

IBM Communications Server for Linux



# Quick Beginnings

*Version 6.2*



IBM Communications Server for Linux



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*Version 6.2*

**Note:**

Before using this information and the product it supports, be sure to read the general information under Appendix B, "Notices," on page 83.

**First Edition (May 2004)**

This edition applies to Version 6 Release 2 of Communications Server for Linux (5724-i33) and to all subsequent releases and modifications until otherwise indicated in new editions.

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## Welcome to Communications Server for Linux

This book introduces IBM® Communications Server for Linux (CS Linux), an IBM software product that enables a computer running Linux to exchange information with other nodes in a Systems Network Architecture (SNA) network.

Communications Server for Linux is designed to operate on either an Intel™ workstation running Linux (CS Linux, program product number 5724-i33) or a zSeries® mainframe running a 31-bit or 64-bit Linux for zSeries (CS Linux on zSeries, program product number 5724-i34). There are two different copies of the *CS Linux Quick Beginnings* book, one for each of these two installation variants. Please ensure that you have the correct copy of this book for your CS Linux installation. This book applies to CS Linux on a workstation running Linux.

This book uses the shorter name CS Linux to refer to Communications Server for Linux Version 6.2 and its features.

CS Linux provides building blocks for a wide variety of networking needs and solutions. They can be used to exchange information with nodes in SNA networks, or to provide host access for Telnet programs communicating over Transmission Control Protocol/Internet Protocol (TCP/IP).

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## How to Use This Book

This section explains how information is organized and presented in this book.

### Road Map

This book is for management and technical personnel involved in network planning, and for anyone interested in Communications Server for the Linux operating system.

To find the information you need to get started with CS Linux, use Table 1.

*Table 1. Getting Started Road Map*

| <b>If you want to...</b>   | <b>Refer to...</b>   |
|--|--|
| Read about CS Linux  | Chapter 1, "About Communications Server for Linux," on page 1                          |
| Plan how to use CS Linux in your network   | Chapter 2, "Planning for Your Network and Communications Server for Linux," on page 15 |
| Install CS Linux on Linux computers  | Chapter 3, "Installing CS Linux on Linux Servers," on page 21                          |
| Install CS Linux on Windows® clients   | Chapter 6, "Planning for and Installing CS Linux on Windows Clients," on page 39       |
| Configure CS Linux   | Chapter 7, "Configuring and Using CS Linux," on page 47                                |
| Find information about the CS Linux documentation and other publications, including online information | Chapter 8, "Information Resources for CS Linux and SNA," on page 79                    |

## How to Use This Book

Table 1. Getting Started Road Map (continued)

| If you want to...                      | Refer to...                       |
|--|-----------------------------------|
| Read notices and trademark information | Appendix B, "Notices," on page 83 |

## Typographic Conventions

The typographic styles used in this document are shown in Table 2.

Table 2. Typographic Conventions

| Special Element        | Sample of Typography                    |
|------------------------|---|
| Emphasized words       | <b>back up files before deleting</b>    |
| Document title         | <i>CS Linux Administration Guide</i>    |
| File or path name      | <code>/usr/spool/uucp/myfile.bkp</code> |
| Program or application | <b>snaadmin</b>                         |
| User input             | <b>0p1</b>                              |
| Computer output        | <b>CLOSE</b>                            |

## Abbreviations Used in This Book

This book uses the following abbreviations:

|          |   |
|----------|---|
| API      | Application Programming Interface                           |
| APPC     | advanced program-to-program communication                   |
| APPN     | Advanced Peer-to-Peer Networking <sup>®</sup>               |
| BrNN     | Branch Network Node   |
| COS      | Class of Service  |
| CPI-C    | Common Programming Interface for Communications             |
| CSV      | Common Service Verb   |
| DDDLU    | Dynamic Definition of Dependent LUs                         |
| DES      | data encryption standard                                    |
| DLC      | Data link control   |
| DLUR     | Dependent LU Requester                                      |
| DLUS     | Dependent LU Server   |
| FTP      | File Transfer Protocol                                      |
| HPR      | High-Performance Routing                                    |
| IETF     | Internet Engineering Task Force                             |
| ISO      | International Organization for Standards                    |
| ISR      | Intermediate session routing                                |
| LAN      | Local area network  |
| LDAP     | Lightweight Directory Access Protocol                       |
| LEN      | Low-entry networking  |
| LLC2     | Logical Link Control 2                                      |
| LU       | Logical unit  |
| LUA      | Conventional LU Application Programming Interface           |
| MDS-NMVT | Multiple Domain Support—Network Management Vector Transport |
| MPC      | MultiPath Channel   |
| MS       | Management Services   |
| NMVT     | Network Management Vector Transport                         |
| NOF      | Node Operator Facility                                      |
| OSI      | Open Systems Interconnection                                |
| PU       | Physical unit   |
| RFC      | Request For Comments  |

---

|                  |   |
|------------------|---|
| RLE              | Run-Length Encoding                             |
| SAA <sup>®</sup> | Systems Application Architecture <sup>®</sup>   |
| SAP              | Service access point                            |
| SNA              | Systems Network Architecture                    |
| SSL              | Secure Sockets Layer                            |
| TCP/IP           | Transmission Control Protocol/Internet Protocol |
| TN               | Telnet  |
| TP               | Transaction program                             |
| VT               | Virtual Terminal                                |
| WAN              | Wide area network                               |

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## What's New

CS Linux Version 6.2 replaces CS Linux Version 6.0.1 (V6.0.1), which was available as PRPQ 5799–RQA.

### New Functions

The following functions have been added to CS Linux in this release:

- Client/server support is now included, allowing you to concentrate SNA resources on servers and share them between applications running on multiple clients. Multiple servers can support load-balancing and resilience by providing two or more links to the same remote system on different servers.
  - Servers can run on both Linux and Linux for zSeries.
  - Clients can run on Linux, Linux for zSeries, or Microsoft<sup>®</sup> Windows.
    - Linux and Linux for zSeries clients support all of the API libraries that are available on Linux or Linux for zSeries servers.
    - Windows clients support the APPC, CPI-C, CSV, LUA (including both LUA RUI and SLI), and NOF APIs.
    - The client support for NOF APIs provides only the query functions. Calls to set, start, or stop resources are not provided.
    - Windows Clients can run in the Windows Terminal Server (WTS) environment, in which two or more users can share the same client but their applications run independently and do not interfere with one another.
- CS Linux now supports dynamic IPv4 hostname resolution for both qualified and unqualified IPv4 hostnames, as specified in the APPN architectural update AMB 8538.

## What's New



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# Chapter 1. About Communications Server for Linux

This chapter explains how CS Linux is packaged and describes its functions, features, and benefits.

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## Communications Server for Linux Features and Packaging

CS Linux is communication software that runs on the Linux operating system. It consists of the features described in “Communications Server for Linux” and “Advanced Networking Features” on page 5.

### Communications Server for Linux

Communications Server for Linux connects applications across SNA and TCP/IP networks. It converts a workstation running Linux into an SNA node by equipping the workstation with SNA resources and protocols; this enables the workstation to communicate with other workstations and host computers in an SNA network. It also provides TCP/IP functions to allow Communications Server for Linux to be used within your TCP/IP network or at the boundary between TCP/IP and SNA networks.

CS Linux provides the following services:

#### Network Support

CS Linux supports host-mediated and peer-to-peer networks:

##### SNA Host-Mediated Networks

These networks are hierarchically organized, with one or more host computers controlling communication between computers, managing the network, and providing processing services and high-capacity data storage. All other nodes in the network are dependent on the control of a host.

Linux computers can participate in a host-mediated network by being configured as host-dependent nodes.

##### Peer-to-Peer Networks

For distributed processing environments, CS Linux supports APPN networks. In these peer-to-peer networks, Linux computers retain processing functions and communicate directly with each other as peers. Peer-to-peer networks fully use the capability of the Linux computer, which today rivals that of expensive host computers.

An APPN network consists of peer nodes of the following types:

- APPN network node (which provides traffic control, dynamic route computation and selection services, and network management services)
- APPN end node (which uses APPN network node services to communicate with peer nodes)
- LEN node (which communicates directly with adjacent nodes or nodes configured to appear adjacent)

**Note:** Host computers can function as peer nodes in an APPN network by using independent LU 6.2 to communicate with Linux computers and other hosts in the network.

## Communications Server for Linux Features and Packaging

### Providing Host-Mediated Functions in an APPN Network

The dependent LU requester (DLUR) function enables traffic between hosts and host-dependent nodes to be carried in an APPN network.

### Data Link Control Options

At the link level, CS Linux offers different connectivity options to help you meet your network's size, speed, security, and cost considerations. (For a detailed list of the link types supported, see "Installation Requirements" on page 17.) It supports data links for different network types, as follows:

#### Local Area Networks

For LAN connectivity, you can install the appropriate links to communicate using token ring, standard Ethernet, and 802.3 Ethernet protocols.

#### Local Attachment

CS Linux supports Multipath Channel (MPC) connectivity for local attachment (CS Linux on zSeries only).

#### IP Integration

If your corporate backbone network is based on IP, you can use the Enterprise Extender (HPR/IP) feature of CS Linux to integrate this with SNA, allowing your SNA applications to communicate over the IP network.

### LU Support

Logical units (LUs) are application-specific network resources that reside on each node in an SNA network. Each LU acts as an interface that applications use to access links in order to communicate over the network with partner applications on other nodes.

CS Linux supports different types of LUs for different classes of applications.

- In a host-mediated network, CS Linux supports dependent LUs, which can be any of the following types:
  - LU 0
  - LU 1
  - LU 2
  - LU 3
  - LU 6.2

LU 0 supports primitive program-to-program communication, typically used at point-of-sale transactions in retail and banking. LU 2 supports terminal emulation applications that enable the Linux computer to emulate an IBM 3270-family terminal. The other LU types enable applications to participate in distributed processing or to communicate with various printers or interactive display terminals.

CS Linux supports host systems that use dynamic definition of dependent LUs (DDDLU), a host feature that enables dependent LUs on the SNA system to be added to the host configuration when the communication link from the SNA system to the host is established. With DDDLU, LUs do not have to be configured statically at the host. (You must still define dependent LUs on the CS Linux node.) This reduces the initial configuration required at the host, and makes later expansion easier.

CS Linux can communicate with both DDDLU-capable and non-DDDLU-capable hosts, with no difference in the configuration

## Communications Server for Linux Features and Packaging

required. When the communications link from the CS Linux node to the host is established, a DDDL-capable host informs the node that it supports DDDL; the node then sends the required information to define the dependent LUs that use the link. If the host is not DDDL-capable, CS Linux does not send this information; it assumes that the LUs have already been defined statically at the host.

- Independent LU 6.2 supports independent traffic in APPN networks. Independent LU 6.2 supports autonomous communication and network management, as well as distributed processing.

In addition, the DLUR function of CS Linux enables traffic from dependent LUs to travel over an APPN network.

### Session Support

A session is a temporary logical channel between partner LUs. Ordinarily, partner applications associated with each LU communicate over the session. CS Linux can support thousands of sessions. CS Linux can also support U-shaped sessions (also known as “local/remote transparency”), in which both primary and secondary LUs reside in the same Linux computer. This enables you to develop and test a pair of source and target transaction programs in one computer without requiring a link connection.

The data flowing on a session between two partner LUs may be compressed, to reduce the bandwidth required.

- For LU type 6.2, CS Linux allows you to specify the use of compression in the configuration of the mode that the session uses. You can specify different compression algorithms to be used, each of which provides a different level of compression (RLE, LZ9, or LZ10). You can also specify different compression levels for data flowing in different directions on the session, or specify compression in one direction but not the other.
- For LU types 0–3, CS Linux allows you to specify the use of compression in the configuration of the link station or PU that the session uses. RLE compression is used for the inbound direction, and LZ9 for the outbound direction.

### API Support

CS Linux includes application programming interfaces (APIs) for developing applications for certain types of LUs, for distributed processing, for network management, and for administration of CS Linux itself. CS Linux provides a range of APIs that are compatible with the APIs provided by members of the Communications Server family running on other operating systems.

An API is an interface that enables a transaction program (TP) to communicate with its supporting LU. It consists of a library of verbs (also called functions, calls, and subroutines) from which the TP selects those it needs to pass to its LU to request an action, such as SEND\_DATA. The LU, in turn, processes the verbs and builds a data stream according to the appropriate protocol, appends a header indicating the destination address, and sends the data over the link to partner LUs.

Common Programming Interface for Communications (CPI-C) is one of the most powerful of the APIs because of its portability. Introduced to support dependent and independent LU 6.2, CPI-C complies with Systems Application Architecture (SAA) mandates to unify different platforms and operating systems. CPI-C uses a set of syntax rules that is common to all systems. It has thus become a standard.

## Communications Server for Linux Features and Packaging

As well as the standard C-language CPI-C API, CS Linux also includes a CPI-C API for use by Java™ applications. For more information, refer to *CS Linux CPI-C Programmer's Guide*. In the CS Linux books, all references to CPI-C include Java CPI-C unless stated otherwise.

