OS/390 eNetwork Communications Server

AnyNet: Guide to Sockets over SNA

Version 2 Release 5

SC31-8577-00

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Note: Before using this information and the product it supports, be sure to read the general information under “Appendix B. Notices” on page 51.

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This edition applies to OS/390 V2R5 (program number 5647-A01).

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About This Book

This publication describes the primary tasks involved with installing, configuring, using, and diagnosing AnyNet* Sockets over SNA.

How This Book Is Organized

This manual presents conceptual information about Sockets over SNA in Chapter 1, followed by chapters divided among the following tasks:

- Chapter 2. Planning for AnyNet Sockets over SNA
- Chapter 3. Defining AnyNet Sockets over SNA
- Chapter 4. Configuring, Customizing, and Tuning AnyNet Sockets over SNA
- Chapter 5. Starting, Initializing, and Stopping AnyNet Sockets over SNA
- Chapter 6. Diagnosing Problems for AnyNet Sockets over SNA.

Reference information in the appendix provides information about the syntax conventions used in this book.

AnyNet Sockets over SNA messages are in the *OS/390 eNetwork Communications Server: SNA Messages*. Throughout this book, the term *AnyNet* refers to the AnyNet function for MVS unless otherwise noted. The term *AnyNet/2* refers to AnyNet for OS/2.

Artwork Used in This Book

Figure 1 on page xii shows the conventions used in this book to illustrate the parts of a network.

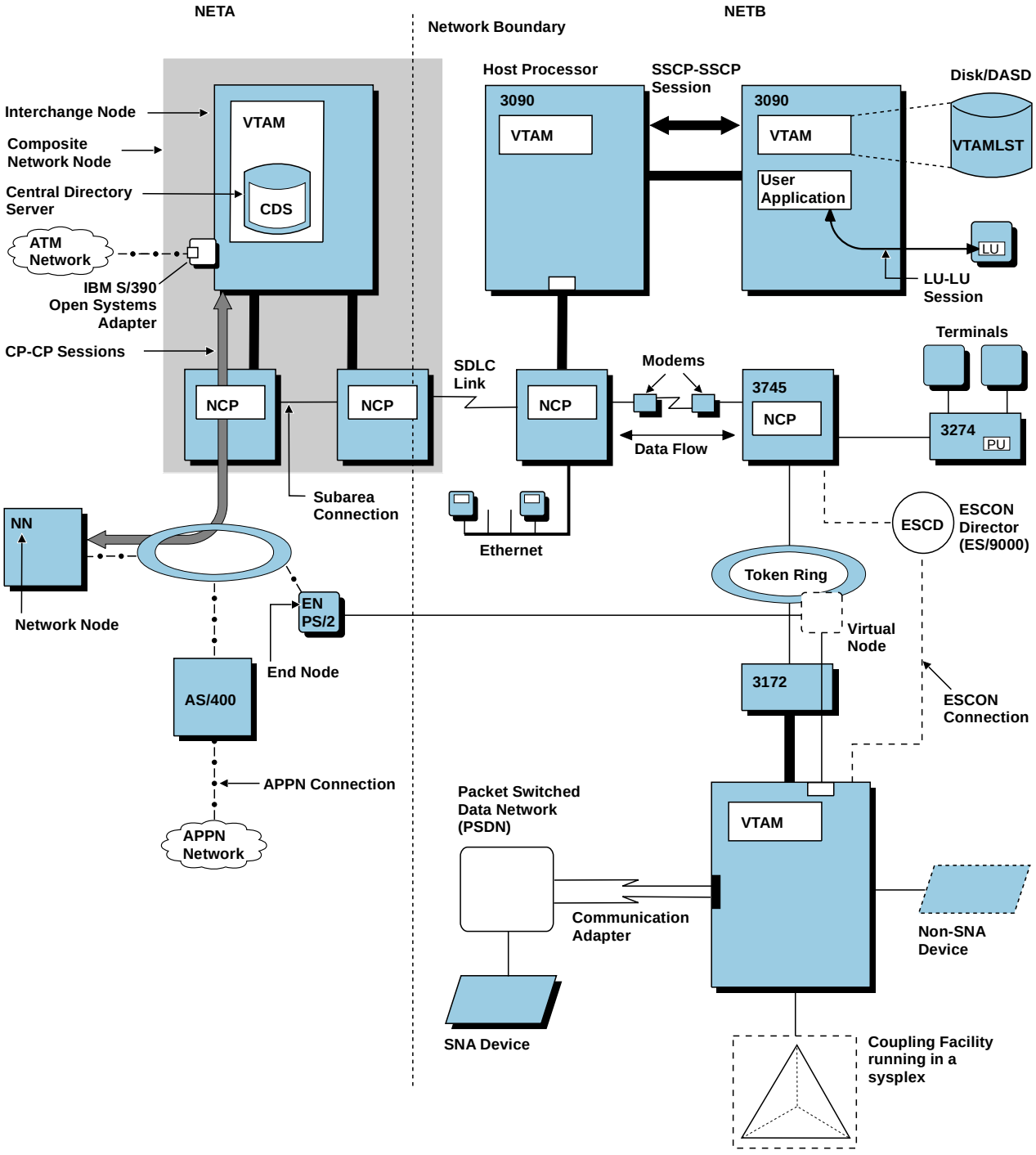


Figure 1. Conventions Used in Network Illustrations

What is New in This Book

Information has been added to this book to reflect the new functions in eNetwork Communications Server for OS/390 V2R5.

This book was previously published in March 1997 with order number SC31-8371-00.

Chapters 5, ″Compiling, Linking, and Running an AnyNet Sockets-over-SNA Application Program″, Chapter 8, ″Socket Calls for AnyNet″, and Appendix A, ″Summary of tcperrno.h Error Codes″ have been deleted due to the following changes:

- OpenEdition OS/390 socket API is supported. VTAM AnyNet socket API is no longer supported. Applications written to AnyNet's C socket API must be ported to OpenEdition. This includes all applications that were supported by earlier Socket over SNA features for VTAM and those applications that are written to AnyNet's socket API instead of OpenEdition's API.
- You must define the Sockets over SNA physical file system (PFS) to OpenEdition. Starting Sockets over SNA is also different; a new parameter is required. Refer to"Starting and Initializing Sockets over SNA" on page 37 for details.
- Only one instance of Sockets over SNA can be started on a single OS/390 host.
- A new function, Dynamic Client Mapping, is supported. It is controlled by the LEARNMAP environment variable. Refer to "LEARNMAP = NO|YES" on page 29 for a description.
- Some environment variables are no longer supported; others are new. Refer to "Defining Sockets-over-SNA Environment Variables: the ENVVAR Data Set" on page 27 for descriptions of the valid environment variables.
- Utilities must now be authorized. See "Running Utilities Using JCL" on page 39 for an example.
- Sockets over SNA now uses OpenEdition HOSTS and NAMES files. It is no longer possible or necessary to define HOSTS, NETWORKS, PROTOCOL, RESOLV, and SERVICES files to Sockets over SNA.

Refer to *OS/390 OpenEdition Programming: Assembler Callable Services Reference* for information on using the OpenEdition MVS socket API. Refer to *OS/390 C/C++ Run-Time Library Reference* for information on the compilers supported by OpenEdition.

For AnyNet Sockets over SNA messages, refer to *OS/390 eNetwork Communications Server: SNA Messages*.

Where to Find Related Information on the Internet

You may find the following information helpful.

Note: Any pointers in this publication to websites are provided for convenience only and do not in any manner serve as an endorsement of these websites.

You can read more about VTAM, TCP/IP, OS/390, and IBM on these Web pages:

Home Page	Uniform Resource Locator (URL)
VTAM	http://www.networking.ibm.com/vta/vtaprod.html
TCP/IP	http://www.networking.ibm.com/tcm/tcmprod.html
OS/390	http://www.s390.ibm.com/os390/
IBM eNetwork Communications Server	http://www.software.ibm.com/enetwork/commserver.html
IBM	http://www.ibm.com/

For definitions of the terms and abbreviations used in our books, you can view or download the latest *IBM Networking Softcopy Glossary* at the following URL:

http://www.networking.ibm.com/nsg/nsgmain.htm

Chapter 1. Introducing Sockets over SNA

This chapter describes:

- How Sockets over SNA works on OS/390
- Sample Sockets-over-SNA network scenarios, illustrating how Sockets-over-SNA nodes can communicate in SNA networks
- System software required to use Sockets over SNA
- System hardware required to use Sockets over SNA
- Restrictions on using Sockets over SNA
- Application program support provided by Sockets over SNA
- How Sockets over SNA and TCP/IP coexist on the same node
- How the IBM NetView* family of products can be used to manage a Sockets-over-SNA network.

What Does Sockets over SNA Do?

Sockets over SNA is one of IBM's AnyNet implementations. AnyNet software enables application programs to communicate over different transport networks and across interconnected networks. Using AnyNet, you can reduce the number of transport networks and reduce operational complexity. These benefits are gained without modification to your existing application programs or hardware.

How Sockets over SNA Works on OS/390

Sockets over SNA provides SNA transport to OpenEdition socket application programs. When an OpenEdition application program issues a socket API call, OpenEdition provides Sockets over SNA with the information necessary to generate the appropriate LU 6.2 calls to VTAM. Sockets over SNA issues these LU 6.2 calls to VTAM using APPCCMD macroinstructions. Figure 2 on page 2 illustrates the relationships between application program, Sockets over SNA, and LU 6.2 interface components on an OS/390 network node.

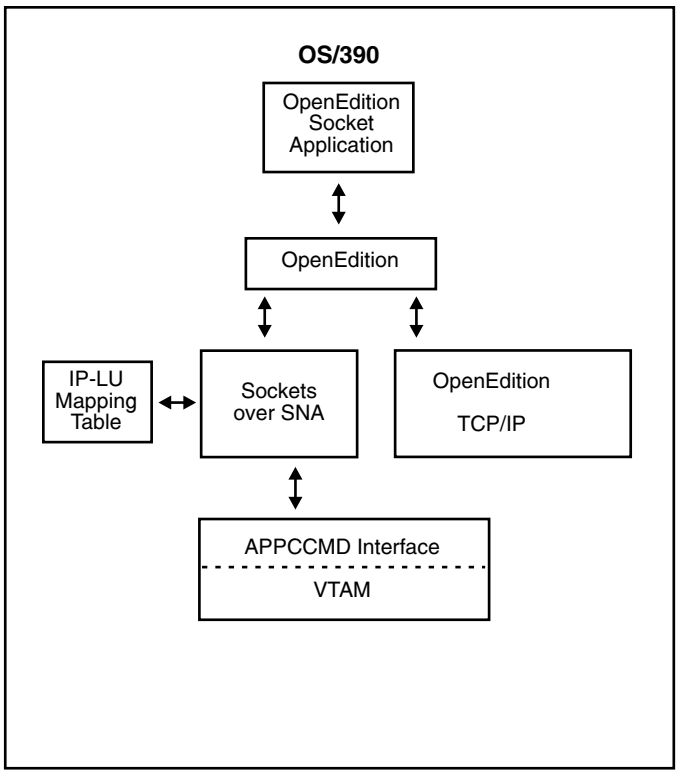


Figure 2. Structure of an AnyNet Sockets over SNA Node

Generating LU 6.2 Calls from Socket Calls

To enable sockets-formatted information to route over SNA, Sockets over SNA maps IP addresses to SNA fully qualified LU names. When an application program invokes Sockets over SNA to establish a stream connection with another application program, Sockets over SNA establishes one or two LU 6.2 conversations for the stream connection. If the nodes on which the communicating applications reside are both full-duplex enabled, only one conversation is established. If either of the communicating nodes is only half-duplex enabled, two conversations are established. The conversations are deallocated when the stream socket connection is ended. For more information about VTAM's LU 6.2 full-duplex support, refer to *OS/390 eNetwork Communications Server: SNA Programmers LU 6.2 Guide*. See "Requirements for Full-duplex Enablement" on page 6 for full-duplex requirements.

Sockets over SNA establishes one LU 6.2 conversation for all datagrams sent to a single destination. Conversations dedicated to datagram traffic are deallocated if they are unused for some specified period of time.

Mapping an IP Address to a Fully Qualified LU Name

When an application program invokes Sockets over SNA to communicate with another application program, it supplies the IP address of the destination node. Sockets over SNA must map the IP address to an SNA address to issue an appropriate LU 6.2 call. For every IP address that identifies a node, there will be a corresponding SNA fully qualified LU name.

See “Chapter 2. Planning for AnyNet Sockets over SNA” on page 7 for information about how address mapping works and for guidelines and requirements for setting up IP-LU address mapping.

Example Network Scenarios that Include Sockets over SNA

The following sample scenarios illustrate how nodes configured with Sockets over SNA can communicate in SNA networks. These samples are intended only to demonstrate how Sockets over SNA fits into SNA network scenarios; Sockets over SNA is compatible with all the system software levels listed in “System Software Required to Use AnyNet Sockets over SNA” on page 5.

Communicating from VTAM Subarea to VTAM Subarea

Figure 3 illustrates an SNA network allowing Socket Application A to communicate with Socket Application B through VTAM subarea attachments.

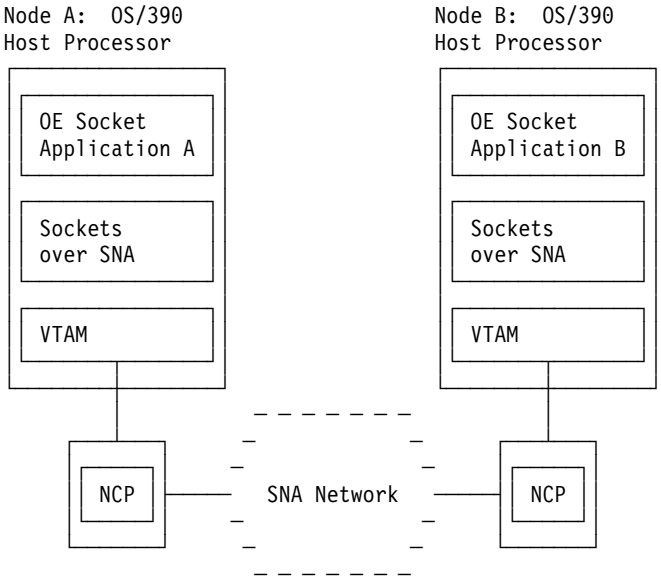


Figure 3. OpenEdition Socket Applications Communicating from VTAM Subarea to VTAM Subarea

Communicating from VTAM Subarea to OS/2 APPC through a 3172 Interconnect Controller

Figure 4 on page 4 illustrates an SNA network allowing Sockets Application A on a VTAM subarea node to communicate with Socket Application B through an IBM 3172 Interconnect Controller connected to a token ring.

