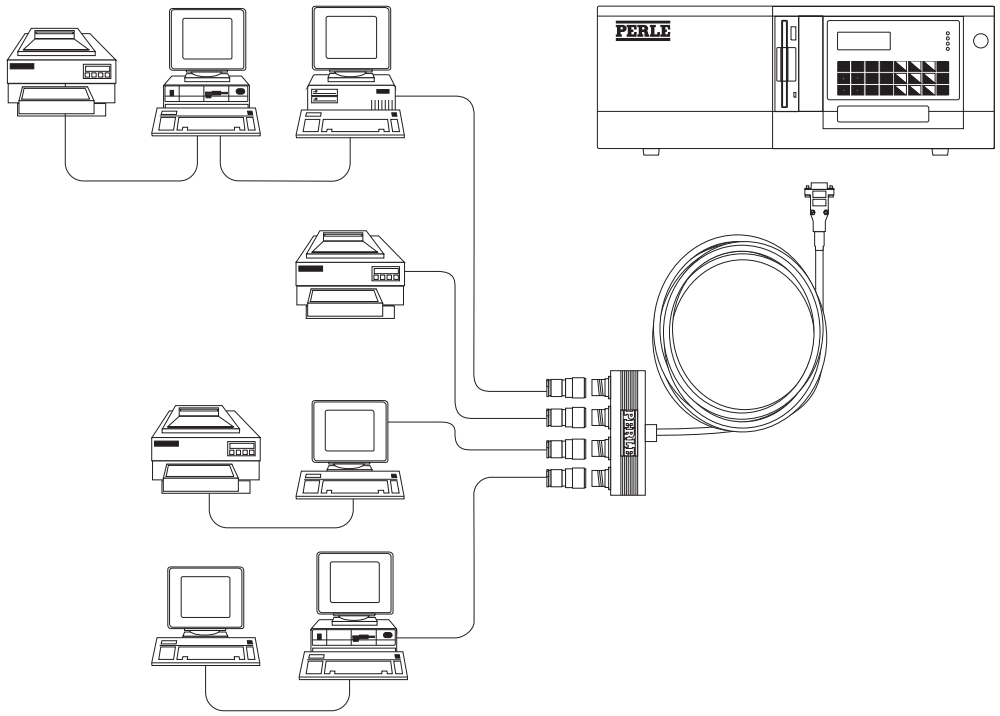
  This type of cabling is used with network computers, personal computers and printers which are equipped with Ethernet communication cards.

- ASCII

  This type of cabling is used with ASCII displays (including terminals and PCs which run terminal emulation software) and ASCII printers.

Twinaxial Workstation Cabling

The following diagram illustrates the attachment of twinaxial workstations to the Perle 594.



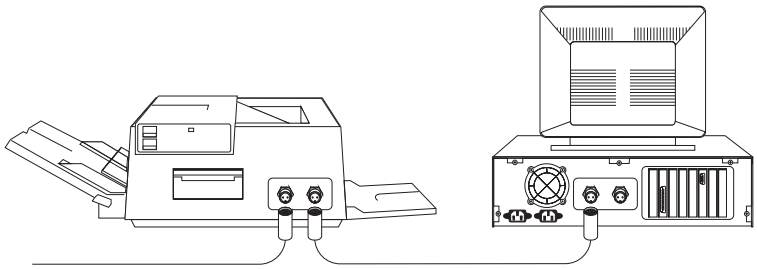
The Twinaxial Feature Card comes equipped with a Twinaxial Adapter Cable, which has four twinaxial connectors. A single twinaxial line can be attached to each connector.

Workstations such as network computers, PCs, display stations and printers which are equipped for twinaxial communication may be attached to the Perle 594 through the Perle Twinaxial Workstation Adapter Cable.

A variety of twinaxial cable types and options are available through many vendors. For example, conventional twinaxial cables may be used to attach individual workstations directly to the Perle Twinaxial Workstation Adapter Cable. Some twinaxial devices are equipped with two twinaxial ports, allowing additional twinaxial device to be "daisy-chained" to the first. This increases the number of devices which can be attached to each line, and reduces the number of cables which must be run to the Perle 594.

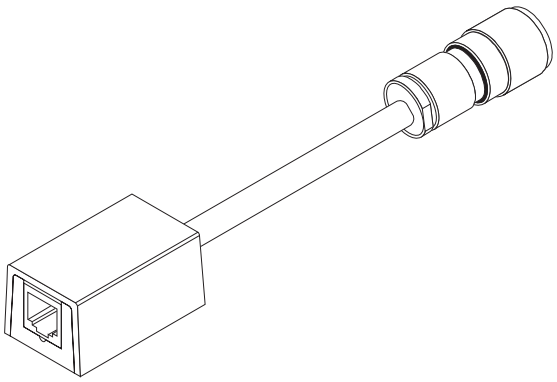
Up to seven devices can be daisy-chained on one twinaxial port. The total length of the twinaxial cable must be 1025m (5000 ft.) or less. Consult your workstation or cable vendor to ensure that the twinaxial cabling is properly terminated at the last workstation.

The following diagram shows an example of daisy-chained workstations.

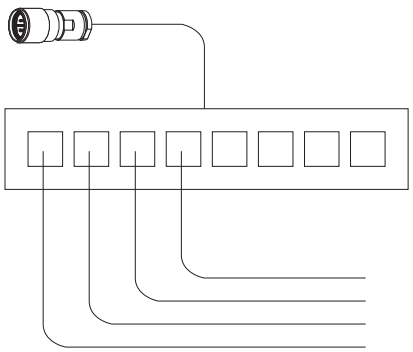


Instead of twinaxial cables, you may decide to use Telephone Twisted Pair (TTP) cables. TTP cable is less expensive than twinaxial cable. It is also smaller in diameter and is therefore easier to install. In many buildings, extra TTP cable was included when the telephone wiring was initially installed.

If a workstation is equipped with a twinaxial connector and you wish to connect the workstation to TTP cable, a special adapter called a balun is required. Many types of baluns are available. The following diagram shows the appearance of one type of balun.



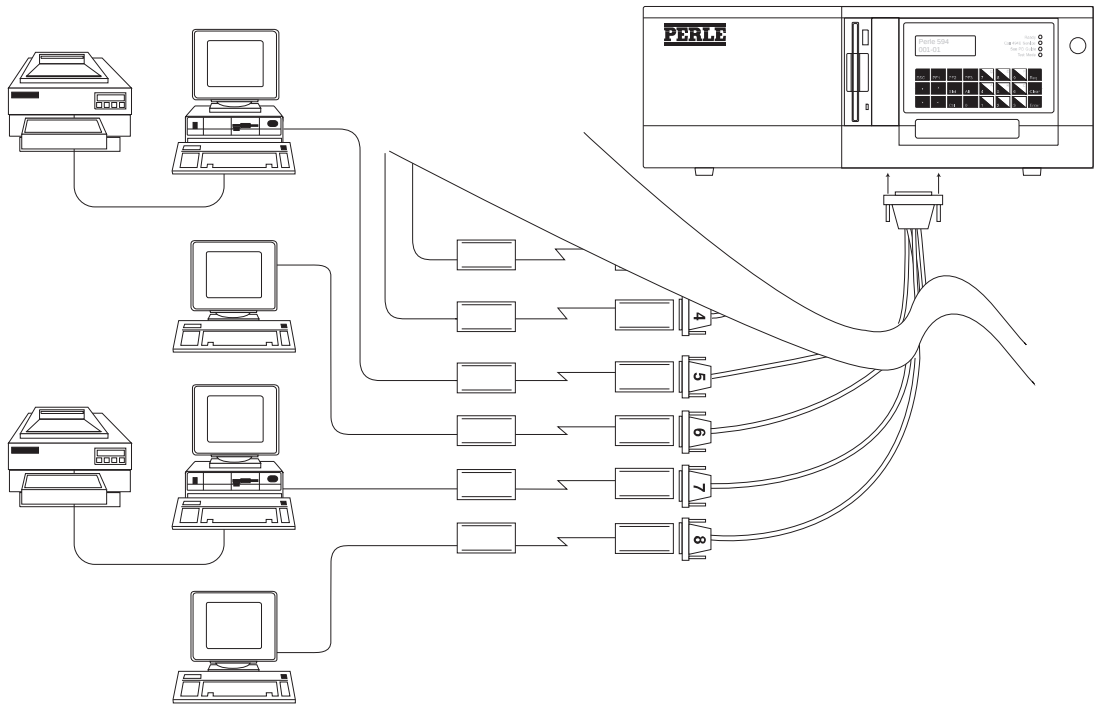
With TTP, each workstation must have its own TTP wire leading to a "hub". Depending on the vendor, a hub may have up to seven TTP connectors for the attachment of workstations. The connection to the Perle 594 is made with a single twinaxial cable. The following diagram shows the appearance of one type of hub.