Other CS Linux APIs include:

- APPC API for peer-to-peer communications between application programs using LU 6.2. The API has the option of being nonblocking. When a TP uses nonblocking verbs, the API can return control to the TP before the requested action has completed. Later, the TP is informed when the action has completed.
- LUA API for communications with host applications.
- CSV (Common Service Verb) API for utility functions such as character translation and application trace control.

In addition, CS Linux includes the following proprietary programming interfaces:

- MS (Management Services) API for network messaging functions.
- NOF (Node Operator Facility) API for applications that configure and manage CS Linux resources.

For more detailed information about an API, refer to the programming guide for the API.

### Client/Server Support

Computers running CS Linux can be configured to communicate using client/server protocols. When client/server protocols are used in a network, all the computers using client/server protocols to communicate in that network are referred to as a “domain.”

The computers running CS Linux in a client/server configuration can take the following roles:

- A server contains an SNA node and its associated connectivity components. The server provides SNA connectivity to applications on the local system or on other computers in the CS Linux domain. Servers must be Linux systems.
- A client does not contain SNA node components, but accesses them through a server. A client can access one or more servers at the same time, and can run concurrent applications as needed. Clients can be running Linux or Windows.

Servers and clients communicate across the CS Linux domain using TCP/IP. The protocols used are different from those used by Telnet clients and provide support for applications using the CS Linux APIs.

In a domain with multiple CS Linux servers, one server holds the master copy of the CS Linux domain configuration file. This server is known as the master server. You can define other servers in the domain to be backup servers, or leave them as peer servers. The domain configuration file is copied to backup servers—either when they are started, or when the master copy is changed—so that all backup servers hold a copy of the latest information. A peer server obtains domain configuration information from the master server as required, but cannot act as a backup server.

If the master server fails, the first backup server on the list of servers defined for the domain takes over as the master. The domain configuration

## Communications Server for Linux Features and Packaging

file on this server is used as the master copy, and is copied to other servers as necessary. When the master server is restarted, it receives a copy of the domain configuration from the backup server currently acting as master, and then takes over as the master.

### Support for Distributed Applications

In a Client/Server CS Linux system, applications running on clients cooperate with connectivity resources on servers to execute a single task. Applications running on other (non-CS Linux) computers can also cooperate with applications on CS Linux computers to perform distributed processing.

CS Linux supports distributed applications using APPC (also known as LU 6.2).

## Advanced Networking Features

Included in the CS Linux base product is a set of features that add advanced networking capabilities to it. These features include the following:

- SNA gateway connects LANs to host-mediated SNA networks.
- Branch Extender simplifies large APPN networks by separating out resources in different locations (for example in separate branches of a large organization). This reduces the amount of topology information that must be stored, while still allowing efficient resource location.
- APPC Application Suite provides selected applications for use in APPN networks.
- Enterprise Extender (EE, also known as HPR/IP) allows SNA traffic to be transported natively over IP networks.
- TN Server provides host access over SNA to TN3270 and TN3270E clients, referred to collectively as TN3270 clients.
- TN Redirector provides passthrough TCP/IP host access to TN3270, TN3270E, TN5250 and VT clients, referred to collectively as Telnet clients.

### SNA Gateway

A gateway is a user-transparent device that connects dissimilar networks or computer systems, supporting both of the environments that it connects. End users perceive each other as residing in the same network.

SNA gateway enables a CS Linux computer to act as a gateway that links multiple downstream computers in an SNA network to one or more host physical units (PUs), as illustrated in Figure 1 on page 6. To simplify host connectivity, and to eliminate excess links, SNA gateway acts as a PU concentrator—it treats the multiple computers as a single PU (that appears to reside on the SNA gateway node) and communicates with the host over a single physical connection.

## Communications Server for Linux Features and Packaging

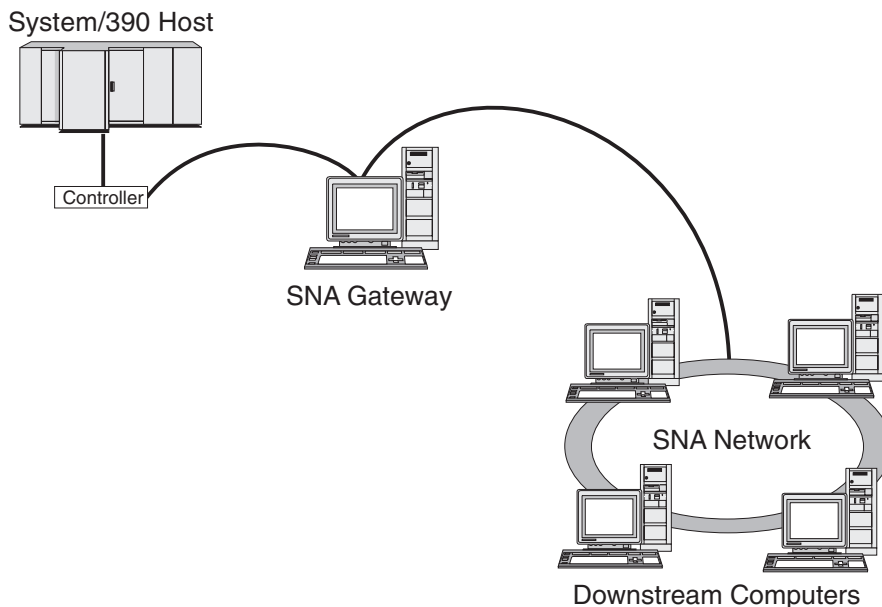


Figure 1. SNA Gateway Linking Multiple Downstream Linux Computers to a Host Computer

### Branch Extender

Network nodes in an APPN network need to maintain topology information (about the location of other nodes in the network and the communications links between them), and to forward this information around the network when the topology changes. As the network grows in size, the amount of stored information and topology-related network traffic can become large and difficult to manage.

It is possible to avoid these problems by separating the network into subnetworks, so that each node only needs to maintain topology information about the nodes in its own subnetwork. However, this results in increased network traffic when trying to locate resources in other subnetworks.

The Branch Extender feature of APPN, illustrated in Figure 2 on page 7, provides a solution to these problems.

## Communications Server for Linux Features and Packaging

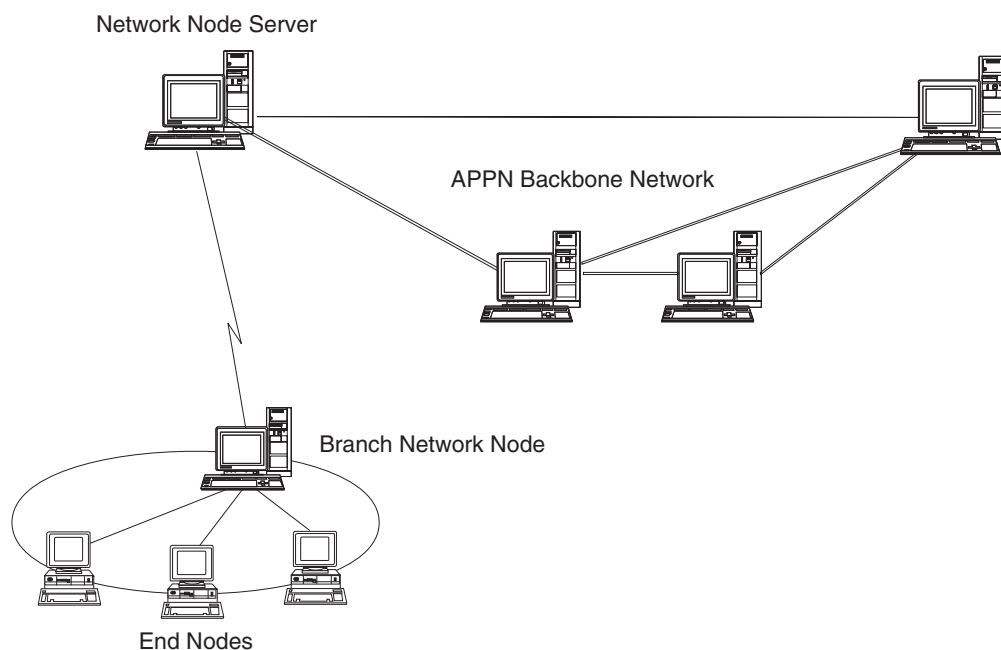


Figure 2. Branch Extender

As the name implies, Branch Extender is designed for networks that can be divided into distinct areas such as separate branches of a large organization. It works by separating out branches from the main APPN network (for example, the network in the organization's headquarters).

Each branch contains a node of a new type called Branch Network Node (BrNN), which is connected to a Network Node in the main APPN backbone network. The BrNN combines the functions of an APPN network node and an APPN end node.

- To the backbone network, the BrNN appears as an End Node, connected to its Network Node Server (NNS) in the backbone network:
  - The nodes in the backbone network are not aware of the nodes within the branch, reducing the amount of topology information that must be stored.
  - Because the BrNN appears as an End Node, it does not receive topology information from the backbone network (topology information is transmitted only between Network Nodes).
  - The BrNN registers all resources in the branch with its NNS as though they were located on the BrNN itself. This means that the nodes in the backbone network can locate resources in the branch without having to be aware of the separate nodes in the branch.
- To the branch network, the BrNN appears as a Network Node, acting as the NNS for End Nodes in the branch. Each node in the branch sees the rest of the network as being connected through its NNS, in the same way as for a standard NNS.

### APPC Application Suite

APPC Application Suite is a set of applications that demonstrates the distributed processing capabilities of APPN networks, and can be helpful in configuration verification and problem determination. APPC Application Suite can be used to provide support for operations such as file transfers, which are frequently performed across a network.

APPC Application Suite contains the following applications:



## Communications Server for Linux Features and Packaging

- **ACOPY** (APPC COPY)
- **AFTP** (APPC File Transfer Protocol)
- **ANAME** (APPC Name Server)
- **APING** (APPC Ping)
- **AREXEC** (APPC Remote EXECution)
- **ATELL** (APPC TELL)

These applications can be accessed from a server or from a Linux or Windows client.

### Enterprise Extender

Enterprise Extender (also known as HPR/IP) provides a mechanism for integrating SNA applications with an IP network.

SNA applications are designed to use SNA protocols to communicate over SNA networks with other SNA applications. When installed in a TCP/IP network using Enterprise Extender, SNA applications can still communicate; the Enterprise Extender function provides a mechanism for transporting SNA protocols over the IP network. In particular, it provides APPN High-Performance Routing (HPR) functionality, giving the applications the benefits of both APPN and IP connectivity.

Enterprise Extender in CS Linux is implemented simply as a communications link. To connect two SNA applications over IP, you define an Enterprise Extender link, in the same way as for any other link type such as Ethernet.

### TN Server

3270 emulation programs that communicate over TCP/IP (rather than over an SNA network) are referred to as “TN3270 programs” (Telnet 3270 emulation programs).

TN3270 programs can also include support for TN3270E (Telnet 3270 standard extensions). TN3270E supports 3270 device emulation (including both terminals and printers) using Telnet. It enables a Telnet client to select a particular device (by specifying the LU name or the name of an LU pool), and provides enhanced support for various functions, including the ATTN and SYSREQ keys and SNA response handling.

**Note:** This guide uses the term TN3270 for information that applies equally to the TN3270, TN3287, and TN3270E protocols.

CS Linux TN server provides access to 3270 host computers for TN3270 users on other computers. TN server enables TN3270 users to share a host connection with CS Linux or with other TN3270 users, instead of requiring a direct link. TN server also enables TN3270 users to access hosts that are not running TCP/IP.

The CS Linux TN server function is illustrated in Figure 3 on page 9.



## Communications Server for Linux Features and Packaging

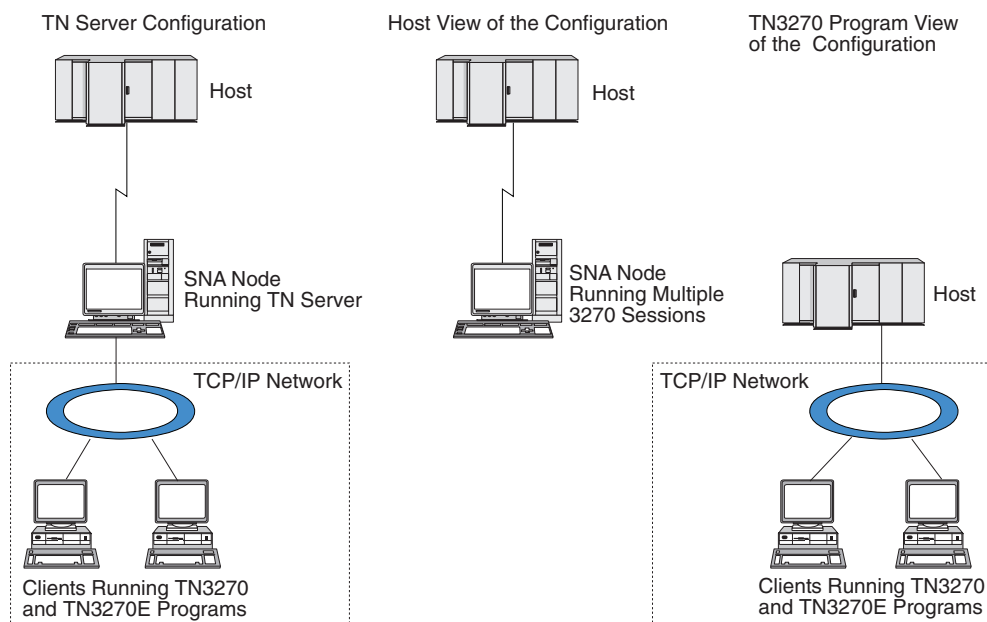


Figure 3. TN Server

The CS Linux TN server feature provides an association between a TN3270 user and CS Linux 3270 LU. All data from the TN3270 user is routed to the LU. This means that the configuration for both the host and the TN3270 user is as though they were connected directly; neither needs to be aware that data is being routed through TN server.