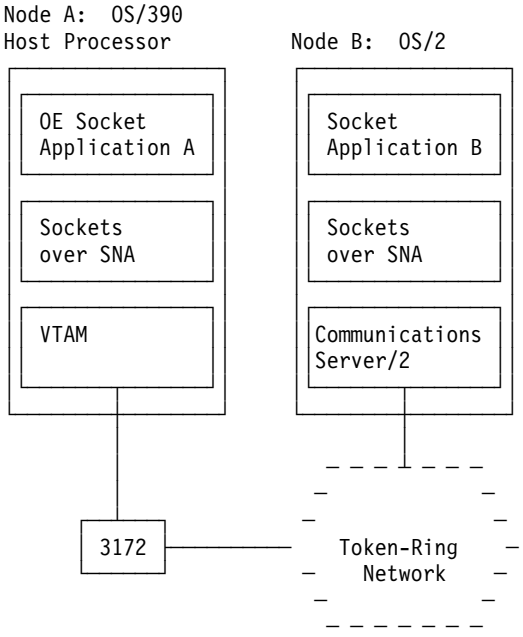


Figure 4. Socket Applications Communicating from VTAM Subarea to OS/2 APPC through a 3172 Interconnect Controller

Communicating from VTAM Subarea to OS/2 APPC through NCP/NTRI

Figure 5 on page 5 illustrates an SNA network allowing Application A to communicate with Application B through an NCP configured with NCP Token-Ring interconnection (NTRI).

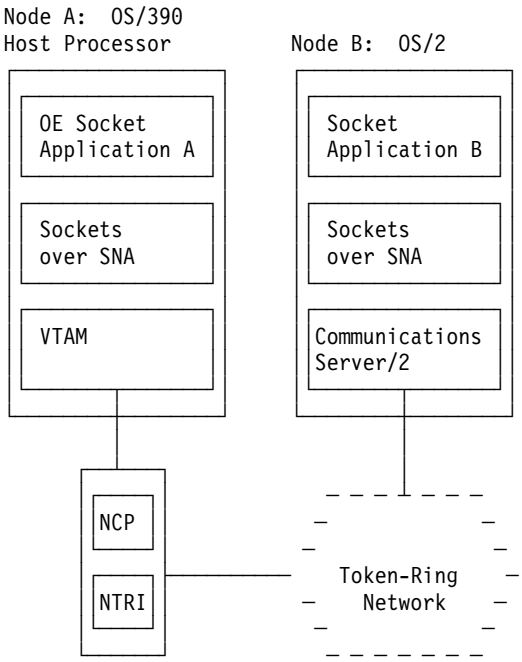


Figure 5. Socket Applications Communicating from VTAM Subarea to OS/2 APPC through NCP/NTRI

System Software Required to Use AnyNet Sockets over SNA

OS/390 Release 5 with Language Environment/370 (LE/370) is required to use AnyNet Sockets over SNA.

Applications Supported by AnyNet Sockets over SNA

Earlier releases of Sockets over SNA supported IBM TCP/IP for MVS/ESA applications, and also provided a BSD 4.3 C socket API for writing programs. These APIs are no longer supported by Sockets over SNA. Any existing applications written to these interfaces must be ported to OE.

See *OS/390 OpenEdition Programming: Assembler Callable Services Reference* or *OS/390 C/C++ Run-Time Library Reference* for information on socket calls offered by OpenEdition and for information on writing OpenEdition application programs. If you have access to the World Wide Web, you can find information on porting applications to OpenEdition at the following URL:

`http://www.s390.ibm.com/products/oe/index.html`

OpenEdition Socket Applications Supported by Sockets over SNA

Sockets over SNA supports OpenEdition socket application programs using the AF_INET address family.

Some of the OpenEdition socket applications that Sockets over SNA supports are:

- FTP Server
- Web Server

- Telnet Server
- oping
- Rlogin

Requirements for Full-duplex Enablement

For an OS/390 node to communicate in full-duplex mode, both connection partners must support full-duplex conversations. OS/390 eNetwork Communications Server and AnyNet Sockets over SNA support full-duplex conversations.

Managing Sockets over SNA

This section lists the network management tasks you can perform using the NetView program in an SNA network that includes Sockets over SNA. Because Sockets over SNA operates as an LU 6.2 application that uses SNA transport, you can use NetView and the NetView family of products to manage Sockets-over-SNA network activity. NetView Version 2 Release 1 (or later) provides network-management functions that allow you to:

- Display topology and status for SNA and TCP/IP devices which have been added to the resource object data manager (RODM)
- Conduct fault management using network alerts
- Trace session routes to identify failing nodes

Chapter 2. Planning for AnyNet Sockets over SNA

This chapter describes what you should consider before installing Sockets over SNA on OS/390. To use the information in this chapter, you should be familiar with the tasks associated with setting up a TCP/IP network and with defining SNA resources.

In a Sockets-over-SNA network, each Sockets over SNA node is identified by both an Internet Protocol (IP) address and an SNA address. Socket applications identify partner applications using IP addresses and port numbers. A socket application program uses IP addresses to tell Sockets over SNA which remote Sockets over SNA is being used by its partner application. Sockets over SNA, however, uses SNA addresses to specify source and destination locations because it operates as an APPC (LU 6.2) application program. Because a sockets application has no knowledge of SNA addressing, Sockets over SNA maps IP addresses provided by socket applications to SNA addresses in order to use the SNA transport protocol. The port number is used by the remote Sockets over SNA to identify one of its socket applications.

The SNA address refers to a network-qualified LU name.

When setting up Sockets over SNA, you must ensure that:

- An IP address is assigned to each Sockets over SNA node in the Sockets-over-SNA network
- Every IP address in the Sockets-over-SNA network is mapped to a unique SNA address (netid.luname)

Assigning IP Addresses to Sockets-over-SNA Nodes

This section describes considerations for assigning IP addresses in the Sockets-over-SNA network.

Assigning IP addresses to nodes in a Sockets-over-SNA network is the same as assigning IP addresses to nodes in a TCP/IP network. If you intend to connect the Sockets-over-SNA network to the Internet using a Sockets-over-SNA Gateway, you must first obtain one or more IP addresses. You may obtain an IP address from an Internet Service Provider (ISP) or by contacting the Network Information Center (InterNIC). The InterNIC assigns only the network portion of an IP address; your organization is responsible for assigning the host address portion.

You can access InterNIC services and information on the Internet at **http://ds.internic.net**. Select “Registration Services” to view registration options, procedures, and information.

If you do not have access to the Internet, you can contact the InterNIC at:

Network Solutions
Attn: InterNIC Registration Services
505 Huntmar Park Drive
Herndon, VA 22070
1-703-742-4777

If both TCP/IP and Sockets over SNA are installed on the same node, the node must have two IP addresses because Sockets over SNA and TCP/IP operate with

no knowledge of each other. One IP address identifies the node's connection to the TCP/IP network, the other IP address identifies the node's connection to the Sockets-over-SNA network. See "Assigning an IP Address to the Sockets-over-SNA Interface" on page 12 for information on how routing decisions are made on an OS/390 node.

If you intend to use both TCP/IP and Sockets over SNA to connect the same network of nodes, you must do either of the following:

- Create one or more different subnetworks (subnets) for all nodes using Sockets over SNA. If you want to use an existing NIC-registered IP address, you can set up a subnetwork for all Sockets-over-SNA nodes. If you have OS/2 machines in your network that use both AnyNet/2 Sockets over SNA and OS/2 TCP/IP, be aware that these products do not support variable subnetworking.
- Use different IP addresses altogether to distinguish Sockets-over-SNA nodes from TCP/IP nodes.

Notes:

1. You can only use one instance of Sockets over SNA for each OS/390 host.
2. If you are using common INET, you can use TCP/IP and Sockets over SNA together. OpenEdition routes information over either Sockets over SNA or TCP/IP as appropriate, according to the configuration of each.

   If you are not using common INET, either TCP/IP or Sockets over SNA can be the OpenEdition transport provider, but not both.

Assigning SNA Addresses to Sockets-over-SNA Nodes

This section describes considerations for assigning SNA addresses to Sockets-over-SNA nodes. Read this section and "Mapping IP Addresses to SNA Addresses" on page 10 before you start to configure Sockets over SNA.

In addition to determining which IP addresses to use, you have to determine which SNA addresses to assign to access nodes in the network. For Sockets over SNA, you need to determine the following:

- Name of the SNA network in which the Sockets-over-SNA nodes reside
- SNA LU names that identify Sockets-over-SNA nodes

Assigning SNA Network Names to Sockets-over-SNA Nodes

To ensure every SNA network name is unique, it is recommended that you register the network name with the IBM SNA Network Registry. The SNA Network Registry serves as a central data base for registered SNA network names. If your SNA network connects to another SNA network, having registered both network names ensures their ability to successfully exchange information. To register an SNA network name, contact your IBM branch office representative.

Assigning SNA LU Names to Sockets-over-SNA Nodes

Before defining LU names for the Sockets-over-SNA network, it is recommended that you establish an LU naming convention. Using a predefined naming convention for Sockets-over-SNA LUs helps you:

- Control which names are used for Sockets-over-SNA LUs and which names are used for other LUs in your SNA network.

- Analyze and resolve mapping and routing errors, should they occur.

For example, you might establish a convention that all LUs used by MPTN access nodes and Sockets over SNA begin with the letters “SX”.

The following sections describe two methods that you can use to assign LU names. Regardless of which method you use to generate LU names from IP addresses, you may need to define the LU names to VTAM. See “Defining Remote Nodes to Sockets over SNA” on page 17 for more information on defining remote nodes in a non-APPN-enabled network.

Method 1: Allow Sockets over SNA to Generate LU Names Algorithmically

This method is most effective for networks made up of more than a few nodes. Using algorithmically generated LU names simplifies the administration associated with IP-LU mapping and reduces the probability of defining erroneous addresses.

To generate LU names algorithmically, use the `ISTSKMAP` utility to do the following:

- Determine the IP address of the local node and the SNA network name and LU-name template used by all nodes in the network.
- Specify the address mask used for the Sockets-over-SNA network. Note that you do not specify an address mask with all bits set (do not use 255.255.255.255) when algorithmically defining LU names. See “Mapping IP Addresses to SNA Addresses” on page 10 for a description of how the address mask is used in IP-LU mapping.

Individual mappings for remote destination nodes do not have to be defined on the local node. Sockets over SNA generates the entire LU name using the unmasked bits of the IP address and the LU name template. For example, each node in the network can define “SX” as the LU template. For each node, Sockets over SNA generates the remaining 6 characters of the LU name using the bits of the IP address that correspond to “0” bits in the address mask.

Method 2: Define an LU Name for Each Node in the Network

This method is most effective if a very small number of nodes are using Sockets over SNA, or if you are initially setting up the network and want to test communication among a few nodes. Be aware, however, that assigning LU names to individual nodes creates considerable administrative overhead.

To define each node in the network, use the `ISTSKMAP` utility to do the following:

- Determine the IP address, SNA network name, and LU name of the local node.
- Specify an address mask of 255.255.255.255 for the local node. Defining an address mask with all bits set (255.255.255.255) creates an explicit mapping of the specified IP address to the specified SNA network name and LU name.
- At each remote node in the network, define the IP address, SNA network name, and LU name of the node. Specify an address mask of 255.255.255.255.

For example, to define a network of 20 nodes, where each node can communicate with the other 19 nodes, use the following steps:

1. At each node define the IP address of the local node.
2. Define the IP address and LU name of all 19 remote nodes.

If after initial configuration you add a node to the network, you must ensure that all nodes that may communicate with the new node locally define the IP address and LU name of the new node.

Mapping IP Addresses to SNA Addresses

This section describes how an IP address is mapped to an SNA address.

Generating an SNA Address from an IP Address

The address mapping process has two steps:

1. The first portion of the IP address is mapped to an SNA network name and an LU-name template.
2. The rest of the IP address is used to generate the remainder of the LU name not defined by the LU-name template. This step is algorithmic: Sockets over SNA generates the LU name using only the second portion of the IP address and the LU-name template.

Step 1: Mapping an IP Network ID to an SNA Network Name and LU-Name Template

In this step, Sockets over SNA uses the IP-LU mapping table to determine which SNA network name and LU-name template to use in mapping a given destination address. Each line entry in the table has the following four fields:

- IP address
- Address mask
- SNA network name
- LU-name template

The first two fields, IP address and address mask, are used by Sockets over SNA to determine whether a given destination address matches the IP-LU mapping table entry.

IP address
When Sockets over SNA determines that a destination address is reachable via the SNA network, it searches the IP-LU mapping table for an entry that matches the destination address. Sockets over SNA uses the address mask to determine which bits of the destination address should be compared with the IP address in an IP-LU mapping table entry.

Address mask
A “1” bit in the mask indicates that the corresponding bits in the destination address and the IP address in the IP-LU mapping table entry must match. Bits in the destination address that correspond to “0” bits in the address mask will be used later to generate the LU name. For example, if the address mask sets the first 24 bits to “1”, when the first 24 bits of the destination address match the first 24 bits of an IP address in the IP-LU mapping table, the remaining 8 bits are used to generate the LU name.

The last two fields of a line entry in the mapping table, SNA network name and LU-name template, are used to generate the SNA network address.

SNA network name
When Sockets over SNA selects an entry in the IP-LU mapping table, it maps the masked bits of the IP address entry to the SNA network name.

LU-name template
Sockets over SNA uses the characters in this field as the fixed positional characters of the LU name (LU-name template) corresponding to the unmasked bits of the IP address. The LU-name template enables you to define an LU-name prefix that:

- Ensures that the LU name begins with a valid character
- Distinguishes LUs used for Sockets-over-SNA communication from other LUs that communicate over an SNA network

Step 2: Generating the LU Name

The algorithmic mapping step generates the characters that are not specified in the LU-name template and combines these characters with the LU-name template to form the 8-character LU name. The portion of the destination address not masked by the address mask is used to generate the portion of the LU name you do not specify in the LU-name template.

If you specify an IP-LU entry with an address mask with all bits set (255.255.255.255), you indicate that you are not using algorithmic mapping. In this case, only the characters you specify in the LU-name template are used to generate the LU name; no additional LU characters are generated. See “Assigning SNA LU Names to Sockets-over-SNA Nodes” on page 8 for information on when to explicitly map individual IP addresses.

Example of an Entry in the IP-LU Mapping Table

Refer to the sample mapping table shown in Table 1. The entry in this table indicates that IP addresses whose upper 24 bits (255.255.255.0) have the value 128.109.130 should be mapped to the SNA network USCOMDIV. The LU name template defines SX as the first two positional characters for the LU-name prefix; the remaining six characters of the LU name are generated algorithmically from the last 8 bits of the IP address. For example, if Sockets over SNA receives the IP address 128.109.130.45 and processes this address using the entry in Table 1, Sockets over SNA produces an SNA address of USCOMDIV.SX00001D.

Table 1. Example of an Entry in the IP-LU Mapping Table

IP Address	Address Mask	SNA Network Name	LU-Name Template
128.109.130.0	255.255.255.0	USCOMDIV	SX

Note: You are responsible for setting up unique mappings; Sockets over SNA does not ensure that the LU names you define are unique to the Sockets-over-SNA network. In Table 1, you could have added:

```
128.109.140.0   255.255.255.0  USCOMDIV   SX
```

In this case, two different IP addresses, 128.109.130.123 and 128.109.140.123, would map to the same SNA network name and LU name.

How Sockets over SNA Uses IP-LU Mapping Table Entries

Each time a Sockets-over-SNA node is started, at least one entry in the IP-LU mapping table must be defined. Depending on how your network is configured, you might need to define more than one entry.