Once you have decided on the type of cabling you will use, you may begin to plan the details of the installation. It is best to draw up a floor-plan, on which you identify: the location of all workstations; the type of cabling; and the adapters required (if any). The floor plan will assist you in ensuring that the cables are within the allowable lengths.

ASCII Workstation Cabling (Perle 594e only) [4]

The following diagram illustrates the attachment of ASCII workstations to the Perle 594e.



The ASCII Feature Card comes equipped with an ASCII Adapter Cable, which has eight (8) serial ports. A serial modem can be attached to each port, and a single user can dial-in to each modem. Up to eight (8) users can access the ASCII Feature Card simultaneously.

Each 594e can support as many as six (6) ASCII Feature Cards, allowing up to 48 terminals or PCs to dial in. Printers can be attached to the auxiliary port on the dial-in terminal or PC, and are called "passthrough" printers. The PC or terminal does not intercept data intended for the printer, but rather passes it directly through to the auxiliary port.

The following cabling must be provided for each ASCII Feature Card:

- A serial cable to connect each ASCII port to its modem.
- A telephone cable to connect each modem to a telephone jack.

The following cabling must be provided for each dial-in terminal or PC:

- A serial cable to connect the modem to the PC or terminal.

  Note: If a PC with an internal modem is used, this cable is not required.

- A telephone cable to connect the modem to a telephone jack.
- To connect a passthrough printer to a terminal or PC, an appropriate cable is needed.

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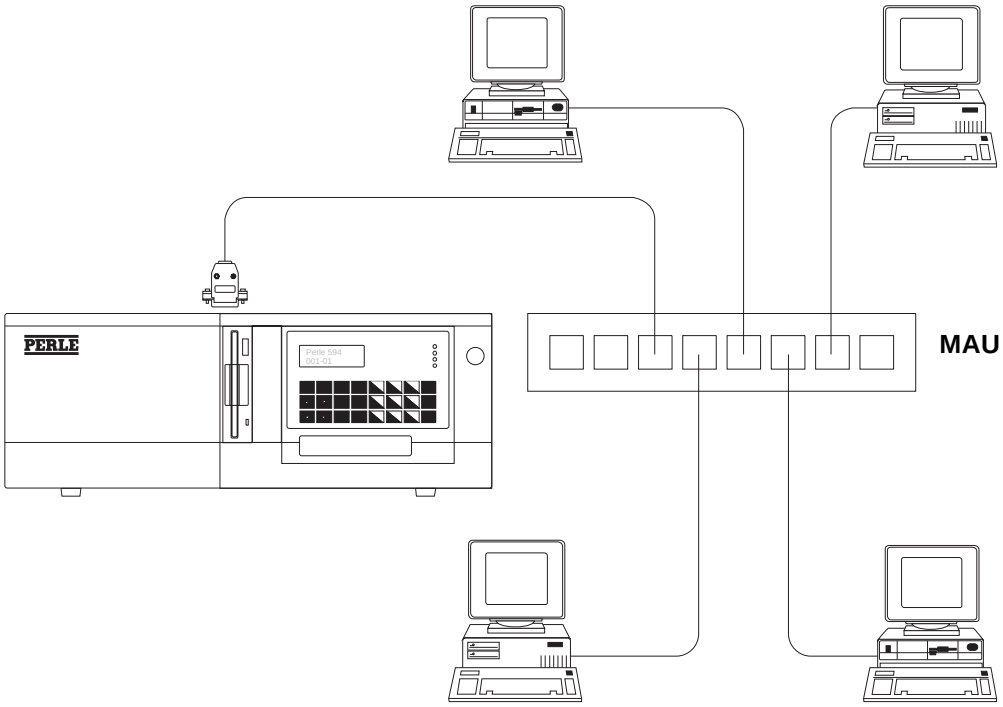
4 This feature is not supported if your 594e is running with the 594e IP Routing Feature.

Token-Ring Workstation Cabling

The following diagram illustrates the attachment of Token-Ring workstations to the Perle 594. A Token-Ring network is formed around one or more Media Access Units (MAUs). Devices are attached to the MAU, and the MAU allows them to communicate with each other.



The connection between a device and the MAU is called a "lobe". Each device must be equipped with an "adapter", which is a circuit board or computer card that allows the device to attach to the lobe.

Each Token-Ring Feature Card can support a maximum of 80 programmable workstations (PWSs). The Perle 594e can support up to two Token-Ring Feature Cards, for a maximum of 160 PWSs.

The Perle 594 Token-Ring Feature Card is compatible with the following cable standards:

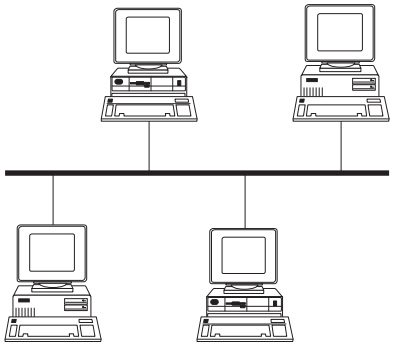
- Shielded Twisted Pair (STP) wiring, types 1,2,6, and 9.
- Unshielded Twisted Pair (UTP) wiring, type 3.
    - An external media adapter filter must be used.
    - Only "data-grade" wire should be used.

There are many vendors offering a variety of Token-Ring cabling methods, Media Access Units (MAUs) and other equipment. Consult the vendor documentation for specifications such as maximum cable length, electrical requirements of equipment and the maximum number of devices.

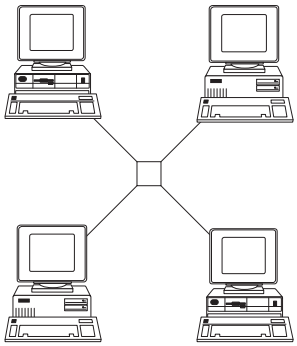
Ethernet Workstation Cabling

The following diagrams illustrate the attachment of workstations to an Ethernet LAN. Ethernet LANs are formed using the following network topologies:

- A Bus topology is formed by attaching workstations to a network trunk cable. Thick (10Base5) and Thin (10Base2) Ethernet networks use this topology.