CS Linux TN server supports all TN3270 client emulation programs that correctly implement the protocols defined in IETF RFCs 1123, 1576, 1646, 1647, and 2355.

**Security Features:** CS Linux TN Server supports data encryption, server authentication, client authentication, and Express Logon, using Secure Sockets Layer (SSL) software:

- Data encryption means that the data flowing between the TN Server and the TN3270 emulator is in encrypted form. 168-bit Triple DES encryption is supported in the United States and Canada. U. S. government export controls and individual countries' import regulations may limit the encryption levels available elsewhere.
- Server authentication allows a TN3270 client to verify that the TN Server it is connected to is the one it expects.
- Client authentication allows a TN Server to verify that the TN3270 client connecting to it is the one it expects. The TN Server can also check a revocation list on an external directory server to ensure that the client's authorization has not been revoked.
- Express Logon operates in conjunction with client authentication to remove the requirement for TN3270 clients to provide a user ID and password when connecting to the host. Instead, the client's security certificate is used to retrieve the necessary user ID and password information.

### TN Redirector

The CS Linux TN Redirector feature provides passthrough services for 3270, 5250 or VT sessions over TCP/IP. The Telnet user communicates with CS Linux over a TCP/IP connection; CS Linux then communicates with the host over another TCP/IP connection.

CS Linux TN Redirector supports data encryption, server authentication, and client authentication, using Secure Sockets Layer (SSL) software, in the same way as for TN Server for 3270. This allows you to use Secure Sockets Layer (SSL) security checking where necessary, and not on the complete user-to-host connection. For example:

- If clients are connecting to CS Linux over a TCP/IP LAN where checking is not required, but are connecting to a remote host that requires SSL, you can use SSL over the TCP/IP connection between CS Linux and the host. This means that security is checked once for all clients, and individual clients do not have to provide security information.
- If CS Linux is installed on the same site as the host, but clients are connecting in from external sites, you can use SSL over the client connections to CS Linux without having to install SSL software on the host.

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## Features and Benefits

CS Linux has features and benefits that range from simplifying configuration to improving problem diagnosis to enhancing network performance.

### Versatile Building Blocks

CS Linux supports most environments and node functions. In any type of network, host-mediated or APPN, it enables the Linux computer to function as any one of, or a combination of, the following:

- Host-dependent node
- Peer node (for a description of APPN peer nodes, see the discussion of peer-to-peer networks in “Communications Server for Linux” on page 1)
- Partner (either source or destination) in distributed applications
- Gateway node that interconnects SNA networks

Through network management APIs, the Linux computer can also be configured to function as a Management Services (MS) entry point to provide support for distributed network management. At the link level, the Linux computer can be connected to various LANs and WANs by using any of the supported link types (described in “Communications Server for Linux” on page 1 and “Installation Requirements” on page 17).

### Client/Server Operation

Client/server configuration provides the following benefits:

- Concentrating SNA resources on servers reduces the load on clients, improving client performance and minimizing the storage needed to provide SNA services to clients.
- A single data link can be shared by multiple users on different machines, eliminating the need for each machine to have a physical SNA network connection.
- Multiple servers can provide redundant connectivity (for example, by having multiple servers providing access to the same host). Having multiple paths to an

SNA resource enables load balancing across the different servers and provides immediate backup in the event that a particular server or link fails.

- By using LU pools across multiple servers, the administrator can easily configure and add servers and users.
- Having fewer links and PUs for host connectivity reduces the size of the host VTAM<sup>®</sup> definition.
- Administration utilities can be used to configure and manage both node resources (for any computer in the domain) and shared resources. The client/server support provided by CS Linux administration tools enables transparent administration of all domain resources from any computer in the domain.

## Easy Configuration

CS Linux is designed with configuration options and capabilities that reduce configuration time and network complexity. For example:

### Motif Administration Program

The easiest way to define and modify the CS Linux configuration is to use the Motif administration program (**xsnaadmin**). This program provides a graphical user interface from which you can view and manage CS Linux resources. This program also simplifies configuration by exposing only the fields whose values typically vary from one installation to another, using default values for other fields.

The Motif administration program includes help screens that provide overview information for SNA and CS Linux, reference information for CS Linux dialogs, and guidance for performing specific tasks.

### Dynamic Configuration in APPN Networks

Configuring a node or network is also made easier through the APPN network's dynamic configuration. For example, APPN end nodes and applications dynamically register configuration data to support LU 6.2 sessions, thus making session configuration optional. Further, by having the node control point act as the default local LU, you can avoid LU 6.2 configuration altogether.

APPN also supports dynamic link station configuration in the absence of configured link stations.

## Additional User Interface Choices for Administration

The Motif administration program is the recommended interface for configuring and managing CS Linux. However, you have a choice of interfaces for CS Linux, which enables you to work with the one that suits your equipment, needs, and preferences.

### Command-Line Administration Program

The command-line administration program (**snaadmin**) can be used to issue commands to manage individual CS Linux resources. You can use **snaadmin** either directly from the Linux command prompt or from within a shell script.

### NOF API

The CS Linux NOF API provides the same management functions as the command-line administration program, providing an interface suitable for use within a program (rather than a command script). You can use the NOF API to write your own application programs to administer CS Linux.

### Better Performance

CS Linux enhances the inherently high performance of SNA networks and uses class of service operation. CS Linux also optimizes network speed through SNA data compression for LU 0–3 session data, and through different traffic-management methods that balance traffic flow according to network size:

- In APPN networks, CS Linux supports both High-Performance Routing (HPR) and intermediate session routing (ISR), and provides connection network options. While ISR works efficiently for small networks, it degrades the performance of larger ones.
- For larger networks using LAN connectivity options (such as Token Ring or ethernet) or using Enterprise Extender, you can also use the connection network option to improve communication efficiency. The connection network option creates a communications path directly between nodes. This enables traffic to bypass intermediate network nodes.
- Another traffic control mechanism, adaptive session-level pacing, automatically adjusts congestion by regulating the rate at which LUs send message units to partner LUs.

### Security Options

With networks becoming more complex and moving to an open architecture, security emerges as a major issue. In SNA networks running CS Linux, you can protect your assets by defining various levels of security through configuration and by implementing certain types of links. For example:

- LU 6.2 users can define up to three levels of security—session, resource, and conversation. Respectively, one ensures that the proper LUs are engaged in a session, one restricts access to all applications associated with a particular LU, and one restricts access to a particular application. Additional security is possible through data encryption routines.
- CS Linux TN Server and TN Redirector can provide data encryption, server authentication, and client authentication between the CS Linux server and TN3270 or Telnet clients, using Secure Sockets Layer (SSL) software. (This feature requires some additional software in addition to the standard CS Linux product. See “Installation Requirements” on page 17 for more information.)

### Network Management Flexibility

CS Linux supports the Multiple Domain Support-Network Management Vector Transport (MDS-NMVT) network management scheme, which can work as a centralized, distributed, or hierarchical management scheme. It is based on a focal point/entry point architecture that gives you a high degree of flexibility.

Focal points are control nodes that manage the network according to the data they collect from entry points (management applications that reside on all other nodes in the network).

- In centralized management, a single focal point acts as a control point for the entire network.
- In distributed management, several focal points share in managing the network.
- In hierarchical management, focal points are nested according to function.

MDS-NMVT can thus be adapted to manage host-mediated, standard APPN, and very large APPN networks.

## Reliability, Availability, and Serviceability

To help you maintain reliable system operation, CS Linux provides a range of display functions and problem-diagnosis tools.

- The Motif administration program provides enhanced configuration and management tools, including the following:
  - Immediate updates of configuration information
  - Status information for links, sessions, and node resources
- Query and status commands provide you with information about:
  - LU-LU sessions
  - APPN intermediate sessions
  - Active links
  - APPN topology databases, which store link information
- Problem-diagnosis tools are available to help you during the different stages of configuration and operation. They include the following:
  - Diagnostics information collection tool (**snagetpd**) to enable you to collect service information easily
  - Status and error messages to help resolve problems with configuration routines and system operation
  - Logs for collecting network error, failure, and audit information
  - Trace facilities for gathering and formatting detailed problem information

Other utilities help you test for link connectivity and communication between applications.

CS Linux also includes the Management Services API, which is used to develop tools for sending and receiving network alerts and problem data.

All of these management and problem-diagnosis tools are fully integrated into the CS Linux Client/Server model, so you can manage the entire CS Linux domain or collect diagnostics information from a single point in the network.

## Network Integration, Growth, and Change

To support network integration, growth, and change, the CS Linux APIs can be used to develop applications for a particular LU, platform, or operating system as your business needs dictate. CPI-C is an especially important API because it is consistent across different platforms and operating systems. It is used to develop applications that can run on any system.

Enterprise Extender also provides a mechanism for integrating SNA and TCP/IP networks.



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## Chapter 2. Planning for Your Network and Communications Server for Linux

This chapter provides an overview of the stages of planning a network that runs CS Linux. It also summarizes the functions that you can configure for the Linux computer and presents guidelines for estimating the resources required to support the functions.

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### Stages of Network Planning

This section presents some general guidelines for planning, configuring, and managing networks through the use of various CS Linux and Linux utilities.

Planning a network involves balancing function, performance, resources, and cost. Although there is no single best plan for a network, some general guidelines and techniques can help ensure that your plan meets your needs. To plan a network, perform the following tasks:

- Determine the functions the network should provide (such as file transfer or 3270 emulation) and your performance requirements.
- Determine how CS Linux can be configured to provide the functions you need.
- Estimate the resources needed to install CS Linux, to support your performance and capacity requirements, and to support CS Linux functions, and identify the associated costs.

### Identifying Functional Requirements for the Network

To determine the functions your network should provide, you need to consider the following questions:

- Is the network to be APPN?
- Will CS Linux run as a client/server system? If so, will all computers operate in a single CS Linux domain, or do I need to define two or more separate domains?
- Do I need more than one server in the CS Linux domain to provide load balancing for connectivity resources? If so, which server will be the master configuration server? Do I need to provide one or more backup configuration servers?
- Will user applications run on the server or on Linux client computers?
- Will the server provide connectivity resources for Windows applications (such as API transaction programs) running on Windows clients?
- Is each server to be an end-point for sessions or is it to be one of the following types of gateways?
  - APPN
  - LU 0
  - LU 2
  - TN Server or TN Redirector
- What types of physical links will the network use?

The answers to these kinds of questions help you determine which CS Linux functions the network requires.

### Determining How to Configure CS Linux

To determine how CS Linux is to function, you should first decide how work is to flow through the network. The following questions should be considered:

- What resources (such as applications) should be available through the network?
- How many users need access to remote resources?
- How frequently is each resource accessed?
- How can users get access to the network?
- How will user requests be routed through the network?

You can configure CS Linux to support many functions, including, for example, the following:

- APPN network node for intermediate session routing (ISR)
- APPN end node (which communicates autonomously with adjacent nodes but uses APPN network node services to communicate with nonadjacent peer nodes)
- Low-entry network (LEN) node (which communicates directly with adjacent nodes or nodes configured to appear adjacent)
- Use of LU 0, LU 1, LU 2, LU 3, and LU 6.2 (dependent and independent)
- SNA gateway connection to a host

One or more functions can be configured for a given node, depending on your needs. For example, you can configure CS Linux as an APPN network node to provide routing services and ISR, and use the same node for SNA gateway to route dependent LU sessions, such as LU 0 and LU 2. Similarly, you can configure CS Linux to run TN Server and support a shared database, as well as an independent LU 6.2 connection to MQSeries<sup>®</sup> on the host.

### Identifying Resource Requirements for Installation and Operation

To estimate support for the functions of CS Linux, the following questions must be answered:

- What personnel skills do I need?
- What transport media do I anticipate using?
- What are the installation requirements for the configuration I select?
- How much memory and paging space do I need for operation?

Answering these questions helps you identify the types of resources that CS Linux uses when it is configured to support any one or more of the many functions described in “Identifying Functional Requirements for the Network” on page 15. Answering the questions also helps you to understand the relationship between CS Linux functions, Linux resources, and network resources.

How you allocate resources to nodes determines how the network will perform.

#### Personnel Requirements

Installing, operating, and tuning CS Linux requires the following personnel:

- Network administrators, who plan the network, add new devices, and maintain or enhance overall network performance
- System administrators, who install and maintain CS Linux and the hardware on which it operates, and who configure systems for network connection



- Programmers, who develop customized applications such as transaction programs or network management routines

Network and system administrators should be thoroughly familiar with the hardware on which CS Linux operates and with the Linux operating system. They must know the networks to which various systems are connected and understand SNA concepts in general. They should also be familiar with the following:

- The Motif interface
- **rpm**, the installation tool for Linux
- TCP/IP, if they plan to use Client-Server functions, TN server or Enterprise Extender
- The Windows 2000, Windows XP, or Windows Server 2003 operating system, if the CS Linux system includes Windows clients

Programmers who develop customized applications for SNA should be experienced with the C language (or Java if they are using Java CPI-C), and should be familiar with the APIs that are available in CS Linux.