Following is an example of how Sockets over SNA would use two IP-LU mapping table entries when it is first started. Assume that the entries have been defined using the ISTSKMAP utility:

```
ISTSKMAP add 128.109.139.0 255.255.224.0 USIBMCO SX0
ISTSKMAP add 128.109.0.0   255.255.0.0   USCOMDIV SX1
```

The first entry tells Sockets over SNA to map all IP addresses that match 128.109.139.0 in the first 19 bits to the SNA network name USIBMCO; the remaining 13 bits are used to generate the LU name that begins with SX0. The second entry tells Sockets over SNA to map all IP addresses that match 128.109.0.0 in the first 16 bits to the SNA network name USCOMDIV; the remaining 16 bits are used to generate the LU name that begins with SX1.

All addresses that qualify for the first map (that is, addresses that begin with 128.109.139) also qualify for the second map (128.109). Sockets over SNA first searches the mapping table for the longest address mask, where “longest” means the mask with the most bits set. If the address supplied to Sockets over SNA does not match the address generated using the longest mask, the next longest mask is tried. The process repeats until a match is found, or until there are no more entries in the mapping table. In this case, the first entry is tried first; if Sockets over SNA receives an IP address that does not match the first entry, Sockets over SNA determines whether the address could be mapped by the second entry.

Summary of the IP-LU Mapping Process

Following is the process that maps an IP address to an SNA address:

1. Sockets over SNA receives an IP address for a destination that can be reached using the SNA network.
2. Sockets over SNA queries the IP-LU mapping table to determine the following:
   - What portion of the IP address to map to an SNA network name
   - Which SNA network name maps to the masked portion of the IP address
   - Which LU-name template is used in calculating the LU name
   - What portion of the IP address to use to calculate the remainder of the LU name
3. Using the information supplied in the IP-LU mapping table, Sockets over SNA passes the SNA network name and LU name of the destination host to VTAM.

Assigning an IP Address to the Sockets-over-SNA Interface

When Sockets over SNA is started, an IP address must be assigned to the network interface (sna0). Assigning an IP address to the sna0 interface activates the interface of the local host. VTAM and the APPL statement for Sockets over SNA must be active in order for the sna0 interface to be activated. Sockets over SNA starts monitoring sna0 for information destined for this node.

The following steps determine whether data received by Sockets over SNA is routed through the Sockets-over-SNA interface:

1. Sockets over SNA receives an IP address.
2. Sockets over SNA searches in the routing table to determine which interface is used to route data for the given IP address.
3. If the interface chosen is the Sockets-over-SNA (sna0) interface, Sockets over SNA uses the mapping information supplied during configuration to generate an

SNA address. See “Mapping IP Addresses to SNA Addresses” on page 10 for information on mapping IP addresses to SNA addresses.

4. If the interface chosen is the local loopback interface (`lo`) instead, Sockets over SNA routes the request back to itself.
5. If no interface is found, Sockets over SNA cannot route the data; the API call of the application program fails and returns completion error code ENETUNREACH or EHOSTUNREACH.

The address mask specified using `ISTSKIFC` determines which remote IP addresses can be reached directly through the `sna0` interface. (The `ISTSKRTE` utility is used to determine which remote IP address can be reached indirectly through the `sna0` interface. See “Using the ISTSKRTE Utility to Update the Local Sockets over SNA Routing Table” on page 24 for information on the `ISTSKRTE` utility.) Because Sockets over SNA must be able to map its own IP address to an LU name when the address is assigned to `sna0`, an `ISTSKMAP` utility must execute before the `ISTSKIFC` utility executes. The `ISTSKMAP` utility establishes the IP-LU address mapping for the local node so the information can be used when the `ISTSKIFC` utility assigns the address to the Sockets-over-SNA interface. See “Starting and Initializing Sockets over SNA” on page 37 for an example of the setup JCL used to start Sockets over SNA.

The mask defined using `ISTSKMAP` and the mask defined using `ISTSKIFC` perform different functions. The `ISTSKIFC` mask is used to determine which remote IP addresses can be reached directly through the `sna0` interface; the `ISTSKMAP` mask determines what portion of a given IP address is mapped to an SNA network name.

Domain Name Server

In previous releases, Sockets over SNA provided a name query function for use with a domain name server. It is no longer possible to define HOSTS, NETWORKS, PROTOCOL, RESOLV, and SERVICES files to Sockets over SNA. Instead, OpenEdition applications get this information from OpenEdition. You must first provide this information to OpenEdition. Refer to *OS/390 OpenEdition Planning* for a description of how to define these services to OpenEdition.

Defining ETC Hosts, Networks, Protocols, and Services to OpenEdition

Files formerly defined to Sockets over SNA are now defined to OpenEdition. The files that must be defined to OpenEdition are /etc/hosts, /etc/networks, /etc/protocol and /etc/services.

Although we identify these files here with HFS style names that suggest BSD formatted files, you are not restricted to HFS files nor to BSD format when defining these files to OpenEdition.

If you plan to use both Sockets over SNA and TCP/IP with OpenEdition, you should define ETC files common to Sockets over SNA and TCP/IP.

OS/390 OpenEdition Planning describes these options, as well as other options, to define ETC files to OpenEdition.

Chapter 3. Defining AnyNet Sockets over SNA

This chapter describes the procedures used to define Sockets over SNA to VTAM. Make sure that you have finished the installation procedures described in the *OS/390 MVS Program Directory* before you attempt the procedures in this chapter. The program directory describes the JCL instructions for transferring all Sockets-over-SNA files from tape to host storage.

Note: For VTAM Version 3 Release 4.2, `ISTSKMAP` was named `ISTSKNET`. If you are upgrading from the V3R4.2 release, make sure your startup procedure uses `ISTSKMAP` instead of `ISTSKNET`. See "Starting and Initializing Sockets over SNA" on page 37 for sample JCL that runs the different utilities.

Defining AnyNet Sockets over SNA to VTAM

This section describes the procedures you follow to define OS/390 nodes to use Sockets over SNA. To perform the tasks described in this section, you should be familiar with defining an application and an independent LU to VTAM, and be aware of the following:

- Sockets over SNA running locally on an OS/390 node operates as an APF-authorized VTAM LU 6.2 application.
- You must define at least one MODEENT macro entry for all sessions established for Sockets over SNA.
- All destination nodes to which connections will be established must be defined as independent LUs on the local VTAM host. The independent LUs can be statically defined in a VTAMLST member or you can allow VTAM to dynamically define the independent LUs.

Defining APPL Statements for Sockets over SNA

All rules and guidelines for defining VTAM APPL definition statements apply to defining Sockets over SNA to VTAM. Sockets over SNA operates as an LU 6.2 application. The simplest way to define the application is to use VTAM's dynamic definition of VTAM applications support.

The following is a sample source APPL definition for Sockets over SNA:

```
SX       VBUILD TYPE=APPL
SX*            APPC=YES,
               PARSESS=YES,
               DSESLIM=10,
               DMINWNL=5,
               DMINWNR=5,
               AUTOSESS=0,
               AUTH=(ACQ,PASS),
               OPERCNOS=ALLOW,
               ATNLOSS=ALL
```

The above example assumes that your LU template is ″SX″.

You may also define the application by determining the APPL name that will be used by the local Sockets over SNA application. Use the ISTSKMAP utility with the convert option to determine the application name based on the IP address of the local Sockets over SNA.

Defining

Refer to the *OS/390 eNetwork Communications Server: SNA Resource Definition Reference* for information on defining APPL statements.

Increasing the Session Limit for Sockets over SNA

This section describes how to use the DSESLIM operand to increase the upper limit for the number of sessions used by Sockets over SNA.

Each stream socket connection that is established uses two half-duplex LU 6.2 conversations (one for each direction) or one full-duplex conversation. Datagram connections use half-duplex LU 6.2 conversations as needed. Depending on the number of concurrent Sockets-over-SNA stream and datagram connections used by your installation, you might need to increase the upper limit for the number of sessions used by Sockets over SNA. The DSESLIM operand defines a session limit. See “Defining APPL Statements for Sockets over SNA” on page 15 for a sample APPL definition containing the DSESLIM operand. Refer to the *OS/390 eNetwork Communications Server: SNA Resource Definition Reference* for information on the DSESLIM operand.

Defining a MODEENT Macro Entry for Sockets over SNA

When Sockets over SNA establishes a conversation with a remote Sockets over SNA, it must supply a mode name to VTAM. VTAM uses the mode name to identify characteristics of the connection between the two Sockets-over-SNA nodes.

By default, Sockets over SNA uses a mode name of SNACKETS for all conversations it initiates. If you want all conversations initiated by a particular Sockets over SNA to use a different mode name, specify this mode name in the SXMODE_DEFAULT environment variable:

```
SXMODE_DEFAULT = DFLTMODE
```

See “Defining Sockets-over-SNA Environment Variables: the ENVVAR Data Set” on page 27 for more information on defining Sockets-over-SNA environment variables.

Defining Mode Names for Specific Ports

For stream socket connections, you can specify a mode name based on the remote port number specified by the application in its connect() API call. For example, assume you are running batch application Z whose server waits for connections on port 5678. To make all connections from Z clients running on this Sockets over SNA use mode name BATCHMOD, you would define an environment variable:

```
SXMODE5678 = BATCHMOD
```

For most applications, the SXMODE*n* entry needs to be defined on the client node because the client typically initiates the connection to the server.

You can specify as many SXMODE*n* variables as you need. You can include both an SXMODE_DEFAULT and SXMODE*n* variables in ENVVAR. Connections to any port number that does not have a corresponding SXMODE*n* variable use the mode name defined by the SXMODE_DEFAULT variable.

Conversations established for datagram sockets always use the default mode name (either SNACKETS or the value you specify for SXMODE_DEFAULT).

See “SXMODE_DEFAULT” on page 31 and “SXMODEn” on page 32 for more information on defining these environment variables.

Specifying an Alternate Logon Mode Table

Because of the way VTAM handles mode names, **all** mode names that are used by Sockets over SNA must be defined in a single logon mode table. Unless you specify otherwise, VTAM attempts to find all the modes requested by Sockets over SNA in the default logon mode table, ISTINCLM. To make VTAM search another logon mode table for the mode names, specify the name of the table using the MODETAB keyword on the APPL definition statement for Sockets over SNA.

Following is a sample logon mode table:

```
MYTABLE  MODETAB
*****************************************************************
*                                                               *
* You might recognize these as the entries for #INTER and #BATCH *
* from ISTINCLM.                                                *
*                                                               *
*****************************************************************
DFLTMODE MODEENT LOGMODE=DFLTMODE,FMPROF=X'13',TSPROF=X'07',
               ENCR=B'0000',SSNDPAC=7,RUSIZES=X'F7F7',
               SRCVPAC=7,PSNDPAC=7,APPNCOS=#INTER
BATCHMOD MODEENT LOGMODE=BATCHMOD,FMPROF=X'13',TSPROF=X'07',
               ENCR=B'0000',SSNDPAC=3,RUSIZES=X'F7F7',
               SRCVPAC=3,PSNDPAC=3,APPNCOS=#BATCH
         MODEEND
```

See the *OS/390 eNetwork Communications Server: SNA Resource Definition Reference* for complete instructions on coding and using your own logon mode table.

Defining Remote Nodes to Sockets over SNA

Sockets over SNA can communicate with other VTAM hosts and workstations that implement Sockets over SNA. Remote workstations typically have to be defined as independent LUs (ILU) in order for the local Sockets over SNA to establish sessions with them. A remote ILU is defined to VTAM as a cross-domain resource (CDRSC). The CDRSC may be predefined or you can allow VTAM to dynamically create the CDRSC. The session path may be any type supported by the remote node including subarea, APPN or LEN connections. Refer to the *OS/390 eNetwork Communications Server: SNA Network Implementation* for information on defining independent LUs as CDRSC

If a remote socket application initiates communication with a socket application in a VTAM subarea, VTAM can dynamically define the LU associated with the remote Sockets over SNA. Refer to the *OS/390 eNetwork Communications Server: SNA Network Implementation* for information on dynamically defining remote LUs and for examples of CDRSC definition statements.

If you choose to predefine ILUs or LUs, you have to determine which LU names are generated from the IP addresses you are using. Use the following steps to determine and define the LU names:

- List the IP addresses of all nodes that have to be defined to the local VTAM.
- Use the convert option of the `ISTSKMAP` utility and specify a range of IP addresses that have to be mapped to LU names.

- If there are a large number of nodes involved, redirect the output from the ISTSKMAP convert command to a file.

  The following example shows how ISTSKMAP can be called under TSO to produce LU names corresponding to the range of IP addresses specified on the convert option. The ISTSKMAP utility resides in the ISTSKMAP member of your VTAMLIB, for example, SYS1.VTAMLIB. Output is redirected to a data set called USERN.OUTPUT.

  ```
  ===> call 'sys1.vtamlib(istskmap)' 'convert 128.109.140.1
  128.109.140.5 0xfffffc00 samp >'usern.output'
  ```

  The previous call produces the following output:

  ```
  > ISTSKMAP convert 128.109.140.1 128.109.140.5 0xfffffc00 samp
  128.109.140.1 SAMP0001
  128.109.140.2 SAMP0002
  128.109.140.3 SAMP0003
  128.109.140.4 SAMP0004
  128.109.140.5 SAMP0005
  ```

- Using the listing of LU names from the ISTSKMAP convert operation, define to VTAM the appropriate independent LU statements for each remote Sockets over SNA to which a conversation is initiated from the local Sockets over SNA.

The ISTSKMAP utility is an OpenEdition application; refer to the *OS/390 Language Environment Programming Reference* for information on running OpenEdition applications and on redirecting output under OS/390. See “Using the ISTSKMAP Utility to Establish, Update, and Query the Mapping Table” for directions on using the ISTSKMAP convert option.

Using the ISTSKMAP Utility to Establish, Update, and Query the Mapping Table

This section describes:

- How to use the ISTSKMAP utility to add, convert, delete, update, and query entries in the IP-LU mapping table
- How to use the ISTSKMAP convert option to generate a listing of LU names corresponding to a range of IP addresses

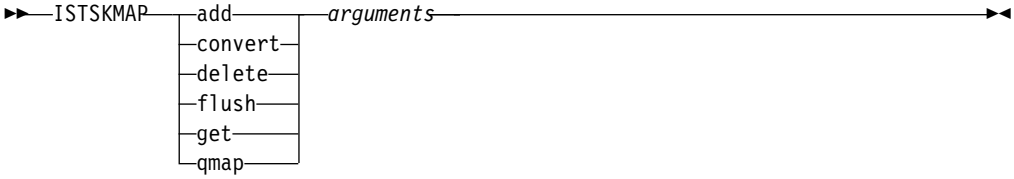
The ISTSKMAP utility can be run either interactively (for example, using TSO), or using batch (for example, JCL). To run ISTSKMAP interactively from TSO, the OpenEdition shell, or from batch, your logon procedure must be set up to run authorized LE/370* application programs. Refer to your *OS/390 Language Environment Programming Reference* for information on setting up your logon procedure to run LE/370 application programs.