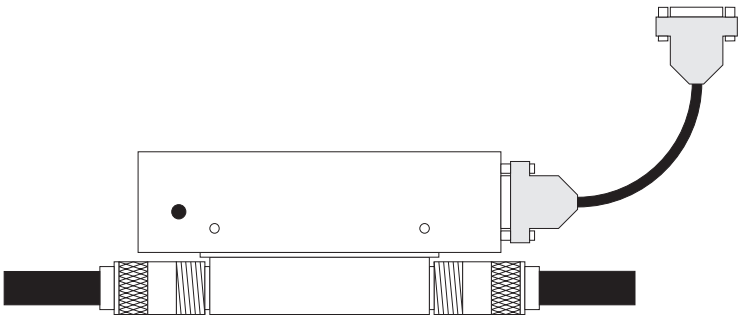
- A Star topology is formed by attaching workstations to a concentrator hub. Unshielded Twisted Pair (10BaseT or 100 BaseTX) networks use this topology.



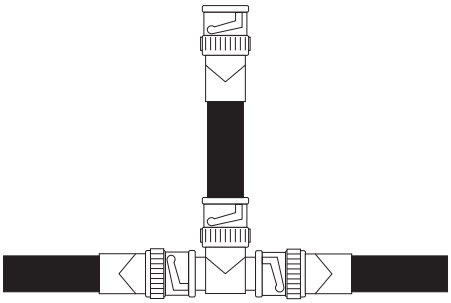
Each Ethernet Feature Card can support a maximum of 80 PWSs. The Perle 594e can support up to two Ethernet Feature Cards, for a maximum of 160 Ethernet PWSs.

The **Perle 594 Ethernet Feature Card** is compatible with the following cable standards:

- 10Base5 Thick Ethernet coaxial cable (0.4" diameter 50-Ohm coaxial cable).
    - An external transceiver and AUI cable must be used to attach to the network trunk. The AUI cable is connected to the AUI adapter (DB-15 port) on the feature card.



- 10Base2 Thin Ethernet coaxial cable (0.2" diameter RG-58A/U 50-Ohm coaxial cable).
    - A T-connector is attached to the BNC adapter on the feature card. The network trunk is then attached to the T-connector.



- 10BaseT Unshielded Twisted Pair cable (8-wire modular telephone-type cable).
    - 8-pin male RJ-45 connectors are used to connect to a 10BaseT concentrator hub.

The Perle 594 Fast Ethernet Feature card is compatible with the following cable standards:

- 10BaseT Unshielded Twisted Pair cable (category 3,4, and 5)
- 100BaseTX Unshielded Twisted Pair cable (category 5)
- 8-pin mail RJ-45 connectors are used to connect to a 100BaseTX concentrator hub

Many LANs use a combination of cable standards for connection into a larger mixed topology networks.

There are many vendors offering a variety of Ethernet cabling methods, Ethernet concentrator hubs and other equipment. Consult the vendor documentation for specifications such as maximum cable length, electrical requirements of equipment and the maximum number of devices.

AS/400 Communication Cabling

AS/400 Communication cabling will be one of the following four types:

- Remote Cabling

  This method is generally used when the Perle 594 and the IBM AS/400 will be located a large distance apart. For example, the systems may be located in different buildings, different cities, or even in different countries.

  With this type of cabling, the Perle 594 is connected to its modem using a Remote Communication Cable. A telephone line or a communications network is needed to allow the modem at the Perle 594 to communicate with the modem at the AS/400.

- Token-Ring Cabling

  This type of cabling is used when the Perle 594 and the AS/400 will communicate over a Token-Ring network. The two systems can be on the same network, but will usually be on different networks which are attached using bridges. Other devices, such as terminals or printers, may also operate on the same Token-Ring network.

- Ethernet Cabling

  This type of cabling is used when the Perle 594 and the AS/400 will communicate over an Ethernet LAN. The two systems can be on the same LAN, but will usually be on different LANs which are attached using bridges. Other devices, such as terminals or printers, may also operate on the same Ethernet LAN.

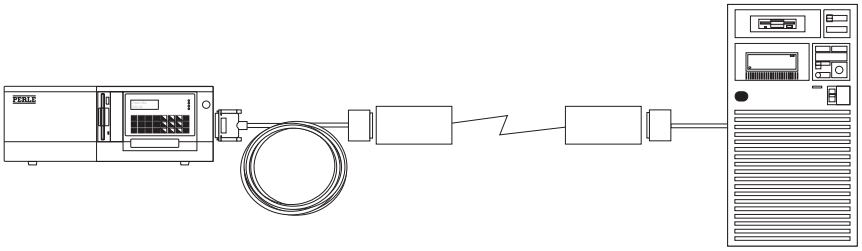
- Direct Cabling

  This type of cabling is used when the Perle 594 and the AS/400 are located in close proximity to one another. Usually they will be within a few hundred feet, and the systems are often both located in the same room.

  The Perle 594 requires a Direct Communication Cable, which is directly attached to the AS/400 communications cable. No modems nor phone lines are needed.

Remote AS/400 Communication Cabling

The Perle 594 and the AS/400 each require a separate cable to connect to their own modems, as shown in the following diagram:

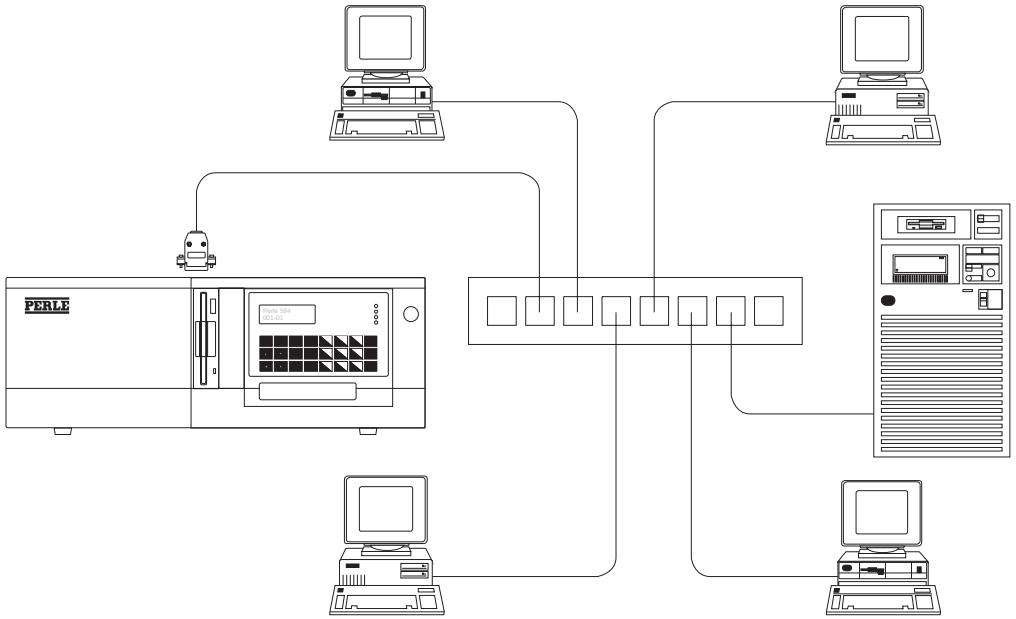


The Perle 594 communication cable will be equipped with one of the following physical interfaces:

- EIA 232D
- X.21
- V.35

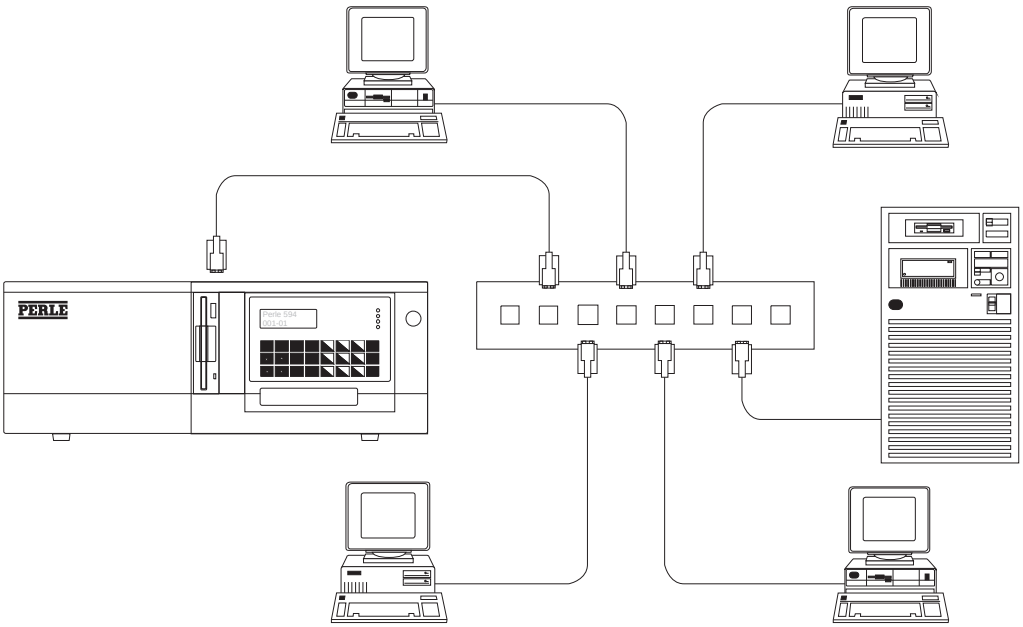
Both modems are connected to the communications network, as indicated by your network representative. Usually, this will be done using standard telephone jacks and cords.

Token-Ring AS/400 Communication Cabling

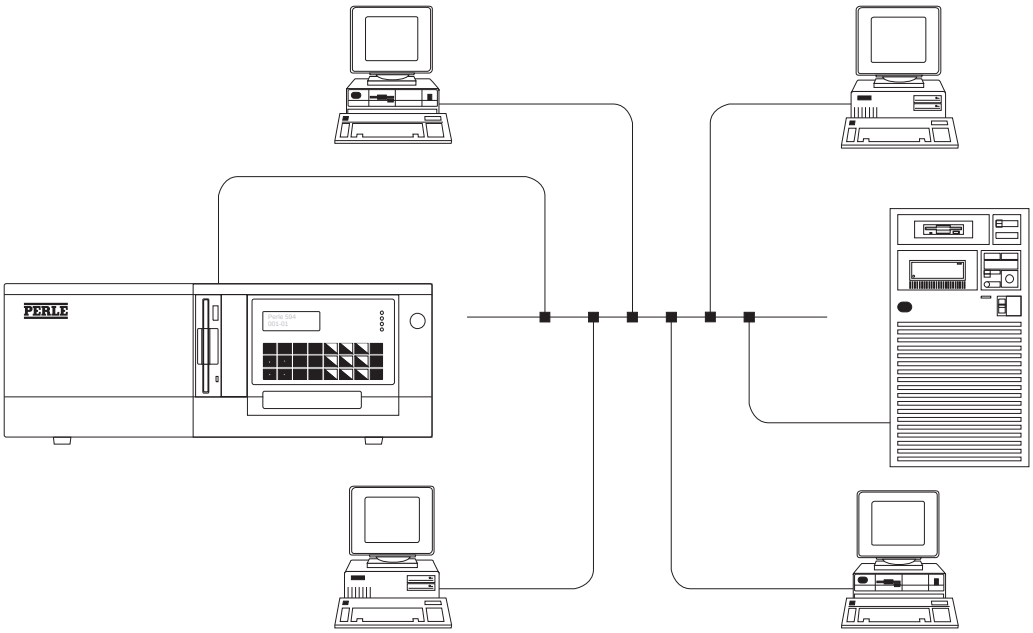


The MAU is connected as described in the vendor documentation. The Perle 594 may be connected to the MAU using the Perle-supplied Token-Ring cable.

Ethernet AS/400 Communication Cabling



For a 10BaseT or 100BaseTX connection, the concentrator hub is connected as described in the vendor documentation. The Perle 594 may be connected to the concentrator hub using a 10BaseT Ethernet cable (see page 29).

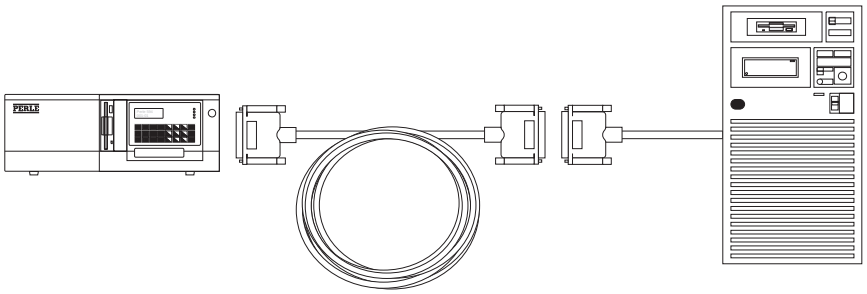


For a 10Base5 (Thick Ethernet) connection, the Perle 594 is attached to a transceiver on the network trunk using an AUI cable attached to the AUI port on the feature card (see page 28).

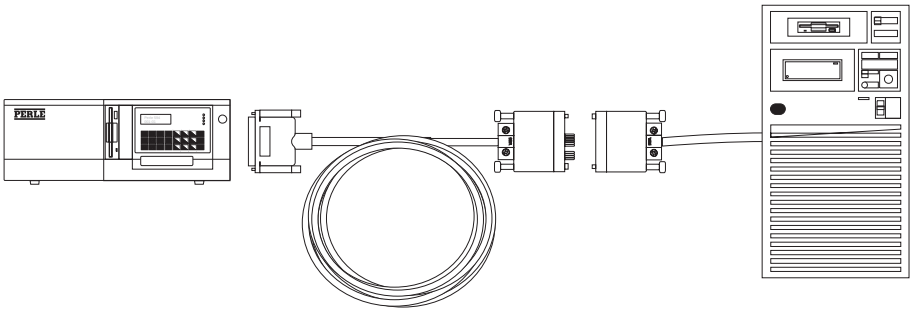
For a 10Base2 (Thin Ethernet) connection, the Perle 594 is attached using a T-connection to the network trunk. The T-connector is attached to the BNC adapter on the feature card (see page 29).

Direct AS/400 Communication Cabling

For direct AS/400 attachment using the EIA 232D or X.21 interface, the Perle 594 communication cable will be equipped with a female connector. The IBM AS/400 communication cable can be plugged directly into the Perle 594 communication cable.



For V.35 cabling, the Perle 594 communication cable is equipped with a V.35 connector. The IBM AS/400 communication cable can be plugged directly into the Perle 594 communication cable.



Chapter 4. Planning the Communications Network

Communication Network Transmission Speed

The transmission speed which your network requires will depend of factors such as:

- the number of devices
- the through-put requirements of printers
- the type of applications which will be run on the workstations.

Consult your network representative for assistance in determining the transmission speed you require.

LAN Speed

All devices on the same LAN segment must operate at the same *LAN speed*: either 4 Mbps or 16 Mbps for Token-Ring and 10 or 100 Mbps for Fast Ethernet. Ensure that the LAN speed of the 594 matches the line speed of the LAN.

Selecting Network Subscription Options

This section provides basic information about X.21 switched, X.25, and Frame-Relay protocols. It also lists the optional facilities which the Perle 594 supports. This information will be useful in planning the network connection, and in speaking with your network representative.