### Transport Media

CS Linux might need to share the underlying transport medium (such as token ring) with other communication protocols. Therefore, physical layer bandwidth requirements must accommodate all the protocols and applications sharing the transport medium.

**Note:** CS Linux can share the token ring and Ethernet adapters with other protocols such as TCP/IP. You might need to specify unique service access point (SAP) addresses for each protocol to use.

### Installation Requirements

The functions that you assign to CS Linux (from “Identifying Functional Requirements for the Network” on page 15) also determine the installation requirements. This section provides an overview of the computer resources required for installing CS Linux. For more information, see the documentation supplied with each product.

#### Link hardware

Link hardware is required only on a server, and not on a client.

Installing a PC in one or more networks requires links that conform to the selected network’s communication protocol. Link hardware consists of a communication adapter that is installed into the computer and a matching cable for attachment to the network (you also need device driver software).

#### Note:

1. Communication adapters must be installed with matching cables. For example, an Ethernet adapter requires an Ethernet cable in order for the link to function.
2. If you are using Enterprise Extender as your only link type, the adapters listed in this section are not required; but you must have one of the adapters required by TCP/IP.

CS Linux supports communication adapters for the following link protocols:

- Token Ring
- Ethernet (standard or IEEE 802.3)

## Stages of Network Planning

For information about adapters that have been tested with CS Linux, see <http://www.ibm.com/software/network/commserver>. If you have any questions about the appropriate adapter or hardware for your needs, call your IBM Sales Representative.

### Operating system

Before you can install and use CS Linux on your Linux workstation, the workstation must have an appropriate Linux operating system version installed.

CS Linux supports the following Linux variants. For up-to-date information about specific version numbers and kernel builds that are supported for each variant, please refer to the **README** file on the CS Linux CD image.

- RedHat (including Advanced Server)
- SuSE (including SuSE Linux Enterprise Server, SLES)
- UnitedLinux

### Additional Software

CS Linux requires the following additional software. See the **README** file on the CS Linux CD image for more details of specific version requirements (depending on your Linux variant), and for instructions on installing these software packages.

- LiS Streams. See the **README** file for details of the LiS Streams version required and installation instructions.
- OpenMotif (required only on a server, and not on a client). This is required in order to use the Motif administration program, which is the recommended method of configuring and managing CS Linux.
- Java (required if you want to use Java CPI-C). You will need the Java Runtime Environment (JRE). If you need to compile new Java classes for use with a Java CPI-C application, you will also need the Java SDK.

### Memory and Storage

To support a full range of configurations and services, a workstation running CS Linux needs the minimum memory required by the Linux distribution plus 32MB, and 44 MB of disk space. In addition, 2 MB of temporary storage is required during installation.

If you decide to install the documentation for CS Linux in softcopy (PDF) form, you need additional fixed-disk storage. To install all softcopy books, you need 11 MB of disk space.

**Note:** Memory and fixed-disk requirements for other licensed programs, user applications, and data are not included in these requirements; carefully review all system, memory, and fixed-disk requirements with your IBM representative or authorized industry remarketer.

### Advanced Configurations

If you expect to run applications that require more than a basic configuration, you need to plan for extra computer resources.

In general, memory and storage requirements for running CS Linux depend on many different factors that vary with the function of the Linux workstation and its environment. Nevertheless, by using the rule of thumb that LUs, active links, and ongoing sessions are the dominant consumers of computer resources, you can estimate the amount of additional memory and disk space that is required to support the most demanding applications.

### Memory and Storage Requirements for Operation

This section describes the memory and storage requirements of a workstation running CS Linux.

#### Kernel Memory

Linux uses kernel memory to enable communication between the communication subsystems and the DLCs. The kernel memory is a shared resource that must be managed at the system level. CS Linux uses kernel memory to send and receive data across the network, but it is just one of the subsystems that uses kernel memory. CS Linux's kernel memory resource utilization can affect the performance of other subsystems, such as TCP/IP or NFS. Coordinate with your network administrator in determining kernel memory requirements.

#### Memory, Disk, and Paging Storage

CS Linux uses primary storage—also known as main memory and random access memory (RAM)—permanent disk storage, and paging disk storage (also known as paging space):

- Control blocks for SNA resources—such as LUs, links, and sessions—consume primary storage.
- Kernel memory consumes only primary storage.
- CS Linux executables, configuration files, and softcopy publications consume permanent disk storage.
- Application programs, sessions, and related processes have paging space requirements that consume permanent disk storage.

Memory and disk storage requirements depend on various factors that widely differ from one environment to another. Transaction programs (TPs) and SNA sessions are the dominant consumers of memory and disk storage.

A TP is a program that uses the SNA application programming interface (API) to access the network. A session is a temporary logical channel between two LUs on partner nodes. TPs use this channel to communicate with each other.

The consumption of memory and disk storage is largely affected by the overall number of sessions, the number of allocated sessions (conversations), the traffic intensity of the conversations, and the number of active user TPs. Memory requirements are mostly affected by the data-traffic intensity and the resulting usage of kernel memory. Disk storage requirements stem from the paging space requirements of the TPs, sessions, and related processes.

For all LU types, a distinction is made between an idle session and an allocated session. An idle session is an active session that is not being used by TPs. An allocated session is one that supports an ongoing conversation. To estimate the total memory requirement, you need to estimate the traffic intensity and the portion of the overall number of sessions that will be allocated, on average, at any one time. You can also choose to configure the system to handle peak demand. These estimates vary among environments.

If you increase the session load beyond system memory capacity, you incur the cost of paging.

## Stages of Network Planning

### Processes

CS Linux requires a minimum of 20 Linux processes.

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## Ensuring Compatibility among Cross-Platform Configurations

SNA products running on different platforms—such as Communications Server for OS/2<sup>®</sup> or VTAM NCP on a host—can function with CS Linux if certain requirements are met.

In general, the current release of an SNA networking product can function with CS Linux as long as it supports PU 2.1 nodes and at least one of the link types supported by CS Linux. However, some very old releases (such as VTAM V2) might not function reliably. The capabilities of each networking product are documented in its corresponding user's guide.

Other factors to consider include the following:

- If you are using independent LU 6.2 and your network is not APPN, you need to make sure that partner LUs are defined to the local system.
- Because default values for DLC window sizes and timers vary from device to device, you must ensure that your remote devices use the correct value. For example, a DLC window size that gives good performance with a Communications Server for Windows NT<sup>®</sup> node might not perform well with a 3172 node.
- When working in a heterogeneous environment (TCP/IP and SNA protocols on the same LAN) with multiple LAN segments, make sure that your LAN interconnect devices can “route” TCP/IP and “bridge” SNA frames at the same time.

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## Naming Conventions

You can use network IDs to logically segment your physical network. Also, if you plan to connect to other networks, it is highly recommended that you register your network IDs to avoid network name conflicts.

You can define network and LU names as follows:

### Network names

You can define different network names (network IDs) to provide segmentation of APPN networks. Segmentation limits the size of network topology databases and the frequency of broadcast LOCATE requests through each network.

To ensure the uniqueness of a network ID, a network administrator can register the network's ID with the IBM worldwide registry. The IBM registry ensures that each network ID is unique among those registered with it. Registry standards are consistent with Open Systems Interconnection (OSI) standards, including OSI country codes, as established by the International Organization for Standards (ISO). For more information about registration, see *User's Guide for SNA Network Registry*.

### LU names

You can use wildcards for LU names to minimize system definition and network searches.

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## Chapter 3. Installing CS Linux on Linux Servers

This chapter provides general information on the steps you will need to take in order to install CS Linux on a Linux server. For detailed step-by-step instructions on the installation process, see the **README** file on the CS Linux CD image, which provides up-to-date, detailed information that is specific to your Linux variant. The **README** file includes:

- Exact package names and/or version numbers for the additional software packages that you need
- Details of the installation and setup commands.

If you are installing CS Linux on a Linux client or on a Linux for zSeries client, see Chapter 4, “Installing CS Linux on Linux Clients,” on page 31 or Chapter 5, “Installing CS Linux on Linux for zSeries Clients,” on page 35 for information on the installation process.

If you are installing CS Linux on a Windows client, see Chapter 6, “Planning for and Installing CS Linux on Windows Clients,” on page 39 for information on the installation process.

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### How the CS Linux Licensed Program Is Packaged

The CS Linux Licensed Program is delivered as a CD image containing the following.

- Installation programs to install the following:
  - CS Linux server
  - Linux client
  - Linux for zSeries client
  - Windows client
- A full set of PDF documentation for CS Linux (in the directory **/DOCS**)
- A **README** file containing information about any product changes following the publication of the CS Linux documentation.

See the **README** file for full details of the files included in the CD image. The PDF documentation is optional and is installed separately.

**Note:** For storage requirements, see “Installation Requirements” on page 17.

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### Preparing for CS Linux Installation

Before installing CS Linux, perform the following tasks:

- Ensure that the Linux PC is not running with Power Management features enabled.
- Ensure that all pre-requisite software listed in “Installation Requirements” on page 17 is installed.

The following sections provide information about these tasks.

### Disabling Power Management features

Before installing CS Linux, you need to check whether your Linux PC includes Advanced Power Management features; if so, you should ensure that these features are disabled. Many PCs now include these features, designed to save power if the keyboard or mouse is not being used (by suspending power to devices such as disk drives, and by reducing the CPU clock rate). Advanced Power Management is designed for use with the PC as a workstation; it is not appropriate when the PC is operating as a server, because a server can be operating normally with no keyboard or mouse activity occurring.

To disable these features, access the BIOS Configuration during startup of the PC (normally by pressing **F1** while initializing hardware), and disable both Advanced Power Management and Hardware Power Management.

To remove the Advanced Power Management feature from your PC, use the following command.

```
rpm -e apmd
```

### Installing Pre-Requisite Software

Before installing CS Linux, you need to install the pre-requisite software listed in “Installation Requirements” on page 17:

- LiS Streams
- OpenMotif
- Java
- SSL

For full details of the software packages required and step-by-step instructions for installing them, see the **README** file on the CS Linux CD image.

### Displaying Product Installation Details

You can display information about CS Linux and related software packages that are already installed. To list all the installed packages, use the following command:

```
rpm -q -a
```

To view more details of a specific package, use the following command:

```
rpm -q -i packagename
```

*packagename* is the base name of the installed package, for example **ibm-commserver**.

### Changing the Language Environment® Variable

When you use CS Linux, make sure that the LANG variable is set correctly to indicate the language you want to use.

Use the following command to change the LANG variable:

```
export LANG=language
```

Replace *language* with the identifier for the language you want to use, which can be one of the following:

| Identifier | Language                 |
|------------|--------------------------|
| en_US      | English (United States)  |
| Ja_JP      | Japanese (PC)            |
| de_DE      | German                   |
| es_ES      | Spanish                  |
| fr_FR      | French                   |
| ko_KR      | Korean                   |
| pt_BR      | Portuguese               |
| zh_CN      | Chinese (Simplified EUC) |
| zh_TW      | Chinese (Traditional)    |

---

## Migrating from previous levels of CS Linux

If you already have an earlier version of CS Linux installed and are now migrating to Version 6.2, you need to take the following steps:

### Save any customized configuration files

If any of the files listed below exist, save them to a temporary directory. Not all of these files will exist in all installations.

```
/etc/opt/sna/sna_node.cfg
/etc/opt/sna/sna_domn.cfg
/etc/opt/sna/sna_tps
/etc/opt/sna/ibmcs.kdb
/etc/opt/sna/ibmcs.sth
/etc/opt/sna/ibmcs.rdb
/etc/opt/sna/ibmcs.crl
```

### Uninstall the old release

Use the following commands to stop CS Linux and uninstall it. Depending on how you installed the previous version, not all of the RPM packages listed may exist on your system.

```
sna stop
rpm -e CS-LINUX-ptf
rpm -e CS-LINUX-Docs
rpm -e CS-LINUX-ecl
rpm -e CS-LINUX
rpm -e gsk5bas
rpm -e gsk6bas
```

### Uninstall LiS

Use the following commands to uninstall the current level of the LiS open source package.

```
PATH=$PATH:/sbin
unset LD_PRELOAD
rmmod streams
cd /usr/src/LiS
make uninstall
make very-clean
cd /usr/src
rm -rf LiS*
```

### Change PATH and other environment variables

If you modified any of the following environment variables for the earlier



## Migrating from previous levels of CS Linux

CS Linux version, you should remove the changes you made, because the paths may be different for the CS Linux Version 6.2 Program Product.

```
PATH
LD_LIBRARY_PATH
LD_RUN_PATH
LD_PRELOAD
CLASSPATH
```

You may want to use the **env** command to check all environment variables for references to **sna**:

```
env | grep sna
```

### Other packages

You are recommended to check your Java installation and update it to the latest level if necessary.