Following is an example of how to run ISTSKMAP in TSO with the interface and IP address arguments:

```
call 'sys1.vtamlib(istskmap)' 'add 128.109.140.0 255.255.224.0 USIBMNR SX'
```

Syntax of the ISTSKMAP Utility

The syntax for the ISTSKMAP command follows. See “Appendix A. Syntax Conventions” on page 49 for information on how to interpret the syntax diagrams for the utilities described in this book.



add
adds a new line entry to the IP-LU mapping table. To replace an existing entry with a new entry that has the same IP address, delete the existing entry first, and then add the new entry.

convert
displays the LU name that is generated from the specified IP address(es), network mask, and LU-name template. The **convert** operand does not use the IP-LU mapping table.

See “Using the Convert Option to Generate LU Names” on page 21 for information on using the convert option.

delete
removes the specified entry from the IP-LU mapping table.

flush
removes all entries from the IP-LU mapping table. **CAUTION:**
Be sure you want to erase all entries in the table before you issue this command.

get
displays the contents of the IP-LU mapping table.

qmap
displays the current LU-name mapping for the specified IP address. The **qmap** operand accesses the IP-LU mapping table to display the LU name, but does not make any changes to the table.

arguments
select arguments depending on the operand you use.

add

ip_address
addr_mask
sna_netname
lu_template

convert

ip_address
addr_mask
lu_template

convert

start_ip
end_ip
addr_mask
lu_template

flush none

qmap *ip_address*

get none

Following is a description of each argument:

ip_address
specifies the IP address. Use either hexadecimal notation or dotted-decimal notation.

Hexadecimal notation is in the form 0x*aabbccdd*, where:

- 0x is a required prefix indicating that the value is in hexadecimal format
- Each portion of the address (*aa*, *bb*, *cc*, or *dd*)
  - Is a two-digit hexadecimal value ranging from 00 to FF
  - Represents 8 bits of a 32-bit IP address

Dotted-decimal notation is in the form *a.b.c.d*, where each portion of the address (*a*, *b*, *c*, or *d*):

- Is a decimal value ranging from 0 to 255
- Is delimited by a period
- Represents 8 bits of a 32-bit IP address

Specify all four 8-bit sections. For example, these are valid address entries:

190.12.0.1

50.218.29.0

129.67.0.0

However, the value 201.0 would not be valid because it does not consist of four sections.

If you are mapping an IP address for a single host to one SNA network name and LU name, specify the entire IP address. Otherwise, specify only the IP network ID and use a host ID of 0.

start_ip
specifies the beginning IP address for a range of addresses. Use beginning and ending arguments when you want to generate corresponding LU names for a range of IP addresses. All rules listed for *ip_address* apply.

end_ip
specifies the ending IP address for a range of addresses. Use beginning and ending arguments when you want to generate corresponding LU names for a range IP addresses. All rules listed for *ip_address* apply.

addr_mask
specifies which bits in a destination IP address are compared to the IP address in an IP-LU mapping table entry. The unmasked bits are used to generate the LU name. Use either hexadecimal notation or dotted-decimal notation. When using hexadecimal notation, precede the value with 0x (for example, 0xFFFFFF00).

If you are mapping an IP address for a single host to one SNA network name and LU name, mask the entire address with either 0xFFFFFFFF or 255.255.255.255.

sna_netname
specifies the SNA network name. The same restrictions that apply to naming an SNA network name apply here. Specify from 1 to 8 characters.

lu_template
specifies the LU-name template. The same restrictions that apply to naming an SNA LU apply to an LU-name template.

Note: The character you specify in the first character position has to be a valid LU-name character to generate a valid SNA network address. Valid first characters for LU names are A–Z, @, #, and $.

The number of characters you can specify ranges from 1 to 8, depending on the size of the mask. Table 2 on page 21 describes the range of characters you can specify for the LU template.

The `ISTSKMAP` utility reports an error if you specify more characters in the LU template than are allowed, or if the LU template does not begin with a valid character. To define a specific LU name, specify a 32-bit address mask (for example, 0xFFFFFFFF).

Table 2. Limitations for Defining LU Templates

Number of Bits in the Address Mask:	Range of Address Mask:	Size of LU template:
8–11 (includes class A addresses)	0xFF000000–0xFFE00000	1–3 characters
12–16 (includes class B addresses)	0xFFF00000–0xFFFF0000	1–4 characters
17–21	0xFFFF8000–0xFFFFF800	1–5 characters
22–26 (includes class C addresses)	0xFFFFFC00–0xFFFFFFC0	1–6 characters
27–31	0xFFFFFFE0–0xFFFFFFFE	1–7 characters
32	0xFFFFFFFF	1–8 characters

If you specify all 8 characters, you effectively define a specific LU name and SNA network name corresponding to the IP address. You must also specify a complete IP address and an address mask of either 0xFFFFFFFF or 255.255.255.255.

Always use dots (periods) to indicate unspecified characters. Characters do not have to be contiguous; for example, the template N..R.P is valid. You do not have to indicate trailing character positions. For example, if you specify SX as the first two characters in the template, no periods are required. If you specify a template with characters that are positioned at the end of the LU name, use periods to indicate all positions up to the specified characters (for example, “N.....RP”).

Using the Convert Option to Generate LU Names

The `ISTSKMAP` convert option is useful for defining SNA destination LUs on low-entry networking (LEN) nodes. Your network might contain LEN nodes that must be locally defined to VTAM. If so, first determine the range of IP addresses you want to use to identify the remote nodes, then use `convert` to generate a list of LU names corresponding to the IP addresses.

Following is an example of how to generate the corresponding LU name for one IP address:

```
ISTSKMAP convert 128.109.139.4 255.255.0.0 SX
```

The previous command returns:

```
128.109.139.4 maps to LU name SX0012R4
```

Following is an example of how to generate the corresponding LU names for a given range of IP addresses:

```
ISTSKMAP convert 128.109.139.4 128.109.139.7 255.255.0.0 SX
```

The previous command returns:

```
128.109.139.4 SX0012R4
128.109.139.5 SX0012R5
128.109.139.6 SX0012R6
128.109.139.7 SX0012R7
```

Using the ISTSKIFC Utility to Define an SNA Network Interface for Sockets over SNA

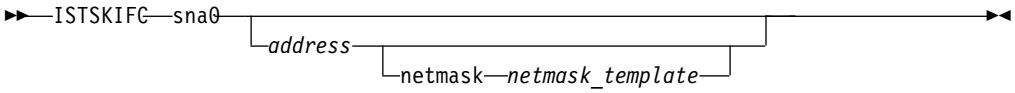
This section describes how to use the ISTSKIFC utility to assign an IP address to the SNA network interface used by Sockets over SNA. The name of the interface to the SNA network for Sockets over SNA is hard-coded as the value sna0. An IP address must be assigned to sna0 before applications try to establish connections.

The ISTSKIFC utility can be run either interactively (for example, using TSO), or using batch (for example, JCL). To run ISTSKIFC interactively from TSO, the OpenEdition shell, or from batch, your logon procedure must be set up to run authorized LE/370* application programs. Refer to your *OS/390 Language Environment Programming Reference* for information on setting up your logon procedure to run LE/370 application programs.

Following is an example of how to run ISTSKIFC in TSO with the interface and IP address arguments:

```
call 'sys1.vtamlib(istskifc)' 'sna0 128.109.140.6'
```

The format of the ISTSKIFC utility is:



Note: The ISTSKIFC utility supports more options and operands than those described here. The only options described here are those that apply specifically to Sockets over SNA.

Following is a description of each operand.

sna0
specifies an interface to the SNA network.

If you specify only sna0, ISTSKIFC displays the status of the sna0 interface. Status includes whether the interface is active (up) and the address assigned to it.

address
specifies the IP address to assign to the interface. Specify either a host name or an IP address:

Host name
The `ISTSKIFC` utility queries the host file and resolves the name into the corresponding IP address.

IP address
Use either hexadecimal notation or dotted-decimal notation. Hexadecimal notation is in the form 0x*aabbccdd*, where:

- 0x is a required prefix indicating that the value is in hexadecimal format.
- Each portion of the address (*aa*, *bb*, *cc*, or *dd*)
  - Is a two-digit hexadecimal value ranging from 00 to FF
  - Represents 8 bits of a 32-bit IP address

Dotted-decimal notation is in the form *a.b.c.d*, where each portion of the address (*a*, *b*, *c*, or *d*):

- Is a decimal value ranging from 0 to 255
- Is delimited by a period
- Represents 8 bits of a 32-bit IP address.

Note: Do not use leading zeros to specify values in dotted-decimal notation, for example, 029.67.1.1. If you specify an integer value using one or more leading zeros, the value is interpreted as an octal value instead of a decimal value.

netmask *netmask_template*
The **netmask** keyword with the *netmask_template* specifies the number of bits in the IP address that will be used to define the network ID. This operand pair is optional. If you assign an IP address to the `sna0` interface, and you do not specify a netmask, Sockets over SNA determines the network ID portion of the address by reading the first three (uppermost) bits. The settings of the first 3 bits indicate the classification of the address.

Table 3 shows, in decimal notation, the address ranges corresponding to address classifications A, B, and C. For a given dotted-decimal IP address expressed in the form *aaa.bbb.ccc.ddd*, the range of values relate to the portion of the address represented by *aaa*.

Table 3. Determining the Classification of an IP Address

This range of values for *aaa*:	**Indicates this address class:**	**And this netmask:**
1–127	Class A	255.0.0.0
128–191	Class B	255.255.0.0
192–255	Class C	255.255.255.0

Use either hexadecimal notation or dotted-decimal notation. The same rules for defining the IP address apply to defining the network mask. When using hexadecimal notation, precede the value with 0x (for example, 0xFFFFFF00).

Following are some examples using `ISTSKIFC`:

```
ISTSKIFC sna0 xipe
ISTSKIFC sna0 128.109.140.1
ISTSKIFC sna0 128.109.140.1 netmask 255.255.0.0
```

Using the ISTSKRTE Utility to Update the Local Sockets over SNA Routing Table

This section describes how to use the ISTSKRTE utility to add and delete entries in the local routing table used by Sockets over SNA. If you are using the AnyNet/2 Sockets over SNA Gateway to route information to a native TCP/IP network, use the ISTSKRTE utility on OS/390 to establish routes to all nodes that can be reached through the Sockets Gateway. (Refer to *IBM Communications Server for OS/2 Warp: Guide to AnyNet Sockets over SNA* for information on using Sockets Gateway.) You can also use the ISTSKRTE utility to delete routing table entries.

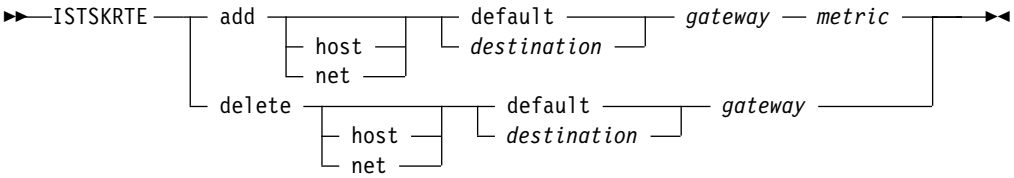
The ISTSKNST utility is used to display the contents of the Sockets-over-SNA routing table. See “Using the ISTSKNST Utility to Display Sockets-over-SNA Routing Tables” on page 43 for information on the ISTSKNST utility.

The ISTSKRTE utility can be run either interactively (for example, using TSO), or using batch (for example, JCL). To run ISTSKRTE interactively from TSO, the OpenEdition shell, or from batch, your logon procedure must be set up to run authorized LE/370* application programs. Refer to your *OS/390 Language Environment Programming Guide* for information on setting up your logon procedure to run LE/370 application programs.

Following is an example of how to run ISTSKRTE in TSO with the -? for a quick view of the usage syntax:

```
call 'sys1.vtamlib(istskrte)' '-?'
```

The syntax for the ISTSKRTE utility follows:



Following is a description of each operand:

(-? or no operand)
If you specify the ISTSKRTE utility with a question mark, unrecognizable operand, or no operand, ISTSKRTE displays the following usage syntax:

```
Usage:
ISTSKRTE: [-?] (add | delete) (net | host) (<destination> | default)
       <gateway> [<metric>]

Where:
  -?            Displays this message.
  add           To add a route.
  delete        To delete a route.
  net           To add or delete a network.
  host          To add or delete a host.
  destination   Is the destination host or network.
  default       All destinations not defined with another routing
```

```
                table entry.
  gateway       Is the next-hop in the path to the destination.
  metric        Number of hops to destination.  Metric is
                required for add commands.

Example:  ISTSKRTE add net 129.34.10.0 129.34.10.60 1
```

add
Adds a route entry to the local Sockets-over-SNA routing table. If you do not specify either the `host` or `net` keyword, `host` is assumed.

If you specify `host`, `add` adds an entry for the node specified as *destination*.

If you specify `net`, `add` adds an entry for the network specified as *destination*.

delete
Deletes the entry specified as *destination* from the local Sockets-over-SNA routing table.

host
Causes the specified *destination* to be interpreted as the address of a single node.

net
Causes the specified *destination* to be interpreted as a network address.

destination
Destination host or network for which you are defining a route entry. Specify either an IP address in dotted-decimal or hexadecimal notation, or a symbolic name representing an IP address. Hexadecimal notation is in the form 0x*aabbccdd*, where:

- 0x is a required prefix indicating that the value is in hexadecimal format
- Each portion of the address (*aa*, *bb*, *cc*, or *dd*)
  - Is a two-digit hexadecimal value ranging from 00 to FF
  - Represents 8 bits of a 32-bit IP address

Dotted-decimal notation is in the form *a.b.c.d*, where each portion of the address (*a*, *b*, *c*, or *d*):

- Is a decimal value ranging from 0 to 255
- Is delimited by a period
- Represents 8 bits of a 32-bit IP address

Note: Do not use leading zeros to specify values in dotted-decimal notation, for example, 029.67.1.1. If you specify an integer value using one or more leading zeros, the value is interpreted as an octal value instead of a decimal value.

If you specify a symbolic name for *destination*, the name is first looked up using gethostbyname(). If this lookup fails, getnetbyname() is then used to obtain the corresponding IP address.

If *destination* can be reached directly through the `sna0` interface (with no intermediate gateways or routers):

- The address of `sna0` should be specified as *gateway*.
- The value specified as `metric` must be zero (0), indicating that a local interface is used to transmit the data.

The optional keyword `default` can be used as the *destination* parameter. Specifying `default` causes the *gateway* parameter to be interpreted as the default exit point from the local network; any IP address that does not match any other entry in the routing table is routed using the `default` entry.

gateway
Next-hop IP address to which information is routed.

Specify an IP address in dotted-decimal or hexadecimal notation. See the description under *destination* for the syntax restrictions.

The specified IP address must reside in the same subnet as the subnet defined for `sna0` using the `ISTSKRTE` utility. Otherwise, Sockets over SNA returns ENETUNREACH on the `ISTSKRTE` utility.

metric
Integer representing the number of nodes (next-hop gateways) through which information is routed before the information reaches the destination network. For example, if *metric* is set to 2, the information is routed through 2 gateways before it reaches its destination node.

Set *metric* to the value one (1) when routing information to a gateway that can be reached directly through the `sna0` interface.