X.21 Switched Network Support

The basic characteristics of Perle 594 support for X.21 switched networks are:

- 1980, 1984 and 1988 CCITT Recommendation X.21
- Automatic unattended answer
- Operator-controlled address call
- Operator-controller online subscription change
- Short Hold Mode (SHM) for automatically connecting and preserving sessions should the line become inactive, then reconnecting when activity resumes.

X.25 Network Support

The following are the basic characteristics of Perle 594 support for X.25:

- 1980, 1984 and 1988 CCITT Recommendation X.25
- Link level LAP-B
- Data terminal equipment (DTE) role
- Permanent virtual circuit (PVC)
- Switched virtual circuit (SVC)
- Manual (operator-controlled) link establishment
- Modulo 8 or modulo 128 packet sequence numbering
- Packet sizes of 64, 128, 256, 512, or 1024
- Qualified logical link control (QLLC)
- Enhanced logical link control (ELLC)
- No data transfer on logical channel 0
- Transmission of optimal minimum number of packets through automatic adjustment of Request Unit (RU) size for packet size
- Reverse charge acceptance
- Flow control parameter negotiation
- Support for network optional facilities.

Frame-Relay Network Support

The following are the basic characteristics of Perle 594 support for Frame-Relay:

- SNA Direct as described in Request for Comments (RFC) 1490.
- Support for the following link management interface (LMI) options. The first two use DLCI 0 as the virtual circuit for communications with the network:
  - ANSI T1.617 Annex D
  - CCITT Q.933 Annex A
  - No LMI
- A maximum of 64 PVCs (DLCIs) configured on the network link between the Perle 594 and the ALS, as well as a maximum of 64 DLCIs exchanged between the 594 and the frame handler. Only one may be active at a time. Therefore, any additional DLCIs are ignored at the 594.

Frame Relay Token-Ring Bridge Support

The 594 supports the bridging of Source-Routed token-ring frames over a frame relay network. The following are the basic characteristics of Perle 594 support for Frame-Relay Token-Ring Bridging:

- The 594 supports bridging on up to four configured frame relay DLCIs which allows the 594 to send and receive bridged traffic with up to four bridge partners at a time

  Note: Any bridged LAN frames will be flooded on all configured DLCIs that are active.

- Bridge partners must support RFC 1490 bridged 802.5 frame format
- The 594 supports a bridged frame size of 1500 bytes
- The 594 does not support fragmentation
- The 594 supports both automatic and manual spanning tree protocol
- The 594 supports a maximum of 7 hops for bridge frames
- The 594 supports user defined bridge filtering
- The frame relay connection is treated as a virtual LAN with MAC addresses being assigned at both ends of the DLCIs
- The 594 uses a single ring number for all frame relay connections

IP Routing Support [1, 2]

With the 594 configured for IP Routing the 594 will provide basic IP routing, using either dynamic or customized static routes to forward IP datagrams between the LAN interfaces (Token-Ring and Ethernet), the twinax interface, the frame relay and PPP interface. IP routing allows devices, such as AS/400s, Network Computers, and PC's running IP applications, on the LAN, twinax, the frame relay and PPP, to send IP datagrams to the 594 with an IP destination address other than the 594's IP address. The 594s at remote sites can now be connected to each other or other IP routers and route IP traffic to interconnect their IP devices. Routers that the 594 will be communicating with over Frame Relay must support Frame Relay RFC 1490 Routed IP format. The following are the basic characteristics of the Perle 594 support for IP Routing:

- The 594 supports IP Routing on up to forty configured or discovered frame relay DLCIs, which allows the 594 to send and receive IP routed traffic between up to forty routers at a time.
- The 594 supports a routed IP frame size of 1500 bytes
- Configuration of Default and Static routes
- Dynamic Routing using RIP Version 1 and Version 2
- ARP and Inverse-ARP support
- Fragmentation and reassembly
- Subnetting per RFC-950
- Supports Token-Ring source Routing Information Fields as per RFC-1042
- Echo, Echo Reply, Destination Unreachable, and Source Quench ICMP messages support
- Concurrent multiple frame types for Ethernet
- IP Routing is supported on the follwoing Physical conntections:
  - Token-Ring SNAP
  - Ethernet SNAP
  - Ethernet Type II
  - Frame Relay RFC 1490 Routed IP
  - Twinax
  - PPP

TCP/IP

The following are basic characteristics of Perle 594 support for TCP/IP:

- The 594 implements IBM’s MPTN (multi-protocol transport network) architecture to transport SNA over TCP/IP

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[1] For the 594e this configuration requires that either the 594e IP Routing Feature or the 594e Network Controller Feature be installed. For more information on these features see the 594e User and Reference Guide.

[2] For the 594T, this configuration requires that the Perle 594T IP Routing Feature be installed. For more information on the 594T IP Routing Feature see the 594T User and Reference Guide.

- The AS/400 host must be running OS/400 V3R1 or V3R6 or higher in order to run a TCP/IP configuration with the 594. If using a PPP connection, the AS/400 host must be running OS/400 V4 R2 or higher.
- The network between the controller and the host must have proper routing for TCP/IP traffic.
- Physical connections supported are:
  - Token-Ring SNAP
  - Ethernet SNAP
  - Ethernet Type II
  - Frame Relay RFC 1490 Routed IP [1, 2]
  - PPP dial up connection [1, 2]
- The 594 supports a maximum of 1680 TCP/IP sessions
- The 594 allows SNA and TCP/IP controllers to run at the same time

[1] For the 594e this configuration requires that either the 594e IP Routing Feature or the 594e Network Controller Feature be installed. For more information on these features see the 594e User and Reference Guide.

[2] For the 594T, this configuration requres that the Perle 594T IP Routing Feature be installed. For more information on the 594T IP Routing Feature see the 594T User and Reference Guide.

Ordering Modems

Modems may be required for the following purposes:

- To allow the Perle 594 Controller to communicate with the AS/400.
- To allow ASCII workstations to communicate with the Perle 594e Controller

AS/400 Communication Modems

Your network supplier should provide you with modems, or with information you will require for ordering modems. When ordering a modem, select a transmission speed is greater than the speed your network requires.

The modem you select for the remote site must be compatible with the modem at the AS/400 site (for example, line speed and transmission mode).

When ordering a modem, keep the following in mind:

- The modem must provide the transmit and receive clocking
- A constant Ready-For-Sending (RFS) signal from the modem is not allowed in duplex or half-duplex mode. The modem must be set for Request-To-Send (RTS), and controlled by the Perle 594
- It is advisable to use a modem with the carrier controlled by RTS (i.e., switched carrier). If the line is point-to-point duplex, the modem can have constant carrier.
- The signal ground should not be connected to the modem's frame ground
- A modem on a switched line must be set as follows:
    - Auto-answer controlled by either Data Terminal Ready (DTR) or Connect Data Set To Line (CDSTL)
    - Pin 22 (calling indicator) must have EIA 232D signal levels
- Contact your network representative to determine whether or not your modem requires an external data coupler.

If ordering a modem for a PPP connection, see list of supported modems in Client Access for Windows modem list or consult your AS/400 documentation.

ASCII Modems (Perle 594e only)

The Perle 594e's ASCII Feature Card supports a wide range of industry-standard asynchronous modems.

Ensure that the modems you choose for attachment to the ASCII Feature Card support a standard, V.24 25-pin asynchronous serial cable. These are the modems which will answer the call when users dial into the ASCII Feature Card.

Also ensure that the modems which your users will use for dial-in are compatible with the answering modems, which are attached to the ASCII Feature Card.