### Final clean-up

The following command will remove any remaining items from the old level of the product:

```
rm -rf /etc/opt/sna /var/opt/sna /opt/sna
```

### Install the new level of the CS Linux Version 6.2 Program Product

Follow the instructions in this manual and in the **README** file to install the product.

### Restore the saved configuration

If you saved any configuration files in the first step of this process, now is the time to restore them. First stop the CS Linux software with the following command:

```
/opt/ibm/sna/bin/sna stop
```

Restore the files you saved to the **/etc/opt/ibm/sna** directory, and then start the CS Linux software again with the following command:

```
/opt/ibm/sna/bin/sna start
```

---

## Installing the CS Linux Licensed Program

After you have installed the pre-requisite software as described in “Installing Pre-Requisite Software” on page 22, you are ready to install CS Linux. Use the following procedure:

1. Log in with root privileges.
2. Install CS Linux as described in “Installing CS Linux” on page 25.
3. If you installed the GSKIT software in order to use TN Server or TN Redirector with the SSL feature, you need to configure the SSL software after you have installed CS Linux. See “Configuring SSL for use with TN Server or TN Redirector” on page 26 for more information.
4. Customize CS Linux configuration information as needed (see Chapter 7, “Configuring and Using CS Linux,” on page 47, or refer to *CS Linux Administration Guide*).

The installation utility starts CS Linux automatically upon completion.

### Note:



1. Installing CS Linux automatically reconfigures the SNA device drivers on the local node. If you are installing on a computer with limited memory, e.g. 64 MB, you may need to reboot after installing CS Linux before the SNA node can be started.
2. You can install adapters after CS Linux is installed. You do not need to reinstall CS Linux after adding an adapter.

### Installing CS Linux

1. Put the installation CD into the appropriate drive on the Linux workstation.
2. Log in with root privileges.
3. Run the **installibmcs** program from the CD. See the **README** file on the CS Linux CD image for details of the commands required to do this.

The program normally prompts you for the following.

- Confirmation that you have read and accepted the CS Linux license terms.
- The name of the server that will be the master server in the CS Linux domain. If you want to run CS Linux as a standalone node, do not specify this parameter; in this case, the node will not support client/server functions.

You can override these prompts by specifying additional parameters on the **installibmcs** command as described below.

4. If you want to install the CS Linux PDF documentation, run the **installibmcsdocs** program from the CD.
5. Customize CS Linux configuration information (see Chapter 7, “Configuring and Using CS Linux,” on page 47, or refer to *CS Linux Administration Guide*).

If you need to do an unattended installation, you can provide additional parameters on the **installibmcs** command to confirm acceptance of the CS Linux license terms and to specify the name of the master server. In this case, the shell script will run without prompting for any additional information. Use the following command:

```
./installibmcs license_accepted [ master_name ]
```

*master\_name* is the name of the master server. If you want to run CS Linux as a standalone node, do not specify this parameter; in this case, the node will not support client/server functions.

**Note:** Installing CS Linux automatically reconfigures the SNA device drivers on the local node.

---

## Post-Installation Procedures

This section explains how to perform maintenance tasks that may be required after installing CS Linux.

### Viewing PDF Books

The manuals included on the installation media for this product are in Portable Document Format (PDF). Softcopy format enables you to search, browse, or print the information easily, using hypertext links for related information. It also makes it easier to share the library across your site, because PDF viewers are available for many different platforms.

## Post-Installation Procedures

If you choose to install the PDF manuals when installing the product, they are installed in the directory `/opt/ibm/sna/docs`. The manuals are also included in the directory `/DOCS` on the CS Linux installation media.

You can read the PDF manuals using any PDF viewer, such as Adobe Acrobat on Windows or `xpdf` on Intel Linux.

### Reviewing Current Release Information

The latest update of the `README` file for the product, contained in the `/opt/ibm/sna` directory, contains information about any product changes following the publication of the CS Linux library. This file is also included in the root directory of the CS Linux installation media. Review the `README` file whenever you receive product updates.

### Configuring SSL for use with TN Server or TN Redirector

If you installed the GSKIT software in order to use TN Server or TN Redirector with the SSL feature, you need to configure the SSL software after you have installed CS Linux.

The SSL software requires two components:

- A key pair is required to allow data encryption and decryption to be carried out.
- A certificate is required to allow server authentication.

The certificate and key pair make up a single record in a keyring database, which is stored on the CS Linux server running TN Server or TN Redirector. CS Linux uses the database to implement SSL.

To manage the keyring database, type the following command at the Linux command prompt:

```
snakeyman
```

The `snakeyman` command launches a Java program. See the help provided with this program for further instructions.

Each record in the database is identified by a unique name known as a label. If you have two or more records to use on different TN Server or TN Redirector sessions, you need to make a note of the labels you assign when setting up the database; these labels are used to identify which record is to be used on each session. You can also identify one of the records as the default, so that sessions will use this record unless you explicitly specify the label of a different record.

### Backing Up CS Linux Configuration Files

CS Linux automatically backs up the node, domain, and TP configuration files whenever you make changes that affect those files (using any of the CS Linux administration tools). For example, when you make a change that affects the node configuration file (`sna_node.cfg`), CS Linux creates a backup file named `sna_node.bk $n$` , where  $n$  is either 1 or 2:

- The first time you change the file, the existing configuration is saved to `sna_node.bk1`.
- The second time you change the file, the existing configuration is saved to `sna_node.bk2`, leaving `sna_node.bk1` unchanged.

- The third time you change the file, and any subsequent times, **sna\_node.bk1** is discarded, **sna\_node.bk2** is renamed to **sna\_node.bk1**, and the existing configuration is saved to **sna\_node.bk2**.

This process means that there is a maximum of two backup files for the node configuration file at any time. The same process is used to generate filename extensions for other backup files.

In addition to automatic backups, you should back up configuration files to protect against loss of data under any of the following conditions:

- Before installing a new level of the Linux operating system
- Before installing a new release of CS Linux
- After you create a new configuration

You can back up configuration files by performing the following steps:

1. `cd /etc/opt/ibm/sna`
2. `tar cvf Devicename sna_node.cfg sna_tps sna_domn.cfg ibmcs.*`

## Restoring a Backup Copy of CS Linux Configuration Files

To restore CS Linux configuration files that were backed up as described in “Backing Up CS Linux Configuration Files” on page 26, do the following:

1. Ensure that CS Linux is not active. To determine whether it is, enter the following command:

```
snaadmin status_node
```

If CS Linux is active, the command displays information about the local node's status; otherwise it displays a message indicating that CS Linux is inactive.

If CS Linux is active, enter the following command to deactivate it:

```
sna stop
```

2. Enter the following commands:

```
cd /etc/opt/ibm/sna
tar xvf Devicename
```

In this command, *Devicename* is the path and file name of the device you used when backing up the files.

This command overwrites any existing configuration files with the same names in the `/etc/opt/ibm/sna` directory.

## Enabling CS Linux with a Specific Configuration

Normally, CS Linux starts using the configuration files in the `/etc/opt/ibm/sna` directory. You can also start (enable) CS Linux using named configuration files, as follows:

```
sna start -n node_config_file -d domain_config_file
```

In this command, *node\_config\_file* is the path and file name of a file that contains valid node configuration data, and *domain\_config\_file* is the path and file name of a file that contains valid domain configuration information.

### Reinitializing Configuration Files

If CS Linux configuration files are inadvertently modified so that the information in them can no longer be used, you may need to reinitialize the files so that you can reconfigure CS Linux as though it were newly installed. This should be done only if you are sure the configuration information cannot be salvaged.

**Note:** If you have backup configuration files that are valid, you can copy those files to the `/etc/opt/ibm/sna` directory and use them to initialize the node using the `sna start` command.

You can reinitialize the following configuration files:

- Node configuration file `sna_node.cfg`
- Domain configuration file `sna_domn.cfg`
- TP configuration file `sna_tps`
- SSL keyring database file and password stash file

Perform the following steps to reinitialize configuration files:

1. Exit the administration program if it is active, and disable CS Linux by issuing the following command:

```
sna stop
```

2. Back up the existing configuration files by copying any files you are reinitializing to a different location.
3. Delete the files you are reinitializing.
4. If you deleted the domain configuration file, issue the following command to recreate it (by copying from the empty domain configuration file delivered with CS Linux):

```
cp -p /opt/ibm/sna/samples/empty.cfg /etc/opt/ibm/sna/sna_domn.cfg
```

This command creates a new domain configuration file, which is required to start CS Linux.

5. If you deleted the SSL keyring database file, issue the following command to recreate it (by copying from the sample file delivered with CS Linux):

```
cp -p /opt/ibm/sna/samples/ibmcs.* /etc/opt/ibm/sna
```

6. Issue the following command to restart CS Linux:

```
sna start
```

7. Start the Motif administration program:

```
xsnaadmin &
```

If the `sna_node.cfg` file does not exist, the administration program prompts you to configure the node. You can continue by configuring the node and the other resources as described in Chapter 7, “Configuring and Using CS Linux,” on page 47 or *CS Linux Administration Guide*.

If you used a valid `sna_node.cfg` file, the new configuration file is used to initialize the node.

---

## Uninstalling CS Linux

You can uninstall the CS Linux product at any time. Use the following procedure:

1. Log in with root privileges.

2. Ensure that CS Linux is not active. To determine whether it is, enter the following command:

```
snaadmin status_node
```

If CS Linux is active, the command displays information about the local node's status; otherwise it displays a message indicating that CS Linux is inactive.

If CS Linux is active, enter the following command to deactivate it:

```
sna stop
```

3. Remove the CS Linux package and associated software packages by using the following instructions:

```
rpm -e ibm-commserver-docs
```

```
rpm -e ibm-commserver-ecl
```

```
rpm -e ibm-commserver
```

```
/sbin/shutdown -r now
```

## Uninstalling CS Linux

---

## Chapter 4. Installing CS Linux on Linux Clients

This chapter describes how to install CS Linux on a Linux client.

If you are installing CS Linux on a Linux for zSeries client, see Chapter 5, “Installing CS Linux on Linux for zSeries Clients,” on page 35 for information on the installation process.

If you are installing CS Linux on a Windows client, see Chapter 6, “Planning for and Installing CS Linux on Windows Clients,” on page 39 for information on the installation process.

---

### Preparing for CS Linux Installation

Before installing CS Linux, perform the following tasks:

- Ensure that the Linux PC is not running with Power Management features enabled.
- Ensure that all pre-requisite software listed in “Installation Requirements” on page 17 is installed.

The following sections provide information about these tasks.

#### Disabling Power Management features

Before installing CS Linux, you need to check whether your Linux PC includes Advanced Power Management features; if so, you should ensure that these features are disabled. Many PCs now include these features, designed to save power if the keyboard or mouse is not being used (by suspending power to devices such as disk drives, and by reducing the CPU clock rate). Advanced Power Management is designed for use with the PC as a workstation; it is not appropriate when the PC is operating as a server, because a server can be operating normally with no keyboard or mouse activity occurring.

To disable these features, access the BIOS Configuration during startup of the PC (normally by pressing **F1** while initializing hardware), and disable both Advanced Power Management and Hardware Power Management.

To remove the Advanced Power Management feature from your PC, use the following command.

```
rpm -e apmd
```

#### Installing Pre-Requisite Software

Before installing CS Linux, you need to install the pre-requisite software listed in “Installation Requirements” on page 17:

- LiS Streams
- Java

For full details of the software packages required and step-by-step instructions for installing them, see the **README** file on the CS Linux CD image.

### Displaying Product Installation Details

You can display information about CS Linux and related software packages that are already installed. To list all the installed packages, use the following command:

```
rpm -q -a
```

To view more details of a specific package, use the following command:

```
rpm -q -i packagename
```

*packagename* is the base name of the installed package, for example **ibm-commserver-client**.

### Setting the Language Environment Variable

When you use CS Linux, make sure that the LANG variable is set correctly to indicate the language you want to use. Use the following command to change the LANG variable:

```
export LANG=language
```

Replace *language* with the identifier for the language you want to use, which can be one of the following:

---

| Identifier | Language                 |
|------------|--------------------------|
| en_US      | English (United States)  |
| Ja_JP      | Japanese (PC)            |
| de_DE      | German                   |
| es_ES      | Spanish                  |
| fr_FR      | French                   |
| ko_KR      | Korean                   |
| pt_BR      | Portuguese               |
| zh_CN      | Chinese (Simplified EUC) |
| zh_TW      | Chinese (Traditional)    |

---

---

## Installing the CS Linux Licensed Program

After you have installed the pre-requisite software as described in “Installing Pre-Requisite Software” on page 31, you are ready to install CS Linux. Use the following procedure:

1. Log in with root privileges.
2. Install CS Linux as described in “Installing CS Linux.” Select the features you wish to install (including any applicable message filesets), or select all to install CS Linux with all of its included features.

### Installing CS Linux

To install CS Linux, take the following steps.

1. Put the installation CD into the appropriate drive on the Linux workstation.
2. Log in with root privileges.
3. Change to the **/ibm-commserver-clients/linux** directory on the CD.
4. Run the **installibmccli** program from the CD. See the **README** file in the **/ibm-commserver-clients/linux** directory on the CS Linux CD for details of the commands required to do this.