Chapter 4. Configuring, Customizing, and Tuning AnyNet Sockets over SNA

This chapter describes how to:

- Configure environment variables for Sockets over SNA
- Substitute user-defined message text for fixed-message text of Sockets-over-SNA messages.

Defining Sockets-over-SNA Environment Variables: the ENVVAR Data Set

Sockets over SNA uses default values for data set names, timer intervals, and thresholds. This section describes the environment variables you can set to override these defaults. The environment variables may be defined in an EBCDIC data set. The data set is pointed to by a ENVVAR DD in the JCL used to start Sockets over SNA. The variables are formatted as follows:

```
environment_variable=value
```

where:

environment_variable
: name of the environment variable for which you are setting a value

value
: value you are setting for *environment_variable.*

Following is an example of an ENVVAR entry in the JCL startup procedure for Sockets over SNA. This entry is included in the JCL procedure in “Starting and Initializing Sockets over SNA” on page 37.

```
//ENVVAR   DD DSN=USER1.ENVVAR,DISP=SHR
```

Notes:

1. The value you specify for each of the environment variables is case-sensitive and used as it is entered; it is not converted to uppercase.
2. All of the environment variables have default values.
3. Any environment variable can be left out of ENVVAR.
4. ENVVAR does not have to be defined at all if you want to use only default values.
5. The ENVVAR data set may contain settings for environment variable names that are not defined or supported by Sockets over SNA; these settings are ignored.
6. You do not have to define the environment variables in any particular order.

When you start Sockets over SNA, the ENVVAR data set is read for any values to use in place of default values. See “Determining Errors During Sockets-over-SNA Initialization and Operation” on page 41 for information on determining if the ENVVAR environment variables are set properly.

The following sections describe the Sockets-over-SNA environment variables you can specify in ENVVAR.

CONNECT_TIMEOUT

Default
120

Use this environment variable to define the number of seconds Sockets over SNA will wait to receive a network response to a stream socket connect () request. If an application issues a connect() for a stream socket, and Sockets over SNA does not receive a network response within CONNECT_TIMEOUT seconds, the connect() will fail with an errno value of ETIMEDOUT.

DG_CONV_IDLE_TIMEOUT

Default
5 minutes

Range
1—10080

Use this environment variable to control the time, in minutes, a datagram conversation must be unused before it is deallocated and closed. If you specify a value that is not valid, a message is issued and the default value is used.

The datagram idle timeout interval enables you to balance between using system resources to maintain an existing datagram conversation and taking longer to reestablish a new datagram conversation. For example, if you set this value low, datagram conversations end faster, but it takes longer to send the next datagram.

DG_SEGMENTATION

Default
MPTN

Alternate
LL

If a datagram is too large to be sent in one piece, the DG_SEGMENTATION environment variable determines what method is used to segment it. The MAX_SENDBUF environment variable determines how large a datagram can be before it is segmented.

Using the Default Value: MPTN

The default segmentation method, MPTN, causes a separate MPTN header to be built for each segment of the datagram. If you are communicating with AnyNet/2 Version 1.0 Sockets over SNA or with AnyNet/2 Sockets over SNA Gateway Version 1.0, you **must** use MPTN segmentation.

Using the Alternate Value: LL

Specifying LL causes a single MPTN header to be sent for the datagram. APPC's native segmentation method, LL, is used to split the datagram into smaller segments. Depending on characteristics of the application program and your network, LL segmentation may be more efficient.

HOSTNAME

Use this environment variable to specify the host name of the local machine. This name is returned by the gethostname() call. If you do not use this environment variable to specify a local hostname, gethostname() returns the string “localhost”.

LEARNMAP = NO|YES

Default
YES

When LEARNMAP is YES, an OS/390 host will deduce the IP-LU mapping for all inbound connections and datagrams, and update the IP-LU table if necessary. Therefore, if an OS/390 host is a server, the IP-LU mapping table entries for all clients that initiate connections to the host need not be configured explicitly into the IP-LU table using ISTSKMAP. Of course, each client needs to configure an IP-LU mapping for the OS/390 host server. Furthermore, an IP-LU mapping must be configured on the OS/390 host for any client the OS/390 host initiates traffic to. The host cannot deduce the mapping if it has no prior inbound traffic from the client.

You must configure IP-LU mappings for gateway nodes. The host will not change an IP-LU mapping for a gateway node.

When the OS/390 host updates the IP-LU table with a new mapping, the IP-LU table becomes larger. The OS/390 host will not add an entry to the table if it is already there, or if the mapping can be generated algorithmically from one of the templates in the IP-LU mapping table. The larger the table, the slower the IP-LU look-ups, so you may find it more efficient to configure your table with IP-LU map templates that generate most or all the IP-LU mappings for the clients you expect your host to serve.

When LEARNMAP is NO, an IP-LU mapping must be configured for all nodes the OS/390 host communicates with. This is the behavior prior to eNetwork Communications Server for OS/390 V2R5.

Note: When LEARNMAP is NO, only those nodes configured into the OS/390 host can communicate with that host. When LEARNMAP is YES, any MPTN access node can communicate with the host.

MAX_CONCURRENT_SOCKET_CALLS

Default
100

Minimum allowed value
10

Maximum allowed value
1500

This environment variable controls the number of socket API calls Sockets over SNA can handle at once.

This is not the same as the maximum number of socket calls for OpenEdition, because OpenEdition will route some calls to other transport providers. Only socket API calls handled by Sockets over SNA count towards this total.

If an application attempts more than MAX_CONCURRENT_SOCKET_CALLS socket calls at once, the excess calls will fail with an errno value of EAGAIN.

Each concurrent socket call requires Sockets over SNA to allocate storage. Some socket calls require Sockets over SNA to allocate more storage than others, and increase storage allocated to Sockets over SNA when MAX_CONCURRENT_SOCKET_CALLS are being processed. The higher you set MAX_CONCURRENT_SOCKET_CALLS, the more storage you will need to provide to your Sockets over SNA job to allow it to attain MAX_CONCURRENT_SOCKET_CALLS calls.

MAX_DG_CONVS

Default
10

Range
1—32768

This environment variable controls the number of outgoing datagram conversations Sockets over SNA allows to be open simultaneously. If you specify a value that is not valid, a message is issued and the default value is used.

Sockets over SNA checks every 5 seconds to ensure that the number of datagram conversations does not exceed the specified value. If the number of datagram conversations exceeds the specified value, the conversations are deallocated. When setting this environment variable, consider the trade-off between using system resources to maintain idle conversations and using system resources to reallocate conversations.

MAX_SENDBUF

Default
8300 bytes

Range
1000—32767

Specifies the maximum number of bytes, including MPTN headers generated by Sockets over SNA, that Sockets over SNA sends at a time.

If the size of the data plus the MPTN header is larger than the value specified as MAX_SENDBUF,

- For stream connections, Sockets over SNA splits the data and uses multiple sends.
- For datagram connections, Sockets over SNA segments the data using the value specified as the DG_SEGMENTATION parameter.

Using the Default Value: 8300

If you are communicating with AnyNet/2 Version 1.0 Sockets over SNA or with AnyNet/2 Sockets over SNA Gateway Version 1.0, you **must** specify a value between 1000 and 8300.

Using an Alternate Value

If a Sockets-over-SNA application program sends data in portions that exceed the default (or specified) value, increasing this environment variable to a value that eliminates the need to segment the data could improve system throughput. It is unlikely that you would ever need to lower the buffer size to less than 8300.

OE_INADDRANY_COUNT

Default
None

Range
1—4000

This environment variable specifies the number of ports that will be be reserved for OpenEdition INADDR_ANY binds starting with the port number specified with the OE_INADDRANY_PORT environment variable. Use this environment variable only if you are using OpenEdition common INET. The values should match the value of INADDRYANY_COUNT in the BPXPRMxx parmlib member.

If you code OE_INADDRANY_COUNT, you must also code OE_INADDRANY_PORT. Furthermore, if another product is also a transport provider to OpenEdition, that product must reserve the same ports. Refer to each product's documentation for information on reserving ports for INADDR_ANY binds.

OE_INADDRANY_PORT

Default
None

Range
1024—65534

This environment variable specifies the starting port number for the range of port numbers that will be reserved by the system for exclusive use on INADDR_ANY bind() requests received from OpenEdition. Use this environment variable only if you are using common INET. The values should match the value of INADDRYANY_PORT in the BPXPRMxx parmlib member.

If you code OE_INADDRANY_PORT, you must also code OE_INADDRANY_COUNT. If another product is also a transport provider to OpenEdition, that product must reserve the same ports. Refer to each product's documentation for information on reserving ports for INADDR_ANY binds.

SXMODE_DEFAULT

Default
SNACKETS

Use this environment variable to override the default mode name (SNACKETS) used by Sockets over SNA. The mode name you specify becomes the default for all ports established for Sockets-over-SNA communication.

See "Defining a MODEENT Macro Entry for Sockets over SNA" on page 16 for more information on specifying a mode entry for all Sockets-over-SNA application programs.

Configuring

SXMODEn

Use this environment variable to specify a mode for stream connections over an individual port. Note that ports using datagram connections cannot use a mode value other than the default mode in effect for all ports. The name you specify overrides the default mode name (SNACKETS) applying to all ports. The last letter of this environment variable, *n*, is a positional character representing the port value that you append to the name. Following are examples of how you would use SXMODE*n* to specify mode SNACK23 for port 23 and mode SNACKSPC for port 1022. Port values in the following examples are in decimal format with no leading zeros.

```
SXMODE23=SNACK23
SXMODE1022=SNACKSPC
```

See “Defining a MODEENT Macro Entry for Sockets over SNA” on page 16 for more information on specifying a mode entry for a specific port.

TRACE_OPTION

Default

off all

This environment variable traces options you can specify during initialization. Besides the default, the other possible values are any parameters passed to ISTSKTRC other than reset, such as “on all” or “on sic”.

Routing ENVVAR Messages

ENVVAR messages generated during startup are routed to the standard output file. If you want to route ENVVAR-setting messages to a file other than the standard output file, define a file with a DD name of LOGMSGS in the job (or procedure) used to start Sockets over SNA. Following is an example of a JCL entry to reroute messages:

```
//LOGMSGS DD SYSOUT=*
```

Customizing Message Text for Sockets-over-SNA Messages

You can alter the fixed message text of Sockets-over-SNA messages according to requirements of your installation. Using the MVS message service is the best way to customize messages. However, if you prefer to change Sockets-over-SNA message text yourself, edit the source data set, ISTSKDMM in SYS1.SAMPLIB, and follow the instructions in the prologue. To make your changes take effect, compile the new source data set and link edit to the new load module. Make sure you back up the source data set and load module for ISTSKDMM before you alter the text in the source data set.

Following is sample code that compiles and links ISTSKDMM:

```
//ISTSKDMM JOB (43A36A0Z,1125,500,DLU,00,N),'USER01',
//  USER=*,PASSWORD=*,
//  MSGLEVEL=(1,1),MSGCLASS=5
//CLRPROC  JCLLIB ORDER=(MVSCLR.RALL250.DATA)
//*******************************************************************
//*                                                                 *
//* LICENSED MATERIALS - PROPERTY OF IBM                            *
//*                                                                 *
//* 5655-121                                                        *
```

```
//* (C) COPYRIGHT IBM CORP. 1988, 1995 ALL RIGHTS RESERVED          *
//*                                                                 *
//* US GOVERNMENT USERS RESTRICTED RIGHTS - USE,                    *
//* DUPLICATION OR DISCLOSURE RESTRICTED BY GSA ADP                 *
//* SCHEDULE CONTRACT WITH IBM CORP                                 *
//*                                                                 *
//*******************************************************************
//*                                                                 *
//*  COMPILE A C PROGRAM                                            *
//*                                                                 *
//*  C/C++ FOR MVS/ESA                                              *
//*                                                                 *
//*                                                                 *
//*******************************************************************
//*
//EDCC  PROC  CREGSIZ='4M',             < COMPILER REGION SIZE
//  CRUN=,                              < COMPILER RUNTIME OPTIONS
//  CPARM=,                             < COMPILER OPTIONS
//  CPARM2=,                            < COMPILER OPTIONS
//  CPARM3=,                            < COMPILER OPTIONS
//  LIBPRFX='CEE.V1R5M0',               < PREFIX FOR LIBRARY DSN
//  LNGPRFX='CPC.CPLUS.V3R2M0',         < PREFIX FOR LANGUAGE DSN
//  CLANG='EDCMSGE', < NOT USED IN THIS RELEASE. KEPT FOR COMPATIBILIT
//  DCB80='(RECFM=FB,LRECL=80,BLKSIZE=3200)',       FOR LRECL 80
//  DCB3200='(RECFM=FB,LRECL=3200,BLKSIZE=12800)'   FOR LRECL 3200
//*
//*------------------------------------------------------------------
//*  COMPILE STEP:
//*------------------------------------------------------------------
//COMPILE EXEC PGM=CBC320PP,REGION=&CREGSIZ,
//    PARM=('&CRUN/&CPARM &CPARM2 &CPARM3')
//STEPLIB  DD  DSNAME=&LIBPRFX..SCEERUN,DISP=SHR
//         DD  DSNAME=&LNGPRFX..SCBC3CMP,DISP=SHR
//SYSMSGS  DD  DUMMY,DSN=&LNGPRFX..SCBC3MSG(&CLANG),DISP=SHR
//SYSIN    DD  DSNAME=SYS1.SAMPLIB,DISP=SHR
//SYSLIB   DD  DSNAME=SYS1.CEE.SCEEH.H,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSOUT   DD  SYSOUT=*
//SYSCPRT  DD  SYSOUT=*
//SYSUT1   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB80
//SYSUT4   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB80
//SYSUT5   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB3200
//SYSUT6   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB3200
//SYSUT7   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB3200
//SYSUT8   DD  UNIT=VIO,SPACE=(32000,(30,30)),DCB=&DCB3200
//SYSUT9   DD  UNIT=VIO,SPACE=(32000,(30,30)),
//             DCB=(RECFM=VB,LRECL=137,BLKSIZE=882)
//SYSUT10  DD  SYSOUT=*
//SYSUT14  DD  UNIT=VIO,SPACE=(32000,(30,30)),
//             DCB=(RECFM=FB,LRECL=3200,BLKSIZE=12800)
//*
//         PEND
//CCOMP  EXEC EDCC,
//  PARM=('LIST,CSE,SO,OPT(1),DEF(MVS),SHOWINC',
//        'SE(''SYS2.LE370.V1R8M0.SCEEH.+'')')
//SYSLIN  DD  DSN=USER.MESSAGES.OBJ(ISTSKDMM),DISP=SHR
//
//
//* link edit
//
//ISTSKDMM EXEC PGM=IEWL,
//  PARM='DCBS,LET,LIST,MAP,REUS,RMODE=ANY,XREF'
//************************************
//SYSPRINT DD SYSOUT=*
//INCLCUT1 DD UNIT=VIO,SPACE=(1024,(500,200))
//SYSUT1   DD UNIT=VIO,SPACE=(1024,(500,200))
//LIBRARY   DD DSN=SYS1.VTAMLIB,DISP=SHR
```

```
//SYSLIB    DD DSN=LE370.V1R8M0.SCEELKED,DISP=SHR,VOL=SER=PGMPD3,
//          UNIT=3390
//          DD DSN=LE370.V1R8M0.SCEESPC,DISP=SHR,VOL=SER=PGMPD3,
//          UNIT=3390
//SYSLMOD   DD DSN=USER.VTAMLIB,DISP=SHR
//SYSLIN    DD DSN=USER.MESSAGES.OBJ(ISTSKDMM),DISP=SHR
//          DD DDNAME=MESSAGE
//MESSAGE   DD *
 SETCODE  AC(1)
 ORDER    MSGS
 ENTRY    MSGS
 NAME ISTSKDMM(R)
/*
```

Refer to the *OS/390 Language Environment Programming Guide* for more information on compiling and linking C programs.