Chapter 5. Concurrent Host Attachment

Introduction

The Perle 594 controller can be configured to allow its nonprogrammable workstations (NWS) to communicate concurrently with up to four AS/400 hosts over a single physical link. This capability is referred to as Concurrent Host. Nonprogrammable workstation (NWS) displays and printers that do not have the use of AS/400 display station or printer passthrough can now communicate with other AS/400s in the communication network. To reach multiple AS/400 systems in the network, concurrent host attachment uses the SNA session-level routing capabilities of an APPN network or an SNA subarea network.

Note 1: *The Concurrent Host feature works with the 594e in either compatible or enhanced mode. In the case of enhanced mode, each emulated controller within the 594e can be configured with Concurrent Host capability.*

Note 2: *Multi-session controllers do not support concurrent hosts.*

Note 3: *The display on the 594 controller that has multi-sessions assigned will not support concurrent host even if it is configured.*

AS/400 System Requirements

Once the configured AS/400 systems are interconnected with an appropriate communication network, whether it be an APPN network or an SNA subarea network, the 594 can provide concurrent host attachment. A route through the network must be established for the flow of LU6.2 session traffic between a 594 controller with which it is intended to communicate and each AS/400 system. Each 594 controller must be configured on each AS/400 system. This configuration will be the same with or without concurrent host attachment.

594 Configuration Requirements

Every AS/400 host that a 594 controller contacts must be configured in the 594 (H1-H4), and one of those hosts must be declared the primary host.

A 594 controller and the primary host interact in the following manner:

- Error log data is sent from a 594 controller to the primary host. A 594 controller does not send error log data to any other host.
- A 594 controller sends alerts to the primary host. However, if the controller session with the primary host becomes inactive, an active session with an alternate host will be used for sending alerts until the primary host controller session becomes active again.
- A 594 controller attempts to to keep the controller session active as long as there is a device active for a particular host.
- A 594 controller attempts to keep the primary host controller session active whenever any alternate host controller session is active. This way alerts and error log information can be sent to the primary host.

Display Options

Concurrent Host capability affects NWS display options and introduces the concept of "default host."

Default host simply refers to the AS/400 that provides the NWS with its sign-on screen. Unless you change it, the default host is the primary host. The first time you use Version 3.6 of the 594 Controller Software, all NWS sign-on screens will be taken from the primary host.

However, you can enter a System Request command to change the default host for a particular NWS to any AS/400 that has been configured for that 594 controller. By doing this, you cause that NWS display to take its sign-on screen from a non-primary AS/400. You can also enter another System Request command to temporarily switch to a different host without changing the default host for that display.

Whenever a display session switches hosts, it will appear to the current host as a display power-off and to the new host as a display power-on.

> ***Note***: *Return to the sign-on screen for the current host before switching a display session to another host.*

Single, shared, and multiple address displays have different capabilities when communicating with the host:

Single-address displays: able to communicate with only one host at a time.

Shared addressing displays: as long as the AS/400 system supports shared addressing displays (Version 3, Release 1 or later), the displays are able to communicate with a different host on each shared session. If the AS/400 system does not support shared address displays, only the base session of a shared address display will be able to communicate with the AS/400 system.

Multiple address displays: a display that uses multiple addresses for additional sessions can also communicate with a different host on each session. For each session on a shared or multiple address display, the default host can be set independently.

Printers and Concurrent Host Attachment

Once a 594 controller has been configured for concurrent host attachment, printer sharing can be enabled or disabled.

Printer Sharing Enabled

The following is a list of functions that apply once printer sharing is enabled.

- any printer attached to a 594 controller can be shared by up to four AS/400 systems.
- whenever a shared printer is powered on, the 594 controller will activate the controller session with the primary host and report to the primary host that the printer is available.
- if a controller session becomes active with any alternate hosts, the 594 controller will report to

the alternate host that the printer is available.

- the 594 controller will not activate a controller session with an alternate host just for a shared printer.
- there are two ways a controller session with an alternate host can be activated:
  - by setting the **Controller Session Initiation** to "yes" for the alternate host.
  - if a display becomes active for this alternate host.

Printer Timeout

A printer can have only one AS/400 system printer writer active at a time. Therefore, once the writer for a particular AS/400 system has started, a 594 controller will report to the other AS/400 systems that the printer is unavailable. When the writer has ended for the printer, the 594 controller will start the printer sharing timeout. After the timeout expires, the 594 controller will report to the other AS/400 systems that the printer has powered on and that a writer on one of the other AS/400 systems can be started and can begin printing.

Chapter 6. Frame Relay Token-Ring Bridge

Introduction

The 594 supports source route bridging between 594 token-ring LAN attached devices and remote LANs using the frame relay protocol over a point-to-point connection or through a frame relay network connection.

This bridge support can be used to connect two or more LAN segments together, allowing users on different LAN segments to communicate across the bridge as if they were all on the same LAN segment. This allows the creation of one logical LAN, which is sometimes referred to as a bridged LAN.

This means non-SNA traffic on token-ring LANs can access the rest of the communication network through the 594. The content of the networking layer of the bridged token-ring frame is transparent to the 594.

The 594 only supports source route bridging, which is a standard method of bridging token-ring LANs and is implemented by most bridge products that support the token-ring protocol. Source route bridging requires that the source of the token-ring frame specify the path over which the frame must be transmitted rather than the bridge determining the path.

The 594 Utility Program and NWS Concurrent Diagnostics provide you with Source Route Bridging Status. This status includes inbound and outbound frame summaries, and counts of the different types of frames (such as Spanning Tree Explorer, All Routes Explorer and Specifically Routed frames) and normal and error frame discards. These counters can also be cleared and frame forwarding stopped or started from either the 594 Utility program, NWS Concurrent Diagnostics or the 594 front panel.

AS/400 Host and Bridge Partner Considerations

The 594 supports bridging on up to four configured frame relay DLCIs which will allow the 594 to send and receive bridged LAN traffic with up to four bridge partners at the same time. The bridge partner can be an IBM AS/400 or any bridge that support RFC 1490 Frame Relay Bridging.

The AS/400 does not provide a true bridging function, as it does not bridge the bridge traffic from the 594 onto another token-ring. Based on the network layer protocol, the AS/400 can transfer data received from the 594 bridged connection to other networks. OS/400 V3R1 and V3R6 or higher support the routing of SNA and IP. OS/400 V3R1 and V3R7 or higher also support the routing of IPX. For other bridge partners, the bridged token-ring frame can contain any networking layer protocol that the bridge partner supports.

594 Frame Relay Bridge Configuration Considerations

Frame-Relay Token-Ring Bridge DLCIs

For every frame relay bridge DLCI configured and is active on the 594, the 594 will flood all the token-ring bridged traffic. Therefore only configure the number of bridge DLCIs that you require the LAN traffic to be sent to.

Frame Relay and LAN Ring Speeds

The values configured for the frame relay line speed and the LAN line speed are used to calculate the relative path cost of the WAN or LAN in the Spanning Tree Protocol. Using lower values for the speeds will tend to cause traffic to be sent over other routes (if available) that may be more powerful and better equipped to handle large amounts of traffic

Ring Numbers

On the frame relay network all bridge partners must use the same ring number for the frame relay virtual LAN

594 FR-TR Bridge Filter

Although it not essential to create a bridge filter, the token-ring speeds are much faster than the frame relay speeds supported on the 594, and a high volume of LAN traffic trying to cross the FR-TR bridge can cause some undesirable results, such as overflowing buffers, timeouts and lost connections. In addition, depending on how you are billed for your frame relay traffic, unnecessary traffic can cost you money. Similarly, you might want to insulate your LANs from frame relay traffic coming across the FR-TR bridge.