The program normally prompts you for confirmation that you have read and accepted the CS Linux license terms. If you need to do an unattended installation, you can provide an additional parameter on the **installibmcscli** command to confirm acceptance of the CS Linux license terms. In this case, the shell script will run without prompting for any additional information. Use the following command:

```
./installibmcscli license_accepted
```

5. Add the CS Linux binary directories to your PATH. You may want to change your profile to do this automatically.

```
export PATH=$PATH:/opt/ibm/sna/bin'  
export LD_LIBRARY_PATH=/usr/lib:/opt/ibm/sna/lib  
export LD_RUN_PATH=/usr/lib:/opt/ibm/sna/lib
```

For Java CPI-C applications you should also set the following environment variable:

```
export CLASSPATH=$CLASSPATH:/opt/ibm/sna/java/cpic.jar
```

For some applications you may also need to set the LD\_PRELOAD environment variable, but you should not make this a global change in your profile:

```
export LD_PRELOAD=/usr/lib/libpLiS.so
```

---

## Post-Installation Procedures

This section explains how to perform maintenance tasks that may be required after installing CS Linux.

### Reviewing Current Release Information

The latest update of the **README** file for the product, contained in the **/opt/ibm/sna** directory, contains information about any product changes following the publication of the CS Linux library. This file is also included in the root directory of the CS Linux installation media. Review the **README** file whenever you receive product updates.

---

## Uninstalling CS Linux

You can uninstall the CS Linux client at any time. Use the following procedure:

1. Log in with root privileges.
2. Remove the CS Linux client package and associated software packages by using the following instructions:

```
rpm -e ibm-commserver-client  
/sbin/shutdown -r now
```

## Uninstalling CS Linux

---

## Chapter 5. Installing CS Linux on Linux for zSeries Clients

This chapter describes how to install CS Linux on a Linux for zSeries client.

If you are installing CS Linux on a Linux client, see Chapter 4, “Installing CS Linux on Linux Clients,” on page 31 for information on the installation process.

If you are installing CS Linux on a Windows client, see Chapter 6, “Planning for and Installing CS Linux on Windows Clients,” on page 39 for information on the installation process.

---

### Preparing for CS Linux Installation

#### Installing Pre-Requisite Software

Before installing CS Linux, you need to install the pre-requisite software listed in “Installation Requirements” on page 17:

- LiS Streams
- Java

For full details of the software packages required and step-by-step instructions for installing them, see the **README** file on the CS Linux install image.

#### Displaying Product Installation Details

You can display information about CS Linux and related software packages that are already installed. To list all the installed packages, use the following command:

```
rpm -q -a
```

To view more details of a specific package, use the following command:

```
rpm -q -i packagename
```

*packagename* is the base name of the installed package, for example **ibm-commserver-client**.

#### Setting the Language Environment Variable

When you use CS Linux, make sure that the `LANG` variable is set correctly to indicate the language you want to use. Use the following command to change the `LANG` variable:

```
export LANG=language
```

Replace *language* with the identifier for the language you want to use, which can be one of the following:

---

| Identifier   | Language                |
|--------------|-------------------------|
| <b>en_US</b> | English (United States) |
| <b>Ja_JP</b> | Japanese (PC)           |
| <b>de_DE</b> | German                  |
| <b>es_ES</b> | Spanish                 |

---

---

| Identifier | Language                 |
|------------|--------------------------|
| fr_FR      | French                   |
| ko_KR      | Korean                   |
| pt_BR      | Portuguese               |
| zh_CN      | Chinese (Simplified EUC) |
| zh_TW      | Chinese (Traditional)    |

---

---

## Installing the CS Linux Licensed Program

After you have installed the pre-requisite software as described in “Installing Pre-Requirement Software” on page 22, you are ready to install CS Linux.

### Installing CS Linux

To install CS Linux, take the following steps.

1. Copy or FTP the **ibm-commserver-client-6.2.0.0-1.s390.tgz** file from the **/ibm-commserver-clients/linux-zseries** directory on the CD-ROM to the Linux zSeries system. Ensure that you use binary mode to copy or FTP the file.
2. Log into the Linux zSeries system as root.
3. Uncompress and unpack the tar file into an empty temporary directory:

```
mkdir /tmp/ibmcs
cd /tmp/ibmcs
zcat ibm-commserver-client-6.2.0.0-1.s390.tgz | tar -xvf -
```

4. Run the **installibmcscli** shell script:

```
./installibmcscli
```

This shell script tests for certain pre-requisites and issues warning messages if they are not met. It also prompts you to confirm that you have read and accepted the CS Linux license terms. You can override this prompt by specifying additional parameters on the **installibmcscli** command as described below. When you have responded to the prompt, the shell script installs the **rpm** packages.

If the shell script encounters an error that prevents successful installation of CS Linux, it writes an error message to standard output (typically to the screen). For help with resolving any such errors, refer to the **README** file on the CS Linux install image.

5. Add the CS Linux binary directories to your PATH. You may want to change your profile to do this automatically:

```
export PATH=$PATH:/opt/ibm/sna/bin
export LD_LIBRARY_PATH=/usr/lib:/opt/ibm/sna/lib
export LD_RUN_PATH=/usr/lib:/opt/ibm/sna/lib
```

For Java CPI-C applications you should also set the following environment variable:

```
export CLASSPATH=$CLASSPATH:/opt/ibm/sna/java/cpic.jar
```

For some applications you may also need to set the **LD\_PRELOAD** environment variable, but you should not make this a global change in your profile:

```
export LD_PRELOAD=/usr/lib/libpLiS.so
```

If you need to do an unattended installation, you can provide an additional parameter on the **installibmcscli** command to confirm acceptance of the CS Linux

license terms. In this case, the shell script will run without prompting for any additional information. Use the following command:

```
./installibmcscli license_accepted
```

---

### Post-Installation Procedures

This section explains how to perform maintenance tasks that may be required after installing CS Linux.

#### Post-Install Cleanup

When you are done with the installation, you can erase the **tgz** file and temporary directory that were created during the installation process.

#### Reviewing Current Release Information

The latest update of the **README** file for the product, contained in the **/opt/ibm/sna** directory, contains information about any product changes following the publication of the CS Linux library. This file is also included in the root directory of the CS Linux installation media and in the **tgz** file. Review the **README** file whenever you receive product updates.

---

### Uninstalling CS Linux

You can uninstall the CS Linux product at any time. Use the following procedure:

1. Log in with root privileges.
2. Remove the CS Linux package and associated software packages by using the following instructions:

```
rpm -e ibm-commserver-client  
/sbin/shutdown -r now
```

## Uninstalling CS Linux

---

## Chapter 6. Planning for and Installing CS Linux on Windows Clients

The CS Linux Windows Client software enables a PC to run SNA applications without having a complete SNA stack installation on the PC. A Windows client PC can connect to one or more CS Linux servers using a TCP/IP network.

The interfaces provided by the CS Linux Windows client software are broadly compatible with those provided by the IBM Communications Server for Windows and Microsoft Host Integration Server products.

The CS Linux Windows Client Software Development Kit (SDK) is an optional package that allows you to use the Windows Client to develop application programs using the APPC, CPI-C, LUA, and CSV APIs. Refer to the appropriate programmer's reference guide for more information about these APIs. You do not need to install this package if the Windows Client will be used only to run existing applications (not to develop new ones).

---

### Hardware and Software Requirements

To run the **Setup** program and the Windows client software, the computer must meet the following requirements:

- It must be running one of the following operating systems:
  - Windows 2000
  - Windows XP
  - Windows Server 2003
- It must have access, over a TCP/IP network, to a CS Linux server that has client support installed.

---

### Accessing the Windows Client Setup Program

The Windows client software and Windows Client SDK software, and the **Setup** program, are included on the CS Linux delivery CD in Windows format, so that you can install them from the CD on the Windows computer. You must install the Windows Client software on each Windows client PC. The SDK is required only if you will be using the client to develop new applications using the CS Linux APIs, and is not required if you will be using it only to run existing applications.

The Windows Client installation image is a self-extracting ZIP executable file named **i\_w32cli.exe**, which is located in the **/ibm-commserver-clients/windows** directory on the CS Linux delivery CD. You can copy this file to other Windows clients across the network, so that you can install them without direct access to the CS Linux delivery CD. When you run this executable, it prompts you for the name of a temporary directory on the Windows computer, into which it unzips the installation image containing the **Setup** program.

The first time you run the **Setup** program on a particular computer, the program runs from the selected source. The program handles the complete installation process, sets up a basic configuration, and also installs and creates an icon for

## Accessing the Windows Client Setup Program

itself. After installation is complete, you can use the **Setup** program (either by selecting it from the File Manager or by selecting its icon) if you need to reinstall the software.

After you have extracted the Windows client installation image into a temporary directory, you can install the Windows client software in either of two ways:

- Run the **Setup** program through Windows, as explained in “Installing Windows Client Software Using the Setup Program.” You must use this method if you want to install the Windows Client SDK.
- Enter the **setup** command from the command line, as explained in “Installing Windows Client Software from the Command Line” on page 43. This method does not allow you to install the Windows Client SDK.

---

## Installing Windows Client Software Using the Setup Program

After you have extracted the Windows client installation image into a temporary directory, follow these steps if you are installing the Windows Client software on this computer for the first time.

1. Change to the temporary directory in which you extracted the installation image, and issue the **setup** command at the prompt.

The program displays a Choose Setup Language screen.

2. Select the language that you want to use for installing and configuring the Windows client, and choose **OK**.

The program displays a Welcome screen that introduces you to the **Setup** program.

3. Choose **Next** to continue with the installation.

The program displays the Software Licensing Agreement, which you should read and understand.

4. If you are happy to accept the licensing terms, choose **Accept** to continue.

The program prompts you to specify a destination directory into which the files are to be installed.

5. Enter the destination directory.

The program asks you to choose the type of installation you want:

### Typical

Include the files that are typically required for normal use. This option is correct for most users.

### Compact

Include the minimum set of files required to run the Windows Client. Choose this option if you need to minimize the hard disk space taken up by the client files.

### Custom

Customize the installation to include specific files that you need.

**Note:** If you want to install the Windows Client SDK, you must choose **Custom**.

6. Choose the installation type.

If you chose **Custom**, the program allows you to select the Windows Client program files, the Windows Client SDK, or both. Choose the files that you want to install.



## Installing Windows Client Software Using the Setup Program

For all installation types, the program then asks you to enter the name of the program folder in which you wish icons for the CS Linux Windows client software to appear.

7. Enter the folder name.
8. If the System directory already contains **.DLL** files with names that are the same as files used by this **Setup** program but are not CS Linux files (for example, files from some other SNA software), the program prompts you to do one of the following:
  - Copy the CS Linux **.DLL** files over the existing **.DLL** files
  - Copy the existing **.DLL** files to a subdirectory named **OTHERSNA** within the installation directory, and then install the CS Linux **.DLL** files. This option enables you to restore the original setup from before the CS Linux installation if you uninstall the CS Linux files at a later time (see “Uninstalling the CS Linux Windows Client Software” on page 45).
  - Cancel the client software installation.

If the CS Linux **.DLL** files are already present, the **Setup** program displays a message indicating this. New **.DLL** files will overwrite the existing **.DLL** files only if the existing files have lower version numbers than the **Setup** program **.DLL** files.

9. At this point, the **Setup** program copies files from the specified source, and installs them in the appropriate places. During this process, an information bar displays what portion of the installation is complete. The **.DLL** files are copied into the System or equivalent directory, and the other files are copied into the destination directory you specified in Step 2. During each file transfer operation, a record is written to the **setup.log** file, which is created in the directory you specified. If any of the files to be written over is “read only”, or any file cannot be copied for any other reason, the new files are removed and you receive a message advising you to look at the **setup.log** file.
10. If the source from which you are running the **Setup** program does not contain all the required files, the program prompts you for a directory name. Enter the name of a directory in which the required files are located.

If the information you specified is not sufficient to locate copies of the CS Linux files, the program displays this screen again.
11. When the required files have been copied, the **Setup** program displays the Configuration window.

Default configuration values are taken from the domain configuration file. For more information, see the *CS Linux Administration Guide*. If you do not want to use these default values, you can configure them as shown below:

### *Domain*

Specify the CS Linux client/server domain name.

The following settings are optional:

### *Server Name*

The screen shows a list of up to nine servers to which this client can connect. The order in which servers appear in this list is the order in which the client selects these servers. If the client cannot connect to the first server on the list, the next server is tried.

- To add a new server to the list, use the **Add** button.
- To remove a server from the list, select the server and use the **Remove** button.
- To move a server up or down the list, select the server and use the slide buttons at the side of the list.

## Installing Windows Client Software Using the Setup Program

### *UDP broadcasts*

Specify whether this client will use UDP broadcasts to connect to a server. When this option is selected, the client sends UDP broadcasts over the network to locate a server connection instead of trying to connect directly to a specific server.

The default setting is to use UDP broadcasts. To change this setting, click on the box.

### *Advanced*

To supply additional values in place of the defaults supplied by the **Setup** program, click on the **Advanced** button at the bottom of the window. The **Setup** program displays the Advanced Options window, which contains advanced settings for Windows client configuration. Most users can use the default settings for these parameters, so you probably do not need to alter the settings in that dialog.