Defining the Sockets-over-SNA Transport Driver to OpenEdition

To define Sockets-over-SNA transport driver to OpenEdition:

- The initialization routine entry point ISTOEPIT must be defined and reside in the STEPLIB of the OMVS cataloged procedure or the system link list.
- The Sockets-over-SNA file system must be defined to OpenEdition via the parmlib member BPXPRMxx, which is specified when the OpenEdition address space is started.
- If you are not using the common INET PFS, the transport driver is defined using the FILESYSTYPE definition statement, and the ENTRYPOINT parameter on the Sockets-over-SNA file system statement specifies ISTOEPIT as the parameter. An example follows:

  ```
  FILESYSTYPE TYPE(APPNSNA)
       ENTRYPOINT(ISTOEPIT)
  ```

  The NETWORK definition statement that corresponds to the Sockets-over-SNA FILESYSTYPE statement should specify a DOMAINNAME of AF_INET and a DOMAINNUMBER of 2. The following NETWORK defintion statement corresponds to the previous FILESYSTYPE definition statement:

  ```
  NETWORK TYPE(APPNSNA)
          DOMAINNAME(AF_INET)
          DOMAINNUMBER(2)
          MAXSOCKETS(32)
  ```

- If you are using the common INET PFS, the NAME(_) on SUBFILESYSTYPE must match the proc name of the job used to start Sockets over SNA.

  An example follows:

  ```
  FILESYSTYPE TYPE(CINET) ENTRYPOINT(BPXTCINT)
  NETWORK DOMAINNAME(AF_INET)
          DOMAINNUMBER(2)
          MAXSOCKETS(32)
          TYPE(CINET)
          INADDRANYPORT(2000)
          INADDRANYCOUNT(100)
  SUBFILESYSTYPE NAME(SNACKOE)
                    TYPE(CINET)
                ENTRYPOINT(ISTOEPIT)
                DEFAULT
  SUBFILESYSTYPE NAME(TCPIP)
                    TYPE(CINET)
                ENTRYPOINT(BPXTIINT)
  ```

- The TYPE parameters on the FILESYSTYPE, SUBFILESYSTYPE and NETWORK definition statements should be the same. The TYPE parameter correlates the definition statements.
- For security authorization, Sockets over SNA must be authorized to your security product before you can use the OpenEdition services. For example, if you use the IBM security product RACF, Sockets over SNA must be RACF-authorized to use the OpenEdition callable services.

Restrictions and Constraints

The following restrictions and constraints apply to defining the Socket-over-SNA transport driver to OpenEdition for MVS:

- Without common INET, only a single FILESYSTYPE definition statement with ENTRYPOINT(ISTOEPIT) can be specified. If additional FILESYSTYPE definition statements with ENTRYPOINT(ISTOEPIT) are specified, the subsequent physical file systems will abend with abend code X'CC5' and reason code X'xxxx0847'.
- Use the following Sockets-over-SNA environment variables in the ENVVAR data set to specify which ports are reserved for INADDRANY binds from OpenEdition:
  - OE_INADDRANY_PORT
  - OE_INADDRANY_COUNT.

  The common INET transport driver ensures that certain ports are available on all INET TPs for INADDRANY_PORT and INADDRANY_COUNT. Within Sockets over SNA, the ports will be reserved using these environment variables.

  There are no default values for these environment variables. These values must be coordinated with other OpenEdition transport providers, such as TCP/IP. For more information about these environment variables, see "OE_INADDRANY_PORT" on page 31 and "OE_INADDRANY_COUNT" on page 31 .

Chapter 5. Starting, Initializing, and Stopping AnyNet Sockets over SNA

This chapter describes the following tasks associated with starting, initializing, and using Sockets over SNA.

- Starting Sockets over SNA
- Initializing Sockets over SNA and running an application
- Stopping Sockets over SNA.

Before you attempt to start and use Sockets over SNA, make sure you have finished the planning, installation, and configuration tasks described in “Chapter 2. Planning for AnyNet Sockets over SNA” on page 7, “Chapter 3. Defining AnyNet Sockets over SNA” on page 15, and “Chapter 4. Configuring, Customizing, and Tuning AnyNet Sockets over SNA” on page 27.

Order of Initialization

Following is the order for starting Sockets over SNA, a Sockets-over-SNA application program, and the supporting system components:

1. IPL the operating system. This step starts OpenEdition and the Sockets-over-SNA physical file system.
2. Start VTAM.
3. Activate the APPL major node containing the Sockets-over-SNA definition.
4. Start Sockets over SNA.
5. Run the `ISTSKMAP` utility to initialize the IP-LU mapping table. This step has to precede using `ISTSKIFC` to initialize the Sockets-over-SNA interface.
6. Run the `ISTSKIFC` utility to initialize the `sna0` interface.
7. Run the `ISTSKIFC` utility to initialize the `lo` interface.
8. Start the socket application.
9. Monitor your operator’s console and standard output device to ensure that Sockets over SNA has initialized successfully. If all the software components start up with no failures, resume normal operation procedures.

Starting and Initializing Sockets over SNA

This section provides sample JCL code for starting Sockets over SNA and the `ISTSKMAP`, `ISTSKIFC`, and `ISTSKTRC` utilities. You can start Sockets over SNA, `ISTSKMAP`, `ISTSKIFC`, and `ISTSKTRC` as procedures or as jobs.

It is recommended that you specify a region size of 8 megabytes (REGION=8M) or more when you initialize Sockets over SNA.

During operation, data is queued in the Sockets-over-SNA address space. If your installation experiences long response delays or transfers large volumes of data, you might need to increase the region size of the Sockets-over-SNA address space to improve performance.

Following is sample JCL code for starting Sockets over SNA as a procedure:

Starting

```
//SNCK     PROC
//DAEMON   EXEC PGM=ISTSKDMN,REGION=0M,TIME=1440,
//         PARM='ENVAR(_CEE_ENVFILE=DD:ENVVAR)'
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//CEEDUMP  DD DUMMY
//ENVVAR   DD DSN=ANYNET.CFG(ENVVAR),DISP=SHR
```

Notes:

1. Specify at least an 8 megabyte address space for Sockets over SNA (REGION=8M).
2. The Sockets-over-SNA load module resides in SYS1.VTAMLIB.
3. ISTSKDMN is the main Sockets-over-SNA load module.
4. SCEERUN requires Language Environment** runtime data sets.
5. CEEDUMP is the data set used to capture information related to situations that should not occur.
6. ANYNET.CFG(ENVVAR) is the ENVVAR data set.
7. SYSPRINT is the default trace data set.

After you start Sockets over SNA, use `ISTSKMAP` and `ISTSKIFC` to initialize the IP-LU mapping table and to assign an address to the `sna0` interface. You must run `ISTSKMAP` and `ISTSKIFC` before you start a Sockets-over-SNA application program (see “Using the ISTSKMAP Utility to Establish, Update, and Query the Mapping Table” on page 18 and “Using the ISTSKIFC Utility to Define an SNA Network Interface for Sockets over SNA” on page 22). Following is sample code that starts the `ISTSKMAP`, `ISTSKIFC`, `ISTSKNST`, `ISTSKRTE`, and `ISTSKTRC` utilities procedure:

```
//SETUP    PROC
//*-------------------------------------------------------------
//* THIS JOB STEP TURNS ON ALL SNACKETS TRACES.
//*-------------------------------------------------------------
//TRACEON  EXEC PGM=ISTSKTRC,PARM=('ON ALL'),REGION=1M
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
//* THIS JOB STEP MAPS IP ADDRESSES TO NETID AND LUNAMES
//*-------------------------------------------------------------
//MAP      EXEC PGM=ISTSKMAP,REGION=1M,
//         PARM=('ADD 128.109.0.0 255.255.0.0 NETA SX')
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
//* THIS JOB STEP CONFIGURES THE LOOPBACK INTERFACE
//*-------------------------------------------------------------
//LOCONFIG EXEC PGM=ISTSKIFC,PARM=('LO 127.0.0.1'),REGION=1M
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
//* THIS JOB STEP CONFIGURES THE SNA0 INTERFACE
//*-------------------------------------------------------------
//ISTSKIFC EXEC PGM=ISTSKIFC,REGION=1M,
//         PARM=('SNA0 128.109.255.202')
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
//* THIS JOB STEP ADDS AN ENTRY TO THE ROUTING TABLE
//* FOR HOST 129.34.10.1 TO USE GATEWAY 128.109.255.204
```

```
//*-------------------------------------------------------------
//ISTSKRTE EXEC PGM=ISTSKRTE,REGION=1M,
//         PARM=('ADD HOST 129.34.10.1 128.109.255.204 1')
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
//* THIS JOB STEP ADDS AN ENTRY TO THE ROUTING TABLE
//* FOR NETWORK 129.34  (CLASS B) TO USE GATEWAY 128.109.255.204
//*-------------------------------------------------------------
//ISTSKRTE EXEC PGM=ISTSKRTE,REGION=1M,
//         PARM=('ADD NET 129.34 128.109.255.204 1')
//STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
//SYSPRINT DD SYSOUT=*
//*-------------------------------------------------------------
/* THIS JOB STEP DISPLAYS THE ROUTING TABLE, SOCKET TABLE AND
/* INTERNAL STATISTICS FOR SOCKETS OVER SNA
/*-------------------------------------------------------------
/ISTSKNST EXEC PGM=ISTSKNST,REGION=1M,
/         PARM=('-R -S -D')
/STEPLIB  DD DSN=SYS1.VTAMLIB,DISP=SHR
/         DD DSN=LE370.V1R8M0.SCEERUN,DISP=SHR
/SYSPRINT DD SYSOUT=*
```

Notes:

1. The `ISTSKMAP`, `ISTSKIFC`, `ISTSKNST`, and `ISTSKTRC` load modules reside in SYS1.VTAMLIB.
2. The REGION parameter is optional. If you specify REGION, specify a region of at least 1M.
3. The procedure must be RACF authorized. Refer to “Running Utilities Using JCL” for an example of how to supply a RACF authorized userid and password when running utilities from JCL.

Refer to the *OS/390 MVS JCL User's Guide* for more information on running programs using JCL. Refer to the *OS/390 Language Environment Programming Guide* for more information on running programs that use the LE/370 runtime library.

Running Utilities Using JCL

You must supply a RACF authorized userid and password when running the utitlities using JCL, as shown in the second line of the following example.

To run Sockets-over-SNA utilities using JCL, submit the following:

```
//TROFFTO  JOB CLASS=A,MSGCLASS=A,MSGLEVEL=(1,1),REGION=0M,
//         USER=USER1,PASSWORD=password
//JOBLIB   DD DSN=SYS1.VTAMLIB,DISP=SHR
//         DD DSN=SYS1.SCEERUN,DISP=SHR
//*
//TRACEOFF EXEC PGM=ISTSKTRC,PARM=('off timo')
//SYSPRINT DD SYSOUT=*
//SNLOUT   DD SYSOUT=*
//*
```

Running Utilities from the OpenEdition Shell

To run Sockets-over-SNA utilities from the OpenEdition shell, execute the following from the OpenEdition shell command line:

```
export STEPLIB="SYS1.VTAMLIB"
```

This adds VTAMLIB to the OpenEdition shell search string. Next, create a file with the sticky bit attribute that has the same name as the utility that you want to execute. For example, to execute ISTSKNST, create a file called ISTSKNST. Use the CHMOD command to turn the sticky bit on and mark the file executable:

```
echo   this is a pointer to load module ISTSKNST >ISTSKNST
chmod +tx ISTSKNST
```

Refer to the *OS/390 OpenEdition User's Guide* for an explanation of sticky bit and the chmod and echo commands.

The following command will enter a load module name and arguments on an OpenEdition command line:

```
ISTSKNST -d
```

Stopping Sockets over SNA

To stop the execution of Sockets over SNA, use the MVS STOP command. Refer to *OS/390 MVS System Commands* for more information on the STOP command.

Chapter 6. Diagnosing Problems for AnyNet Sockets over SNA

This chapter describes:

- How you can use console and system log messages to help determine definition and configuration errors
- How to use the ISTSKNST utility to display Sockets-over-SNA routing tables
- Traces you can run to help diagnose problems that might arise when you install, configure, or use Sockets over SNA
- How to respond to abends caused by Sockets over SNA.

The status of Sockets over SNA, associated subsystems, and associated application programs is indicated using the following methods:

Console Messages
: Sockets over SNA issues ISU-prefixed console messages for error situations where operator intervention might be needed and for status milestones that report the progress of initialization and shutdown. ISU-prefixed messages are described in *OS/390 eNetwork Communications Server: SNA Messages*.

Log Messages
: Sockets over SNA issues log messages to inform you when certain values have been set. For example, when Sockets over SNA starts, values used for ENVVAR parameters are reported. Informational log messages are directed to the standard output device.

Errno Values
: When an application program begins communication with Sockets over SNA, errors that occur are usually mapped to the errno global variable.

Determining Errors During Sockets-over-SNA Initialization and Operation

Message ISU1501I is issued when Sockets over SNA starts successfully. The ISTSKMAP utility is then used to initialize the IP-LU mapping table, causing the arguments you specify to echo to ISTSKMAP's standard output. If Sockets over SNA detects a mapping error during normal operation, either of the following two message groups are generated. Note that these message groups are generated by Sockets over SNA, not by ISTSKMAP.

- If Sockets over SNA is unable to map an IP address to an LU name, message ISU1517I is generated. If ISU1517I is preceded by ISU1519I, the IP-LU mapping table does not contain an entry that matches the IP address contained in the message.
- If Sockets over SNA detects a mapping inconsistency between the LU name generated by the IP-LU mapping algorithm and the LU name used by a partner, messages ISU1534I and ISU1535I are generated.

The next step, using ISTSKIFC to initialize the Sockets-over-SNA interface, does not echo any arguments you specify. If Sockets over SNA detects an error attempting to configure the sna0 interface, the name of the macro function that caused the failure is included in the message group generated for message ISU1519I. Refer to message ISU1519I in *OS/390 eNetwork Communications Server: SNA Messages* for complete information on message ISU1519I.

Diagnosing

If an application program issues an API call that results in an error, the API call indicates failure and the global errno variable is set to indicate the cause of the failure. A typical failure scenario is EAGAIN:

EAGAIN
You tried to start your application before Sockets over SNA completed its initilization.

EIO Sockets over SNA was stopped while processing the socket call.

For more error node values and meanings, refer to the *OS/390 OpenEdition Programming: Assembler Callable Services Reference* or the *OS/390 C/C++ Run-Time Library Reference*.