The 594 bridge filter will allow you to limit traffic in either or both directions. You can specify precisely the kinds of frames that can cross the FR-TR bridge, by using such attributes as frame type, hop count, source and destination addresses and data within the frames themselves. You can create a bridge filter that will include those frames you want to cross, exempting those frames you do not want to cross or some combination of both. For a description of how to create a 594 FR-TR bridge filter see the 594 User's Guide.

The need for bridge filtering is usually indicated by network congestion and poor response times.

Chapter 7. IP Routing Support

Introduction

With the 594 configured for IP Routing the 594 will provide basic IP routing, using either dynamic or customized static routes to forward IP datagrams between the LAN interfaces (Token-Ring and Ethernet), the twinax interface, the PPP interface and the frame relay interface. IP routing allows devices, such as AS/400s, Network Computers, and PC's running IP applications, on the LAN, twinax, PPP and the frame relay, to send IP datagrams to the 594 with an IP destination address other than the 594's IP address. The 594s at remote sites can now be connected to each other or other IP routers and route IP traffic to interconnect their IP devices. Routers that the 594 will be communicating with over Frame Relay must support Frame Relay RFC 1490 Routed IP format.

The 594 Utility Program and the front panel Concurrent Diagnostics provide you with IP Routing Status. These statuses include such things as IP packets received, transmitted or discarded due to no routes found or congestion. Counters for different types of frames forwarded, such as IP, TCP, UDP, and ICMP on each IP router port can also be displayed. These counters can also be cleared and frame forwarding stopped or started through the use of the 594 Utility program. The 594 Utility program can also be used to display the current Static IP Router Table and the IP Router DLCI Table.

AS/400 Host and Routers Configuration Considerations for Frame Relay

For an IP routing over Frame Relay configuration the 594 supports IP Routing on up to forty configured or discovered frame relay DLCIs, which allows the 594 to send and receive IP routed traffic between up to forty routers at a time. The AS/400 can be used as an adjacent IP router if it is natively connected to the frame relay network or in using the frame relay protocol over a point to point connection. Since the 594 treats all DLCI's on it's frame relay port as being in the same IP network then it is required that all frame relay IP routers and hosts that wish to communicate with the 594 over Frame Relay must be configured with the same IP network.

OS/400 V3.2 and V3.6 or higher support the routing of IP traffic. All routers communicating with the 594 over Frame Relay must support RFC 1490 Routed IP frame format.

If static routing is used, then all routers (including the AS/400) that are communicating with 594, will require a static route entry or default gateway configuration of the 594 router port's IP address.

If dynamic routing using RIP is used then all routers (including the AS/400, OS400 V4.2 or higher), that we are communicating with, must also be configured for dynamic routing using RIP.

AS/400 Host Configuration Considerations for PPP

To Run PPP on the AS/400, it must be running OS/400 Release 4 Version 2 or later

Client Access (V3R2M0) or Client Access Express for Windows (V4R4M0) and Operations Navigator must be used to configure and operate the PPP interface.

594 IP Routing Configuration Considerations

IP Router Ports

To define an IP router port you must configure an IP address and IP mask that will be associated with that IP router port on the 594. These two values will also be used to define what IP network is associated with this IP router port.

Static IP Route Entries

No static IP route entries are required if you only want to route IP traffic from your remote IP network to or from your frame relay IP network. If your remote IP users will access devices on other subnets or networks, then there must be at least one IP router on the same subnet as the 594. This router is your Default Gateway. You can define other routers in the network by specifying their IP addresses and the destinations they service, by configuring multiple Static IP Route Entries, but only one Default Gateway router is allowed.

Dynamic Routing using RIP

The support of Dynamic Routing allows the 594 to exchange route or link information from which the best paths to reach destinations in the internetwork are calculated. With Dynamic Routing enabled, you will no longer be required to configure static route entries in the 594 and adjacent IP routers, as long as the adjacent IP routers support RIP V1 or V2.

If the 594 is configured for dynamic routing using RIP then all adjacent router must also be configured for RIP. The 594 will accept both RIP Version 1 and RIP Version 2 messages, but will only advertise it's RIP information using RIP Version 1.

Frame Relay IP Routing DLCIs

It is not necessary to configure any DLCIs on the 594e for frame relay IP Routing because Inverse Address Resolution Protocol (InARP) is used on any reported active DLCIs to identify which DLCIs can support IP protocols. If you enable dynamically discovered DLCIs on the 594e (which is the default), the available active DLCIs on the frame relay interface with be automatically added to your configuration. Otherwise you need to define DLCIs in the IP DLCI Table. If "No LMI" is configured then you can not dynamically discover new active DLCIs.

If you wish to use the same DLCI for IP Routing, SNA controller and/or frame relay bridging then you must define these DLCIs in the 594 IP DLCI Table.

Twinax IP Routing

The support of IP devices on the 594's twinax interface allows customers with PCs or Network Computers attached to the 594 via their twinax cabling to gain access to any of their IP networks. One of the benefits of running IP over twinax is that it supports cable distances of up to 5,000 feet of twinax without any kind of repeater. This is longer that many LAN types that require additional hubs to obtain this distance.

With the support of IP over Twinax it is now possible to have non-LAN PCs and Network Computers attached to the 594 Network Controller to access the worldwide web, share printers and files and use workgroup applications.

Each twinax card on the 594 must be configured as a seperate IP router port with it's own unique address. When a twinax IP device is first connected to the 594, the 594 will pre-define an IP address to the device based on the configured IP network address configured for the twinax IP router port and the LSID of the attached twinax IP device. This pre-defined address is usually only used temporarily, until the attached twinax device acquires an IP address from a BOOTP or DHCP server.

Routed IP Devices Considerations

If any BOOTP/DHCP Clients (such as Network Computers) are attached to the 594 then the BOOTP Relay Agent feature of the 594 will need to be configured. This will provide the clients access to remote BOOTP/DHCP servers.

The maximum IP frame size supported by the 594 is 1500 bytes.

594 IP Routing Configuration Considerations for PPP

594 controller IP address assignment

The 594e can support up to 40 controllers. These controllers must be given an IP address. The assignment of the IP address can be done as follows;

1. All the controllers can be placed on a "virtual network". This would be done by specifying a host IP address for each of the controllers and a common subnet mask which would place all the controllers on the same network. This would introduce a virtual network which will exist within the 594e controller

2. All of the controllers can be placed in the network associated with any other IP interface on the 594e controller excluding the PPP interface. For example they can be placed on the IP network associated with an Ethernet interface on the controller.

3. A combination of the two methods above could be used where some of the controllers are placed in a "virtual network" and others are associated with an IP interface on the 594e controller.

Assigning the PPP port address

The IP address of the PPP port can be specified or left as all zeros. If left as all zeros, it indicates that the IP address assignment will take place at connect time and will be provided by the other end of the PPP connection.

Static and Default Route definition

When defining a static or default route, it is possible to specify the "next hop" address as all zeros. A "next hop" address of all zeros will cause the IP packet which matches the destination network associated with this entry to be forwarded on the PPP link. This feature should be used when the IP address of the PPP link is dynamically negotiated and will not known until connect time.

Chapter 8. Network Computer Boot Server (594e only)

Introduction

Network Computers (NCs) are micro-processor based based systems that do not have any local hard drive or floppy drives. The NC's software is stored on one or more servers on the network and is downloaded by the NCs when it is required. The software consists of both the operating system and applications and is supplied by the NC vendor or 3rd party vendors. Typical application can include:

- Web browser
- 5250, 3270, VT100 terminal emulation
- Java applet and applications
- e-mail
- Xstation and Windows terminal support.