For more information about these parameters, see “Advanced Options for Windows Client Configuration.”

For more information about any of the configuration parameters or settings, click on **Help**.

12. When you have completed the Configuration window, click on **OK**. The **Setup** program displays a message if you have not completed this screen properly.
13. When the installation has successfully completed, the Finish window is displayed. You can select either or both of the following actions to be taken after you exit the installation program:

#### **View README file**

View the **README** file.

#### **Start client**

Begin running this CS Linux client.

Choose **Finish** to exit the installation program.

---

## Advanced Options for Windows Client Configuration

The Advanced Options window enables you to configure some advanced parameters for the Windows client. Most users do not need to alter these parameters, but you can adjust the default settings if necessary.

### *LAN access time-out*

Specify the time in seconds that the socket can remain idle before it is closed. When this check box is empty, no LAN access time-out has been specified (and so an infinite time-out will be used). If you check this box, you can enter a time-out value in seconds in the adjacent field. The minimum value is 60 (for 60 seconds); if you leave the box blank or specify a value lower than 60, the Windows client uses the minimum value 60.

### *Max. broadcast attempts*

Specify the maximum number of times the client attempts to connect to a server by broadcast. When the Advanced Options window is opened, the default value of 5 is displayed. The value in this box is used only if the UDP broadcasts check box is checked on the main Configuration window.

### *Reconnect time-out*

Specify the time in seconds that the client waits before attempting to reconnect to a server after the server has gone down. When the Advanced Options window is opened, the default value of 200 is displayed.

For more information about these parameters, press **Help**.

When you have completed the Advanced Options window, click on **OK**. If you have completed the screen properly, the **Setup** program returns to the Configuration window. If you are installing a new Windows client, return to Step 12 on page 42. Otherwise, click on the **OK** button in the Configuration dialog to complete the configuration.

---

## Installing Windows Client Software from the Command Line

**Note:** If you want to install the Windows Client SDK, you must use the **Setup** program, as explained in “Installing Windows Client Software Using the Setup Program” on page 40. You cannot install the Windows Client SDK from the command line.

After you have extracted the Windows client installation image into a temporary directory, you can install the Windows client software from the command line instead of using the **Setup** program through Windows. At the command line, enter the **setup** command with one or more options. You can enter these options in uppercase or lowercase, and can precede them with a / (slash) or - (hyphen). If a parameter, such as *folder*, is a string that contains a space, you must enclose the string inside double quotes.

After you enter the **setup** command, the **Setup** program prompts you for any information you have not included on the command line, and displays confirmation messages at various stages of the setup. If you do not want the **Setup** program to prompt you, use the **-accept -s** option to run the program in silent mode, accepting the terms of the Software License Agreement.

Following are the **setup** command options:

**-?** Display a list of the command line options. This is the same as the **-h** option.

**-h** Display a list of the command line options. This is the same as the **-?** option.

**-accept -s**  
Run the installation in silent mode, accepting the terms of the Software License Agreement. This agreement can be found in the **license** subdirectory of the Windows installation image.

The **-s** option must be the last one in the command line, and you must be sure you have specified the domain name (using the **-i** option) and any other parameters that you want to specify. When the installation runs in silent mode, it does not prompt you for any parameters or display confirmation messages. Any command-line arguments after **-s** are ignored.

**-f2** Specify the full pathname of the installation log file that is created during silent mode installation (using the **-s** option).

If you do not specify this option, the file is created as **setup.log** in the directory from which you run the installation program. If you are installing in silent mode from the CD drive, you must specify this option to ensure that the file is created on your computer (because it cannot be created on the CD drive).

**-k folder**  
Specify the Program folder.

## Installing Windows Client Software from the Command Line

- p** *directory*  
Specify the install directory.
- i** *domain*  
Specify a domain name for this client. This parameter is required; there is no default.
- w** *directory*  
Specify the source directory containing CS Linux client software files if the source is located on a disk or CD. Otherwise, use the **-v** option.
- v** *server*  
Specify the server from which the client software files are to be downloaded. You can specify either the server name or TCP/IP address. If you are copying the source files from a disk or CD, use the **-w** option instead of the **-v** option.
- l** *server*  
Specify a server to be included in the list of servers this client can access.
- o**  
Overwrite existing **.DLL** files. If the CS Linux **.DLL** files are already present, the **Setup** program overwrites these files even if they have a higher version number than the **Setup** program **.DLL** files.
- y**  
Save existing **.DLL** files. If the CS Linux **.DLL** files already exist in the required directories, the **Setup** program copies the existing **.DLL** files to a subdirectory of the install directory, and then installs the CS Linux **.DLL** files. The copies in the subdirectory ensure that if you uninstall the CS Linux client software, the uninstall process will be complete.
- n**  
Cancel the installation if existing CS Linux **.DLL** files are found.
- a** *timeout*  
Specify the LAN access time-out in seconds. This is the length of time a socket can remain idle before being closed. The value 0 indicates no time-out.
- b** *max-broadcast*  
Specify the maximum number of UDP broadcast attempts. A UDP broadcast is a client's attempt to connect to any server in the domain rather than to a specific server. The value 0 indicates no broadcast attempts are made.
- j** *reconnect-timeout*  
Specify the time in seconds that the client waits before attempting to reconnect to a server after the server has gone down.

---

## Customizing the Client Software after Installation

You can change any of the customized settings any time after the initial installation by running the **Configuration Utility** program, located in the CS Linux program group. The program displays the same Configuration window that was displayed in the initial install process. You can change the information in any field by following the procedure in "Installing Windows Client Software Using the Setup Program" on page 40.

If you did not install the Windows Client SDK files during the initial installation and you now want to add them, you can do this by running the Setup program again. Choose **Custom** for the installation type, and select the Windows Client SDK package.

---

### Reinstalling the Windows Client Software

You can reinstall the Windows client software at any time, for example, when you wish to upgrade the software.

To do this, run the Setup program as before, using the instructions in “Installing Windows Client Software Using the Setup Program” on page 40 or “Installing Windows Client Software from the Command Line” on page 43. The **Setup** program displays the location from which the client software files were copied during the initial installation. Click on **OK** to get new copies of the files from this same location. When you click on **OK**, the **Setup** program copies the files and returns to the Options screen.

**Note:** If you are reinstalling the Windows Client software in silent mode (as described in “Installing Windows Client Software from the Command Line” on page 43), you may need to restart the computer to complete the installation. This is because some of the program files may be in use during the installation process (for example if the Windows Client is running), and so cannot be replaced by the new files. In this case, the new files are copied to a temporary directory, and will be moved into place automatically when the computer is next restarted.

To check whether you need to restart the computer, use a text editor such as **Notepad** to view the contents of the installation log file when the installation process has completed. The installation log file is called **setup.log** and is created in the directory from which you run the Setup program, unless you use the **-f2** command-line option to specify a different path and filename.

At the end of the file, under the heading **Response Result**, the text **Result Code** should be followed by one of the two values 0 (zero) or -12. If the value is 0, there is no need to restart the computer; if the value is -12, restart the computer before attempting to use the Windows Client.

---

### Uninstalling the CS Linux Windows Client Software

You can uninstall the CS Linux Windows client software at any time, by using the **Remove** option from the Windows Control Panel. Once the uninstall process is confirmed, Windows does the following:

- Deletes all installed files.
- If any **.DLL** files were saved to a subdirectory during the initial installation, restores files to their original location.
- Deletes the subdirectory in which the saved **.DLL** files were stored, as long as the subdirectory is empty.
- Removes the Program folder and created directory if they are empty.
- If the uninstallation is successful, deletes the **setup.log** file, which contains all file transfers and deletions.
- Displays a message saying either that the uninstallation was successful, or that the user should check the **setup.log** file because some part of the installation failed.

The **Exit** button returns you to Windows.

## Help

You can access Help at any time by pressing the **F1** key. The Configuration and Advanced Options windows each have **Help** buttons as well.

---

## Chapter 7. Configuring and Using CS Linux

The easiest way to define and modify the CS Linux configuration is to use the Motif administration program (**xsnaadmin**). This program provides a graphical user interface from which you can view and manage SNA resources on the local node. You can also use other administration tools such as command-line administration, but the Motif program is recommended.

The Motif administration program includes help screens that provide overview information for SNA and CS Linux, reference information for CS Linux dialogs, and guidance for performing specific tasks. For each task (such as configuring the node) or type of communications (such as 3270 or APPC), the program guides you in setting up the configuration of the required resources.

The Motif administration program enables you to set up all required parameters for standard CS Linux configurations. For advanced parameters, the Motif administration program supplies default values. You need to supply only the essential configuration information, which enables you to set up SNA communications quickly and easily.

You can also use the Motif administration program to manage the running CS Linux system. The administration program enables you to make and apply changes to the configuration while CS Linux is active, and provides easy access to status information for node resources.

The Motif administration program automatically displays status information for CS Linux resources. Most of this information is shown on the Node window (see “Managing CS Linux with the Motif Administration Program” on page 50). In addition, you can control certain resources—such as nodes and link stations—using the **Start** and **Stop** buttons on the Node window. Other resources are always started and stopped automatically, so there is no need to control them manually.

### Note:

1. You must be a member of the login group `sna` to define or modify resources for CS Linux.
2. To use the Motif administration program, you must have an X-terminal.
3. For more information about the Motif administration program’s user interface, including the buttons and icons that appear in its windows, refer to the program’s help screens or to *CS Linux Administration Guide*.
4. The windows and dialogs in the Motif administration program may differ from those shown in this guide, depending on the choices you make on a particular dialog.

For information about other CS Linux administration tools, including command-line administration and NOF application programs, refer to *CS Linux Administration Guide*, *CS Linux Administration Command Reference*, or *CS Linux NOF Programmer’s Guide*.



### Planning for CS Linux Configuration

Before you make any configuration changes it is very important to plan thoroughly. Changes that you make can cause disruption, not only to the users of your local node but possibly to users all around the network.

You may find it useful to draw a diagram of any changes that you are making to the topology of the network. If you are adding or removing connections to other nodes, draw a picture showing your node and the other nodes. You can use the Motif administration program to gather configuration information about all of the existing connections and add that information to your diagram.

When you add new resources to your diagram, it is easy to see whether they duplicate existing ones, or whether any names clash. Similarly, your diagram can help you decide which resources you need to remove and help you avoid deleting essential ones.

If you are configuring a Client/Server CS Linux system with more than one node, ensure that you include all the CS Linux nodes and their connectivity resources in your diagram. You can then configure each node in turn as described in this chapter, in the same way as you would configure a standalone node.

Once you determine the changes you need to make, collect the configuration information that you need. To guide you in collecting configuration information for specific CS Linux functions, you can use the task sheets provided in the online help for the Motif administration program, or the planning worksheets provided in *CS Linux Administration Guide*.

This chapter provides instructions for configuring the most frequently used functions available in CS Linux. For each configuration task, this guide also notes the information you need to gather before configuring the resource.

**Note:** This guide does not provide detailed descriptions of the configuration information you need to enter on CS Linux dialogs. For more information about the fields on a particular dialog, consult the online help for that dialog in the Motif administration program.

### Planning Worksheets

Before you begin to configure resources for CS Linux, gather all of the configuration data for the new resources. To record all of the information for a particular function or application that you need to support, use the planning worksheets provided in *CS Linux Administration Guide*.

You will probably need to gather configuration information from several sources, such as network administrators, host administrators, application programmers, and end users.

If you are trying to connect to another node, the administrator at that node is a key contact. The administrator for a node can tell you names, addresses and characteristics of all the resources on that node. Often, you will need to ensure that matching configuration parameters are entered at the local node and the remote node.



## Task Sheets

The online help screens in the Motif administration program contain task sheets that provide guidance for specific configuration tasks. The task sheets contain pointers to all of the help screens for the dialogs that you will use to enter the configuration information. You can use these to browse the help and see exactly what data you must collect.

The task sheets also refer to more detailed help for each of the individual windows and dialogs that you must use to enter configuration information. Those help screens explain each field that you must fill in or select.

---

## Using the Motif Administration Program

Before you use the Motif administration program, you may want to add path information to your **.login** or **.profile** file to enable the system to find executable programs (see “Specifying the Path to CS Linux Programs”). In addition, you must enable the CS Linux software before you can use the administration program (see “Enabling CS Linux”).

For information about invoking the Motif administration program and an overview of using the program, see “Managing CS Linux with the Motif Administration Program” on page 50.

## Specifying the Path to CS Linux Programs

To run CS Linux programs, you must specify the path to the directory that contains the CS Linux executable programs. You can specify the path either by adding the directory to your PATH environment variable before you run the programs for the first time, or by including the directory name each time you run the programs.

The Motif administration program is stored in the directory **/opt/ibm/sna/bin/X11**, and the other programs are stored in the directory **/opt/ibm/sna/bin**. If you add these directories to the definition of the PATH environment variable in your **.login** or **.profile** file, CS Linux locates the programs automatically. Alternatively, you can specify the directory name when you run the program, as in the following examples:

```
/opt/ibm/sna/bin/sna start
```

```
/opt/ibm/sna/bin/X11/xsnaadmin
```

The sample command lines shown in this manual assume that you have added the directories to your PATH environment variable, and do not include the directory names.