Determining Whether Environment Variables Are Set Successfully

During initialization, Sockets over SNA writes all environment variable values to the standard output file (SYSPRINT), or to DD:LOGMSGS, if defined. To ensure that the environment variable values you want are being used, examine the SYSPRINT output during initialization. Following are examples of log messages that go into standard output indicating environment variable values for Sockets-over-SNA initialization:

```
Sockets-over-SNA: Log message table initialized
Sockets-over-SNA: Message table initialized
Sockets-over-SNA: ENVVAR settings in effect:
Sockets-over-SNA: TRACE_OPTION is on all
Sockets-over-SNA: MAX_CONCURRENT_SOCKET_CALLS is 12
Sockets-over-SNA: HOSTNAME is SNACKETS.RALEIGH.IBM.COM
Sockets-over-SNA: DG_SEGMENTATION is MPTN
Sockets-over-SNA: SXMODE_DEFAULT is SNACKETS
Sockets-over-SNA: MAX_DG_CONVS is 10
Sockets-over-SNA: DG_CONV_IDLE_TIMEOUT is 5
Sockets-over-SNA: MAX_SENDBUF is 8300
Sockets-over-SNA: CONNECT_TIMEOUT is 120
Sockets-over-SNA: OE_INADDRANY_PORT is 2000
Sockets-over-SNA: OE_INADDRANY_COUNT is 100
Sockets-over-SNA: LEARNMAP is YES
```

If during initialization, Sockets over SNA detects an environment variable value that is not valid, the default value for that environment variable is used and Sockets over SNA continues the initialization process. There are two exceptions: OE_INADDRANY_PORT and OE_INADDRANY_COUNT, which are ignored because they do not have a default value.

Messages ISU1512I, ISU1568I, ISU1569I, and ISU1570I during initialization indicate an invalid environment variable.

Refer to *OS/390 eNetwork Communications Server: SNA Messages* for complete information on all Sockets-over-SNA messages.

Using the ISTSKNST Utility to Display Sockets-over-SNA Routing Tables

This section describes how to use the ISTSKNST utility to display entries in the local Sockets-over-SNA routing table. This version of the ISTSKNST utility is provided to help you verify routes that are established through one or more Sockets Gateways. (Refer to *IBM Communications Server for OS/2 Warp: Guide to AnyNet Sockets over SNA* for information on using Sockets Gateways.)

The ISTSKNST utility can help you determine:

- Whether a route exists to a specific destination node or destination network
- Which gateway is used for a given route
- Which gateway is defined for the default route
- If a specific route has been used.
- An appropriate value for MAX_CONCURRENT_SOCKET_CALLS

The ISTSKNST utility can be run either interactively (for example, using TSO), or using batch (for example, JCL). To run ISTSKNST interactively, your logon procedure must be set up to run an authorized LE/370* application programs. Refer to "Domain Name Server" on page 13 for information on defining a domain name server. Refer to your *OS/390 Language Environment Programming Guide* for information on setting up your logon procedure to run LE/370 application programs.

Following is an example of how to run ISTSKNST in TSO with the -? argument for a quick view of the usage syntax.

```
call 'sys1.vtamlib(istsknst)' '-?'
```

The syntax for the ISTSKNST utility follows:

Following is a description of each operand:

(-? or no operand)
If you specify the ISTSKNST utility with a question mark, unrecognizable operand, or no operand, ISTSKNST displays the following usage syntax:

```
Usage: ISTSKNST [-r] [-s] [-d] [-u]
Where:
-r          displays the entries in the routing table
-s          displays the socket table
-d          displays statistics
-u          updates the displays every two seconds
```

-r displays the following information for all route entries in the Sockets-over-SNA routing table.

destination
IP address of the node or network that can be reached through the IP address displayed as gateway

gateway
IP address of the node through which the *destination* node or *destination* network can be reached

refcnt
Current number of active uses of the route. Connection-oriented protocols normally hold on to a single route for the duration of a connection; connectionless protocols obtain a route while sending data.

metric
The number of hops to destination. If metric is zero, it is a local interface. If it is greater than zero, it is non-local.

use
Number of packets that have been sent using this route

flags

U indicates this route is connected, active, and available for use.

D indicates this route was created dynamically.

M indicates this route has been modified.

G indicates this route is a gateway.

H indicates this is a host.

intrf
indicates the network interface that is used to reach the specified gateway. On OS/390, if Sockets over SNA is configured correctly, these fields are set to `sna0` or `lo`.

Following is an example of the output produced when you run `ISTSKNST` and specify the `-r`:

```
destination        gateway     refcnt   metric  flags  intrf
129.34.10.1    128.109.255.204   0         1    UGH     sna0
127.0.0.1          127.0.0.1     0         0    UH      lo
129.34.10.0    128.109.255.205   0         1    U       sna0
128.109.0.0    128.109.255.202   0         0    U       sna0
```

-s displays the socket table.

Following is an example of the output produced when you run `ISTSKNST` and specify the `-s`:

```
SOCK  TYPE    FOREIGN PORT   LOCAL PORT  FOREIGN HOST    STATE
 4    STREAM    0               0          0.0.0.0
```

Socket descriptors are those assigned by Sockets over SNA. OpenEdition gives the application a different descriptor.

-d displays the statistics.

Following is an example of the output produced when you run `ISTSKNST` and specify the `-d`:

```
2 out of a maximum 10 environments are allocated.
```

This output shows you have configured MAX_CONCURRENT_SOCKET_CALLS to be 10; however, Sockets over SNA has only executed 2 calls concurrently since Sockets over SNA was started.

If the output shows all environments have been allocated, consider increasing MAX_CONCURRENT_SOCKET_CALLS.

Using the OPING Utility

Earlier releases of Sockets over SNA provided the ISTSKPNG, or ping, utility. In this release, OPING is provided by eNetwork Communications Server for OS/390 V2R5.

Using the ISTSKTRC Utility to Trace Sockets over SNA

The `ISTSKTRC` utility can be run either interactively (for example, using TSO), or using batch (for example, JCL). To run `ISTSKTRC` interactively, your logon procedure must be set up to run an authorized LE/370* application programs. Refer to "Domain Name Server" on page 13 for information on defining a domain name server. Refer to your *OS/390 Language Environment Programming Guide* for information on setting up your logon procedure to run LE/370 application programs.

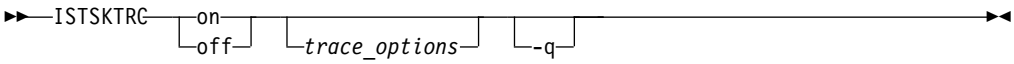
Following is an example of how to run `ISTSKTRC` in TSO with all trace options on.

```
call 'sys1.vtamlib(istsktrc)' 'on all'
```

Syntax for Running ISTSKTRC

The `ISTSKTRC` utility is used to turn tracing on and off for the Sockets-over-SNA address space. You can select the categories of information you want to trace by specifying one or more trace options. Your IBM support representative can help you determine what trace categories to trace.

The syntax for the `ISTSKTRC` utility follows:



ISTSKTRC
required utility used to activate ISTSKTRC

on | off
required argument that turns tracing on or off. If you specify one or more trace options, turns tracing on or off for the specified options.

reset
optional argument that turns off all tracing and closes the trace output file. Do not specify a trace option when you use reset.

Reset is the only way to empty the trace buffer. If you restart tracing, previous trace information may be overwritten.

trace_options
category of information you want to trace. *trace_options* is optional. You can specify one or more of the following trace options.

Notes:

1. If you do not specify at least one trace option, all categories are traced.
2. Separate each option with a space.
3. Options are not case sensitive.

Trace Option	Description
TCP	streams
UDP	datagrams
TIMO	timeout routines
MISC	miscellaneous
GEN	gen_usrreq function
INP	input
OUT	output
SIC	socket interface calls
DATI	data in
DATO	data out
ASY	asynchronous events
APPC	APPC calls
SLP	sleep and wakeup calls
SIA	socket interface arguments
MEM	memory usage
MSG	console messages
IP	IP
DIE	termination events
ALL	traces all categories
OE	OpenEdition events

−q active trace options are listed when `ISTSKMAP` completes completes execution unless −q is specified. This argument is optional.

Routing Output from the ISTSKTRC Utility

Unless you use one of the methods shown below, Sockets over SNA sends trace data to the SYSPRINT DD of the job or PROC used to start Sockets over SNA.

If an error is encountered writing trace data to the standard output file, for example, SYSPRINT fills with data, Sockets over SNA continues running but stops writing trace data to SYSPRINT. If you want to route `ISTSKTRC` output to a file other than the standard output file, use either of the following methods:

- Define a file with a DD name of TRACE in the job (or procedure) used to start Sockets over SNA. If an error is encountered while writing to TRACE, for example, if the TRACE file fills with data, Sockets over SNA stops writing trace data to the file and reverts to using SYSPRINT.

  Following is an example of a JCL entry to reroute trace messages to a spool data set:

  ```
  //TRACE  DD SYSOUT=*
  ```

- Define one or more files with a DD name of TRACE*n*, where *n* is an integer from 1 to 999. Following is an example of JCL entries that route trace messages to 3 TRACE*n* entries:

```
//TRACE1  DD DSN='USERX.TRACE1',DISP=SHR
//TRACE2  DD DSN='USERX.TRACE2',DISP=SHR
//TRACE3  DD DSN='USERX.TRACE3',DISP=SHR
```

If an error is encountered while writing to any of the TRACE*n* files, Sockets over SNA stops writing to the file and goes to the next TRACE*n* file in the sequence. Writing continues until an error occurs attempting to write to file TRACE*n*+1 (for example, the last specified TRACE*n* file fills with trace data). After TRACE*n* fills up, the process starts over and trace entries are written to TRACE1.

If an `ISTSKTRC reset` is issued during tracing, the current TRACE*n* data set is closed. If tracing is restarted, Sockets over SNA starts writing trace data to TRACE1.

Using TRACE*n* data sets enables you to collect the most current trace information and limit the amount of past trace information that is stored.

If your trace card and/or TRACE DD card prints to a data set (DASD) then the data set name must be an HFS file name or an OS/390 data set of fixed format with logical record length of at least 150 (LRECL must be greater than or equal to 150 and RECF must be equal to F).

See “Starting and Initializing Sockets over SNA” on page 37 for sample JCL that starts the `ISTSKTRC` utility and sends the output to either a standard output device (SYSPRINT) or a user-specified data set.

If you use `ISTSKTRC reset` to turn off tracing and close the file, the file is reopened and the entries are overwritten when tracing is resumed. If you want to save the contents of the trace file before you resume tracing, copy the file after you issue `ISTSKTRC reset`.

Responding to Sockets-over-SNA Abends

Sockets over SNA issues abends to OS/390 and requests dumps if an unrecoverable error occurs.

If Sockets over SNA abends without creating a dump, you can obtain abend-related information by dumping the Sockets-over-SNA address space just as you would dump any other address space under OS/390.

Sockets over SNA detects some abend situations and attempts to bring itself down. See *OS/390 eNetwork Communications Server: SNA Messages* for a listing of the abends that can be generated by failures related to Sockets over SNA.

Service Information

If you cannot determine the cause of the problem from the output provided, take the following actions:

- If you have access to IBMLink*, search for known problems in this area. If no applicable matches are found, report the problem to IBM by using the Electronic Technical Report (ETR) option on IBMLink.
- If you do not have access to IBMLink, report the problem to the IBM Support Center.

Diagnosing

Appendix A. Syntax Conventions

This appendix describes the syntax conventions that are used in this book.

To help you locate and identify information easily, this book uses the following visual cues and standard text formats:

Font Type
Used for

`monospace`
Commands, command options, examples, messages, text that you type or enter

CAPS File names and file paths

italics User-supplied variables, message variables, titles of books

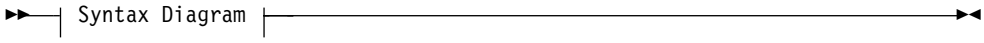
bold Socket call names, return codes

“quotes”
Titles in a menu

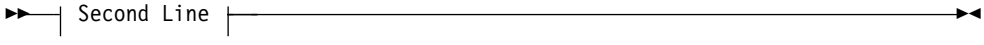
Command Syntax Diagrams

This section describes how to read the syntax diagrams used to describe the commands in this book.

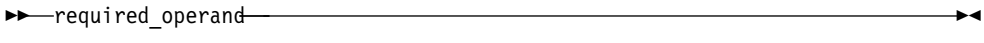
- Read the diagrams from left-to-right, top-to-bottom, following the main path line. Each diagram begins on the left with double arrowheads (►►) and ends on the right with two arrowheads facing each other (►◄).



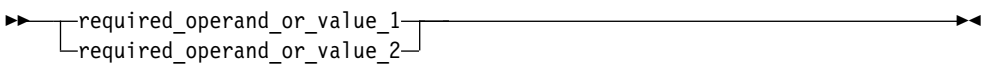
- If a diagram is longer than one line, the first line ends with a single arrowhead (►) and the second line begins with a single arrowhead.



- Commands and required operands appear on the main path line.

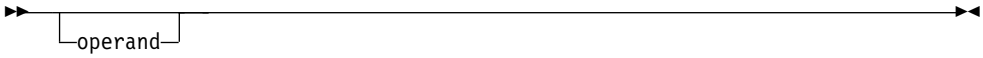


You must enter commands and required operands.
If there is more than one mutually-exclusive required operand to choose from, they are stacked vertically in alphanumeric order.



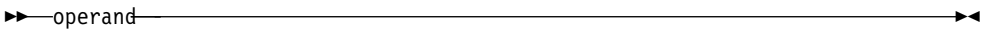
- Optional operands appear below the main path line.

Syntax Conventions

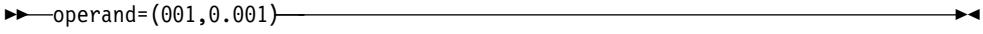


You can choose not to enter optional operands.
If there is more than one mutually-exclusive optional operand to choose from, they are stacked vertically in alphanumeric order below the main path line.

- A word in all lowercase, but not in italics, is a command or operand you must spell exactly as shown. In this example, you must enter **operand**.



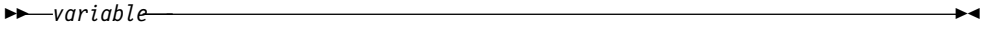
  If a command or operand can be abbreviated, the abbreviation is discussed in the text associated with the syntax diagram.
- If a diagram shows a character that is not alphanumeric (such as parentheses, periods, commas, and equal signs), you must enter the character as part of the syntax. In this example, you must enter ***operand=(001,0.001)***.



- Generally, use spaces between keywords and variables unless the syntax diagram shows otherwise.
- If a diagram shows a blank space, you must enter the blank space as part of the syntax. In this example, you must enter ***operand=(001 fixed)***.

- Default operands and values appear above the main path line.

  In the text of this book, defaults are printed in bold and underscored.
- A word in all lowercase italics is a *variable*. Where you see a variable in the syntax, you must replace it with one of its allowable names or values, as defined in the text.