The 594e provides support for Network Computers (NCs) at remote locations of a Wide Area Network (WAN) by storing the NC's operating system and applications on the 594e's hard disk drive. NCs can be connected to the 594e Ethernet, Token-Ring or Twinax interfaces. When the NCs are powered on, they can load their software from the local 594e instead of downloading these large files across the WAN.

The NC support is accomplished by two services on the 594e:

BOOTP Relay Agent

Bootstrap Protocol (BOOTP) and Dynamic Host Control Protocol (DHCP) are IP protocols that allow client devices (such as Network Computers) to request an IP address and optionally an operating system file. When a client is powered on, it sends a BOOTP/DHCP request on the LAN. A BOOTP/DHCP server will send back a reply that contains the IP address defined for that client, the name of the operating system start-up file to load, and the IP address of the Boot Server which contains the operation system.

DHCP does not force a fixed link between a client's MAC address and an IP address and therefore it is more flexible than BOOTP.

The 594e BOOTP relay agent will relay a BOOTP or DHCP request from a client locally connected to a 594e LAN interface across the corporate WAN to specific BOOTP or DHCP Servers. Up to 4 BOOTP or DHCP servers can be configured for the 594e.

NC Boot Server

The 594e has a hard disk drive which can be used to store a network computer's operating system and application files. The 594e can be configured to provide a File Transfer Protocol (FTP) and/or Trivial File Transfer Protocol (TFTP) server function.

The system administrators will use an FTP client on the Primary Boot Server to download the operating system and application files to the 594e hard disk drive.

NCs can download their software from the 549e using either FTP or TFTP.

NC Boot Sequence

The 594e will support Network Computers that comply with the following boot up sequence.:

- Perform self-test and read non-volatile ram for boot-up configuration.
- If configured to get boot information from the network, then broadcast a BOOTP/DHCP request.
- Download the operating system from the specified Boot Server (594e)
- Load the default configuration files from the boot server and reconfigure itself accordingly
- Start a login session on the primary boot server (not the 594e).
- Load user specific configuration files and start applications.

Supported Connections

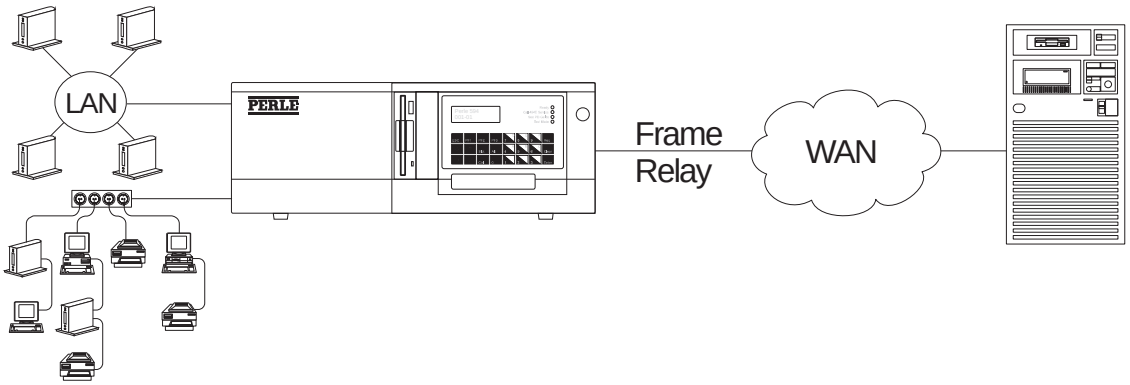
The 594e will support NCs in two typical configurations:

Frame Relay Host Connection.

In this configuration the NCs can be connected to the 594e Token-Ring, Ethernet or Twinax interface. The 594e will have IP routing enabled and therefore the NC's IP traffic will be routed between the 594e LAN interface and the Frame Relay Interface and out onto the WAN.

The NCs will access a BOOTP/DHCP server through the 594e BOOTP Relay Agent to get their IP addresses and location of the Boot Server. The Boot Server will be configured as the 594e.

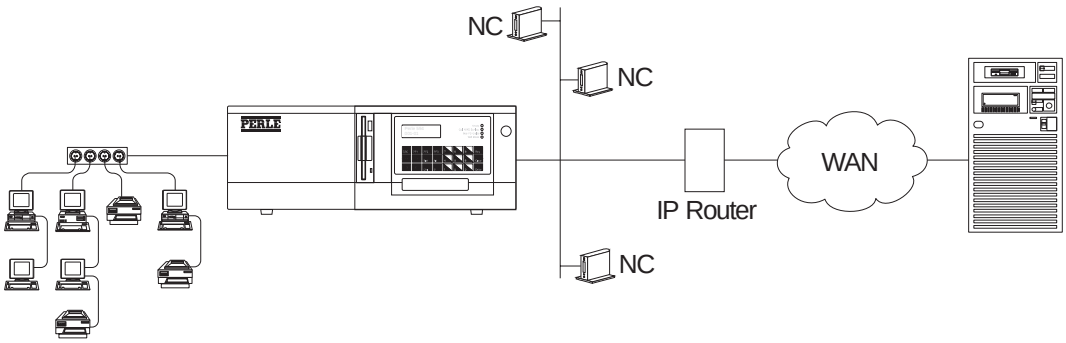
The NCs will then load their start-up files from the 594e hard disk drive.



Ethernet or Token-Ring Host Connection.

In this configuration the NCs can be connected to the 594e Host connection LAN interface. This configuration does not require IP routing and the BOOTP relay agent on the 594e will not be enabled. Therefore the NCs will access the BOOTP/DHCP Servers directly over the WAN to get their IP addresses. Any routers between the NCs and the BOOTP/DCHP server must have a BOOTP Relay Agent.

The BOOTP/DHCP servers will still be configured to have the 594e act as the Boot server. The NCs would then download the start-up files from the 594e instead of across the WAN.



Primary Boot Server Considerations

The primary boot server is a host machine in a central location on the WAN. It is used for the initial install of the NC software, configuration of system and user preferences, and login authentication. The server can be an AS/400, Windows NT or Unix system. Check the specifications of the NC software for the supported host platforms.

After the software is installed, download the appropriate files to the 594e hard disk drive. Typically, the operating system files, workstation specific configuration files and applications would be downloaded. The user specific configuration files will stay on the Primary Boot Server so they can be accessed from any remote location. This is called a split boot. See the *594e User's and Reference Guide* for detailed instructions on how to configure this feature.

The files are downloaded by using any standard FTP client running on the Primary Boot Server. This software comes as part of the operating systems of some hosts (i.e. Windows NT, AS/400) or can be purchased off the shelf.

BOOTP/DHCP Server Considerations

Up to 4 BOOTP/DHCP server IP addresses can be configured for the 549e. When the 594e BOOTP Relay Agent processes a BOOTP/DHCP request from an NC, each of the configured servers will be sent a request. The server which responds will depend on network loading factors and network paths. You cannot be sure which server will respond first. Therefore each of these servers should have identical configurations for each NC.

The BOOTP/DHCP server software used must allow the configuration of a Boot server IP address. This will be configured with the IP address of the 594e that the NCs are connected to.

594e NC Boot Server Configuration Considerations

BOOTP Relay Agent.

The BOOTP relay agent must be enabled if the 594e is acting as a router for the NC's and at least one BOOTP/DHCP server IP address must be configured.

File Transfer Protocols

Enable and configure the FTP and/or TFTP server options that are required by your NCs for downloading software.

The default value for the **Home Directory** option for FTP and TFTP services is the root directory of the 594e hard disk drive. An FTP client should be used by the system administrator to create a sub-directory for the software required by the NCs that will be connected to the 594e. When the software has been downloaded, then the **Home Directory** option should be changed to point to the new sub-directory. This sub-directory will be accessed by the NCs as their home (or root) directory.

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