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ES/9370
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GDDM
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Bibliography

eNetwork Communications Server for OS/390 V2R5 Publications

Following are descriptions of the books in the eNetwork Communications Server for OS/390 V2R5 library. The books are arranged in the following categories:

- Softcopy Information
- Marketing Information
- Planning
- Installation, Resource Definition, and Tuning
- Operation
- Customization
- Writing Application Programs
- Diagnosis
- Messages and Codes
- APPC Application Suite.
- Multiprotocol Transport Networking (MPTN) Architecture publications

The complete set of unlicensed books in this section can be ordered using a single order number, SBOF-7011.

Softcopy Information

IBM Networking Softcopy Collection Kit CD-ROM(SK2T-6012).

The softcopy library contains softcopy versions of the licensed and unlicensed books for eNetwork Communications Server for OS/390 V2R5.

All of the unlicensed and licensed books described in this section are available in softcopy on this CD-ROM. These softcopy files can be read using any of the IBM BookManager READ programs. They can also be read with the IBM Library Reader program shipped on this CD.

The CD also contains softcopy of the unlicensed books of many other products.

Marketing Information

A Networking Overview and the following IBM Networking Previews are available:

- VTAM
- TCP/IP

Ask your IBM marketing representative for more information.

Planning

OS/390 eNetwork Communications Server: SNA Planning and Migration Guide (SC31-8622). This guide helps you upgrade to eNetwork Communications Server for OS/390 V2R5. It includes:

- Installation procedures
- Planning to upgrade
  - Upward and downward compatibility
  - Software and hardware requirements
  - Storage requirements
  - Impacts of new functions and enhancements performed without changes to user interfaces
  - Changes to installation process
- Upgrading user interfaces
  - Changes to start options
  - Changes to buffer pools
  - Changes to definition statements
  - Changes to IBM-supplied default user-definable tables and modules
  - Changes to user-definable table macroinstructions
  - Changes to commands
  - Changes to messages
  - Changes to SNA application programming interface
  - Changes to installation-wide exit routines
  - Changes to control blocks
- Implementing optional functions and enhancements introduced in eNetwork Communications Server for OS/390 V2R5.
  - Overview of each new function and enhancement introduced since VTAM V4R4
  - Pointers to other books in the library where implementation details can be found.

OS/390 eNetwork Communications Server: IP Planning and Migration Guide (SC31-8512). This book is intended to help you plan for TCP/IP

whether you are migrating from a previous version or installing TCP/IP for the first time. This book also identifies the suggested and required modifications needed to enable you to use the enhanced functions provided with TCP/IP.

Installation, Resource Definition, Configuration, and Tuning

Program Directory. These documents are shipped with the product tape and explains the steps for installing VTAM and TCP/IP.

OS/390 eNetwork Communications Server: IP Configuration (SC31-8513). This book is for people who want to configure, customize, administer, and maintain TCP/IP. Familiarity with MVS operating system, TCP/IP protocols, and IBM Time Sharing Option (TSO) is recommended.

OS/390 eNetwork Communications Server: SNA Network Implementation (SC31-8563). This book presents the major concepts involved in implementing a SNA network, and includes:

- Buffer pools, slowdown, pacing, storage considerations
- Implementation considerations
- Sample major node definitions
- Migration considerations
- Tables and filters
- TSO, VCNS, and other programs that run with VTAM
- Tuning procedures
- VTAM start options.

Use this book in conjunction with the *OS/390 eNetwork Communications Server: SNA Resource Definition Reference*

OS/390 eNetwork Communications Server: SNA Resource Definition Reference (SC31-8565). This book describes each VTAM definition statement, start option, and macroinstruction for user tables. It also describes NCP definition statements that affect VTAM. The information includes:

- IBM-supplied default tables (logon mode and USS)
- Major node definitions
- User-defined tables and filters
- VTAM start options.

If you are unfamiliar with the major concepts involved in implementing a SNA network, use this book in conjunction with the *OS/390 eNetwork Communications Server: SNA Network Implementation*.

OS/390 eNetwork Communications Server: SNA Resource Definition Samples (SC31-8566). This book contains sample definitions to help you implement VTAM functions in your networks, and includes sample major node definitions. Use this book in conjunction with the *OS/390 eNetwork Communications Server: SNA Network Implementation* and *OS/390 eNetwork Communications Server: SNA Resource Definition Reference*

OS/390 eNetwork Communications Server: AnyNet SNA over TCP/IP (SC31-8578). This guide provides information to help you install, configure, use, and diagnose SNA over TCP/IP.

OS/390 eNetwork Communications Server: AnyNet Sockets over SNA (SC31-8577). This guide provides information to help you install, configure, use, and diagnose Sockets over SNA. It also provides information to help you prepare application programs to use sockets over SNA.

Operation

OS/390 eNetwork Communications Server: IP User's Guide (GC31-8514). This book is for people who want to use TCP/IP for data communication activities such as FTP and Telnet. Familiarity with MVS operating system and IBM Time Sharing Option (TSO) is recommended.

OS/390 eNetwork Communications Server: Operations (SC31-8567). This book serves as a reference for programmers and operators requiring detailed information about specific operator commands. The information includes:

- VTAM commands and start options
- Logon manager commands
- DISPLAY output examples (messages received)
- VSCS commands.

OS/390 eNetwork Communications Server: Operations Quick Reference (SX75-0121). This book contains essential information about VTAM operator commands.

High Speed Access Services User's Guide (GC31-8676).

Customization

OS/390 eNetwork Communications Server: SNA Customization (LY43-0110). This book enables you to customize VTAM, and includes:

- Communication network management (CNM) routing table
- Logon-interpret routine requirements
- Logon manager installation-wide exit routine for the CLU search exit
- TSO/VTAM installation-wide exit routines
- VTAM installation-wide exit routines:
  - Command verification exit (ISTCMMND)
  - Configuration services XID exit (ISTEXCCS) with description of IBM-supplied default exit
  - Directory services management exit (ISTEXCDM)
  - Generic resource resolution exit (ISTEXCGR)
  - Performance monitor exit (ISTEXCPM)
  - SDDLU exit (ISTEXCSD) with description of IBM-supplied default exit
  - Session accounting exit (ISTAUCAG)
  - Session authorization exit (ISTAUCAT)
  - Session management exit (ISTEXCAA) with example
  - TPRINT processing exit (ISTRAEUE)
  - USERVAR exit (ISTEXCUV) with description of IBM-supplied default exit
  - Virtual route pacing window size calculation exit (ISTPUCWC)
  - Virtual route selection exit (ISTEXCVR).

OS/390 eNetwork Communications Server: IP Network Print Facility (SC31-8522). This book is for system programmers and network administrators who need to prepare their network to route VTAM, JES2, or JES3 printer output to remote printers using TCP/IP.

Writing Application Programs

OS/390 eNetwork Communications Server: IP API Guide (SC31-8516). This book describes the syntax and semantics of program source code necessary to write your own application programming interface (API) into TCP/IP. You can use this interface as the communication base for writing your own client or server application. You can also use this book to adapt your existing applications to communicate with each other using sockets over TCP/IP.

OS/390 eNetwork Communications Server: IP CICS Sockets Guide (SC31-8521). This book is for people who want to set up, write application programs for, and diagnose problems with the socket interface for CICS using TCP/IP for MVS.

OS/390 eNetwork Communications Server: IP IMS Sockets Guide (SC31-8546). This book is for programmers who want application programs that use the IMS TCP/IP application development services provided by IBM TCP/IP for MVS.

OS/390 eNetwork Communications Server: IP Programmer's Reference (SC31-8515). This book describes the syntax and semantics of a set of high-level application functions that you can use to program your own applications in a TCP/IP environment. These functions provide support for application facilities, such as user authentication, distributed databases, distributed processing, network management, and device sharing. Familiarity with the MVS operating system, TCP/IP protocols, and IBM Time Sharing Option (TSO) is recommended.

OS/390 eNetwork Communications Server: SNA Programming (SC31-8573). This book describes how to use VTAM macroinstructions to send data to and receive data from (1) a terminal in either the same or a different domain, or (2) another application program in either the same or a different domain. The information includes:

- API concepts
  - Cryptography
  - RUs and exchanges
  - Session establishment and termination
- BIND area format
- Communication Network Management Interface
- Dictionary of VTAM macroinstructions
- OPEN or CLOSE errors
- Operating system differences
- Program Operator Coding requirements
- RAPI DSECTs and control block mappings (ACB, ADSP, BLENT, CV29, EXLST, MTS, NIB, NIB DEVCHAR, NIB PROC, RH, RPL, RPL RTNCD=FDB2=FDBK=DSECT)
- RAPI global variables
- Vector lists

- RPL-based macroinstructions
- RPL RTNCD,FDB2 codes
- User exit routines.

OS/390 eNetwork Communications Server: SNA Programmers LU 6.2 Guide (SC31-8581). This book describes how to use the VTAM LU 6.2 application programming interface for host application programs. This book applies to programs that use only LU 6.2 sessions or that use LU 6.2 sessions along with other session types. (Only LU 6.2 sessions are covered in this book.) The information includes:

- VTAM's implementation of the LU 6.2 architecture
- Design considerations for LU 6.2 application programs
- Negotiating session limits with partner LUs
- BIND image and response
- Allocating and deallocating conversations
- FMH-5 and PIP data
- Conversation states
- Sending and receiving data
- Using high performance data transfer (HPDT)
- Session- and conversation-level security and data encryption
- Register usage
- Sync point services
- LU 6.2 global variables
- Vector lists
- Sense codes for FMH-7 and UNBIND
- RCPRI,RCSEC codes
- User exit routines.

OS/390 eNetwork Communications Server: SNA Programmers LU 6.2 Reference (SC31-8568). This book provides reference material for the VTAM LU 6.2 programming interface for host application programs. The information includes:

- APPCCMD macroinstructions
- Primary and secondary return codes (RCPRI, RCSEC)
- DSECTs
- Examples of using VTAM's LU 6.2 API
- Register usage

OS/390 eNetwork Communications Server: CSM Guide (SC31-8575). This book describes how applications use the communications storage manager. The information includes:

- Creating and deleting buffer pools
- Obtaining and freeing buffers
- Return codes and reason codes
- DSECTs

OS/390 eNetwork Communications Server: CMIP Services and Topology Agent Guide (SC31-8576). This book describes the Common Management Information Protocol (CMIP) programming interface for application programmers to use in coding CMIP application programs. The book provides guide and reference information about CMIP services and the VTAM topology agent and includes the following topics:

- Management information base (MIB) API functions
- CMIP message strings
- Special CMIP message strings
- Read queue exit routine
- Sample CMIP application program
- VTAM resources as CMIP objects
- Naming conventions for objects
- VTAM resources and OSI states
- Attributes to object cross-reference
- ASN.1 syntax for CMIP messages
- GDMO table format
- ACYAPHDH header file.

Diagnosis

OS/390 eNetwork Communications Server: IP Diagnosis (SC31-8521). This book explains how to diagnose TCP/IP problems and how to determine whether a specific problem is in the TCP/IP product code. It explains how to gather information for and describe problems to the IBM Software Support Center.

OS/390 eNetwork Communications Server: SNA Diagnosis (LY43-0079). This book helps you identify a VTAM problem, classify it, and collect information about it before you call the IBM Support Center. The information collected includes traces, dumps, and other problem documentation. The information includes:

- Command syntax for running traces and collecting and analyzing dumps
- VIT entries
- Procedures for collecting documentation (VTAM, TSO)
- VTAM internal trace and VIT analysis tool

- FFST Probes
- Channel programs
- Flow diagrams
- Procedures for locating buffer pools
- CPCB operation codes
- Storage and control block ID codes
- Offset names and locations for VTAM buffer pools.

OS/390 eNetwork Communications Server: Data Areas Volume 1 (LY43-0111). This book describes VTAM data areas and can be used to read a VTAM dump. It is intended for IBM programming service representatives and customer personnel who are diagnosing problems with VTAM.

OS/390 eNetwork Communications Server: Data Areas Volume 2 (LY43-0112). This book describes VTAM data areas and can be used to read a VTAM dump. It is intended for IBM programming service representatives and customer personnel who are diagnosing problems with VTAM.

Messages and Codes

OS/390 eNetwork Communications Server: SNA Messages (SC31-8569). This book describes the following types of messages and other associated information:

- Messages:
  - ELM messages for logon manager
  - IKT messages for TSO/VTAM
  - IST messages for VTAM network operators
  - ISU messages for sockets-over-SNA
  - IVT messages for the communications storage manager
  - IUT messages
  - USS messages
- Other information that displays in VTAM messages:
  - Command and RU types in VTAM messages
  - Node and ID types in VTAM messages
- Supplemental message-related information:
  - Message additions, deletions, and changes
  - Message flooding prevention
  - Message groups and subgroups
  - Message routing and suppression including descriptor codes, routing codes, and suppression levels for ELM, IKT, IST, and ISU messages
  - Message text and description formats
  - Message text of MSGLVL option messages including general information on the MSGLVL option
  - Message text of all VTAM network operator messages including variable field lengths

OS/390 eNetwork Communications Server: IP Messages Volume 1 (SC31-8517). This volume contains TCP/IP messages beginning with EZA.

OS/390 eNetwork Communications Server: IP Messages Volume 2 (SC31-8570). This volume contains TCP/IP messages beginning with EZB.

OS/390 eNetwork Communications Server: IP Messages Volume 3 (SC31-8674). This volume contains TCP/IP messages beginning with EZY, EZZ, and SNM.

OS/390 eNetwork Communications Server: IP and SNA Codes (SC31-8571). This book describes codes and other information that display in CS/390 messages:

- Sense codes including VTAM sense code hints, SNA sense field values for RPL-based macroinstructions, and 3270 SNA and non-SNA device sense fields
- Return codes for macroinstructions including ACB OPEN and CLOSE macroinstruction error fields, RTNCD-FDB2 return code combinations, and LU 6.2 RCPRI-RCSEC return codes
- Data link control (DLC) status codes
- Status codes including resource status and session state codes
- Wait state event codes and IDs
- Abend codes
- ATM network-generated cause and diagnostic codes

APPC Application Suite

OS/390 eNetwork Communications Server: APPC Application Suite User's Guide (GC31-8619). This book documents the end-user interface (concepts, commands, and messages) for the AFTP, ANAME, and APING facilities of the APPC application suite. Although its primary audience is the end user, administrators and application programmers may also find it useful.

OS/390 eNetwork Communications Server: APPC Application Suite Administration (SC31-8620). This

book contains the information that administrators need to configure the APPC application suite and to manage the APING, ANAME, AFTP, and A3270 servers.

OS/390 eNetwork Communications Server: APPC Application Suite Programming (SC31-8621). This book provides the information application programmers need to add the functions of the AFTP and ANAME APIs to their application programs.

Multiprotocol Transport Networking (MPTN) Architecture Publications

Following are selected publications for MPTN:

Networking Blueprint Executive Overview (GC31-7057)

Multiprotocol Transport Networking: Technical Overview (GC31-7073)

Multiprotocol Transport Networking: Formats (GC31-7074)

OS/390 Publications

For information on OS/390 and other products, refer to *OS/390 Information Roadmap* (GC28-1727-04).

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Readers' Comments — We'd Like to Hear from You

OS/390 eNetwork Communications Server
AnyNet: Guide to Sockets over SNA
Version 2 Release 5

Publication No. SC31-8577-00

Overall, how satisfied are you with the information in this book?

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