## Enabling CS Linux

CS Linux must be enabled on the local system before you can configure or manage the local node. As with any X/Motif application, you may also need to set up the DISPLAY environment variable to indicate a suitable X server.

To enable CS Linux, enter the following command at the Linux command prompt:

```
sna start
```

## Using the Motif Administration Program

When you install CS Linux, the installation utility automatically updates the startup file `/etc/rc.d/init.d/snastart` to include the `sna start` command. This ensures that CS Linux is started automatically at system startup. If you do not want CS Linux to be started automatically, you can remove or comment out this line, and then follow the instructions in this section to enable the CS Linux software manually.

CS Linux writes messages to standard error (normally your terminal's screen) to indicate that it is initializing, and to indicate whether initialization completes successfully.

## Managing CS Linux with the Motif Administration Program

To use the Motif administration program for CS Linux, first make sure that CS Linux is initialized as described in "Enabling CS Linux" on page 49. (You may also need to set up the `DISPLAY` environment variable to indicate a suitable X server.)

To start the Motif administration program in the background, issue the following command:

```
xснаadmin &
```

CS Linux displays the Domain window. This window shows all defined nodes, and enables you to add, delete, start, and stop nodes. Double-clicking on any node brings up the Node window for that node, as shown in Figure 4 on page 51.

The Node window shows information about the node and its resources. If you have not yet configured the node, the administration program prompts you to configure it as described in "Configuring the Node" on page 55.

**Note:** This guide uses the term window to describe Motif windows that display information about CS Linux resources. A window can contain one or more sections, or panes. A dialog is a Motif window on which you can enter information.

The Node window shows most of the information you need, and gives easy access to everything else. It shows all the key resources on the local node.

If you are configuring a Client/Server CS Linux system with more than one node, follow the instructions in this chapter to configure each node in turn (returning to the Domain window to select the next node).

Other windows can be reached from the **Windows** menu in the Node window. These windows include the following:

- LU Pools window
- CPI-C Destination Names window

The **Services** menu in the Node window provides a quick way to add resources and provides help for configuration and management tasks. The **Diagnostics** menu takes you to the Logging dialog and Tracing dialog.

### Node Window

A sample Node window is shown in Figure 4 on page 51. The title bar shows the name of the Linux system.

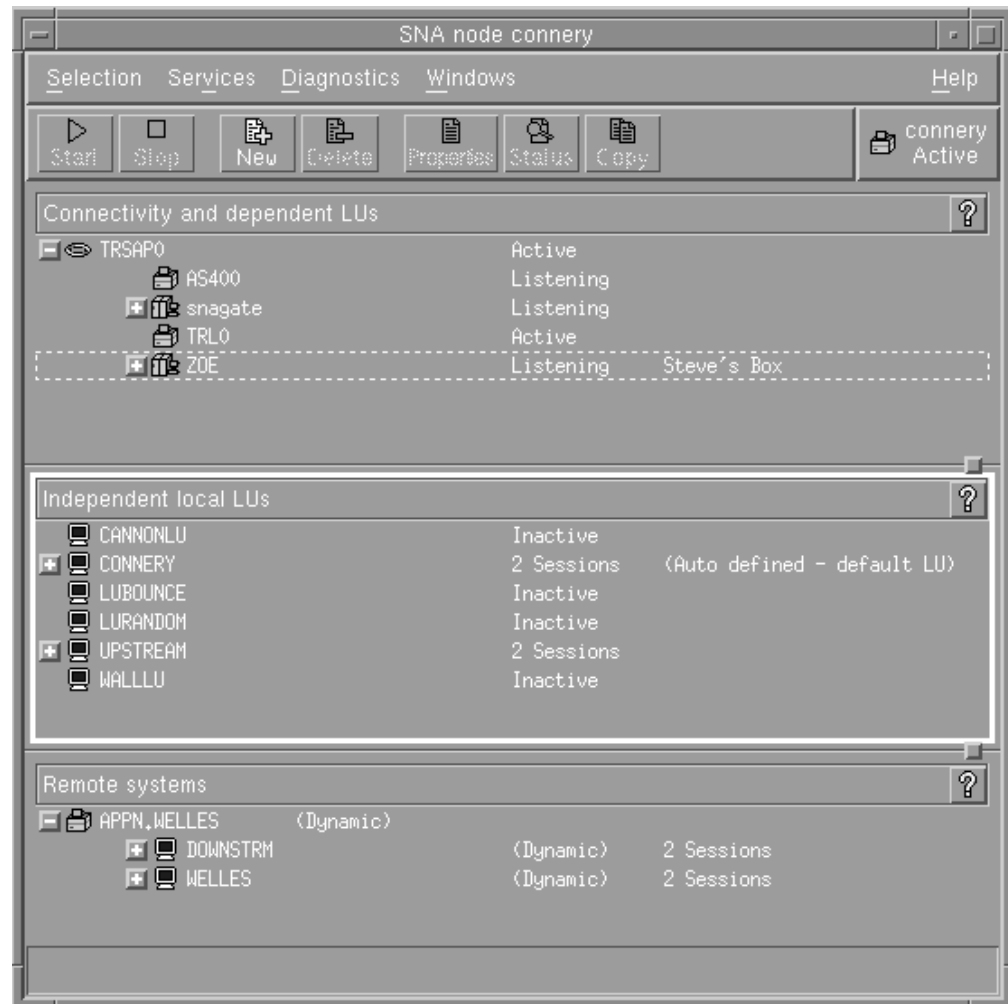


Figure 4. Node Window

From the Node window, you can configure and manage all of the resources and components for the CS Linux node.

- Ports
- Link stations
- LUs of type 0-3 and dependent LUs of type 6.2
- DLUR internal PUs
- Independent local LUs
- Remote nodes
- Partner LUs

You can add, delete, modify and manage all of these resources from the Node window. The layout of the resources in the window shows the relationships among resources and enables you to control which resources are displayed.

Ports, local LUs, and remote nodes are always displayed. The Node window shows each link station below its parent port, and each dependent LU below its parent link station. It also shows partner LUs below local LUs and below remote nodes.

## Using the Motif Administration Program

The Node window contains separate sections for the different types of resources for the node:

- The Node box in the top-right corner of the Node window indicates whether the node is **Active** or **Inactive**.
- The top pane of the Node window (the **Connectivity** pane) lists connectivity resources for the node, including ports, link stations or PUs on each port, and dependent LUs on a specific link station or PU. For each resource, this window shows current status information.
- The middle pane (the **Independent Local LUs** pane) shows independent LUs defined on the local node. This window also displays information about sessions using a particular LU, and any records that define a partner LU's location by the link station that is used to access it.
- The lower pane (the **Remote Systems** pane) shows information about remote nodes and partner LUs. It also shows session information for each remote node or partner LU.

You can select any of these panes by clicking on the pane. You can also select specific resources within a pane by clicking on the line for the resource. To view or modify the configuration for an item, you can double-click on the item. (You can use the buttons and menus on this window to access configuration information for specific resources.)

For each item listed, resources that belong to that item are nested within the information for that item. For example, link stations are grouped under the port to which they belong. You can click on the **Expand** button (+) next to an item to show the resources for that item if they are not currently displayed, or click on the **Contract** button (–) to hide the resources for an item.

You can perform the following administration tasks from the Node window:

### **Start or stop a resource**

Select the resource and click on the **Start** or **Stop** button. (Alternatively, you can select **Start item** or **Stop item** from the **Selection** menu.)

### **Add a resource for an item**

Select the item and click on the **New** button (or select **New** from the **Selection** menu). For example, to add a link station for a port, select the port and click on the **New** button.

### **Delete a resource**

Select the resource and click on the **Delete** button (or select **Delete** from the **Selection** menu).

### **View or modify the configuration for any resource**

Select the resource and click on the **Properties** button (or select **Properties** from the **Selection** menu).

### **Get status information for any resource**

Select the resource and click on the **Status** button (or select **Status** from the **Selection** menu).

### **Copy the configuration for any resource**

Select the resource and click on the **Copy** button (or select **Copy** from the **Selection** menu).

In addition, you can choose specific configuration tasks for the node from the **Services** menu, control logging (for the domain) and tracing (for the node) from the **Diagnostics** menu, and view or modify domain resources by selecting one of the items on the **Windows** menu.

### Resource Items

The layout of the resources in a window shows the relationships among them.

If an item has one or more child items associated with it, an **Expand** symbol (+) or **Contract** symbol (–) appears next to it:

- An **Expand** symbol indicates that the associated child items are hidden. You can click on the **Expand** symbol, or press the + key on the numeric keypad, to show them.
- A **Contract** symbol indicates that the child items are shown. You can click on the **Contract** symbol, or press the – key on the numeric keypad, to hide them.
- If an item has neither symbol next to it, the item has no associated child resources.

For example, a link station is associated with a particular port. In the Connectivity pane of the Node window, the link station is displayed below its parent port, along with all other link stations associated with that port. The port is always displayed, but you can choose whether the list of associated link stations is shown or hidden. Similarly, link stations with a list of associated LUs can be expanded to show the LUs, or contracted to hide them.

A parent resource must always be configured before its child resources, and deleting the parent resource causes all its child resources to be deleted too.

### Tool Bar Buttons

Resource windows include tool bar buttons to make it easy to perform common functions. A tool bar for CS Linux is shown in Figure 5.



Figure 5. CS Linux Tool Bar

Not all buttons appear in the tool bars of each resource window. If a button's operation is not valid for the currently selected item (or an operation requires an item to be selected, but none is), the outline of the button is displayed in gray, and the function cannot be selected (clicking on the button has no effect). The following buttons can appear on resource windows:

**Start** Starts the selected item.

**Stop** Stops the selected item.

**New** Adds a new resource item.

**Delete** Deletes the selected resources.

#### Properties

Opens the dialog for the selected item to view or modify the item's configuration.

**Status** Displays the current status of the selected item.

**Copy** Copies the selected item. Clicking on this button opens a dialog whose

## Using the Motif Administration Program

fields duplicate the configuration of the selected item. Complete the dialog's fields (filling in the new item's name) to add the new resource.

Many resources, such as ports and link stations, cannot be modified while they are active. You can, however, view an active resource's parameters by selecting the resource and clicking on the **Properties** button to open its dialog. Click on the **Close** button when you are finished.

---

## Configuring Client/Server Functions

This section is relevant only if you installed CS Linux to run in a client/server environment (with multiple CS Linux nodes in the same network).

In a client/server environment, a server can be marked as a configuration server; CS Linux maintains a list of these configuration servers. The first server listed is the master server, and any other servers listed are backup servers. The servers are listed in order, so that the second server listed (the first backup server) takes over if the master server is unavailable, the third server listed (the second backup server) takes over if neither the master nor the first backup server is available, and so on.

When any of the nodes in the domain are active, the first available configuration server in the domain (the first server that can be contacted and has CS Linux software running) becomes the master server. If the current master becomes unavailable (because it cannot be contacted, perhaps due to a network failure, or because the SNA software running on it is stopped), the next available configuration server in the list becomes the new master.

CS Linux can run without a master. This happens if none of the servers in the configuration server list can be contacted. If this happens, you can view and configure node resources only on the servers that can be contacted.

**Note:** You cannot directly indicate which node acts as the master server; the master server is selected based on the order in which nodes are added to the configuration server list. If you wish to move a server to the top of the list, remove all other nodes from the list and then add them again.

In the Motif administration program Domain window, you can add a configuration server by selecting **Make configuration server** from the **Selection** menu. The server is added to the end of the list; it becomes the master server only if all other configuration servers are unavailable. To remove a server, select **Remove configuration server** from the **Selection** menu.

**Note:** You cannot delete a server if it is the only server listed on which the CS Linux software is running, because in this case there is no other server that can take over as the master server. At least one enabled master server is required in a client/server configuration.

For more information about configuring and managing a Client/Server CS Linux system, refer to *CS Linux Administration Guide*. This manual also provides information about advanced Client/Server configuration, including how to move clients and servers into different CS Linux domains and how to configure the details of client operation.

## Configuring the Node

The first step in configuring CS Linux on a system is to configure the local node. Node configuration provides the basic information that the node needs in order to communicate in an SNA network. You must configure the node before you can define connectivity or other resources for the node.

If the node has already been configured, you can use the procedures described in this section to modify the node configuration; but you must stop the node before making configuration changes.

Before configuring the node, decide whether to configure the node as an APPN node or as a non-APPN node. This decision depends on the capabilities of the other SNA nodes with which you are communicating.

A CS Linux node that communicates directly with a host computer is shown in Figure 6.

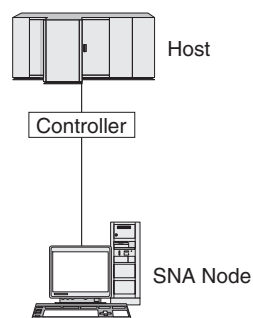


Figure 6. CS Linux Node That Communicates Directly with a Host

If the host does not support APPN, configure the CS Linux node as a LEN node. If the host supports APPN, you can configure the CS Linux node as either an APPN network node or an APPN end node (if CS Linux uses SNA only for communication with the host, you probably want to configure the CS Linux node as an end node or branch network node).

Several CS Linux nodes in an APPN network are shown in Figure 7 on page 56.

## Configuring the Node

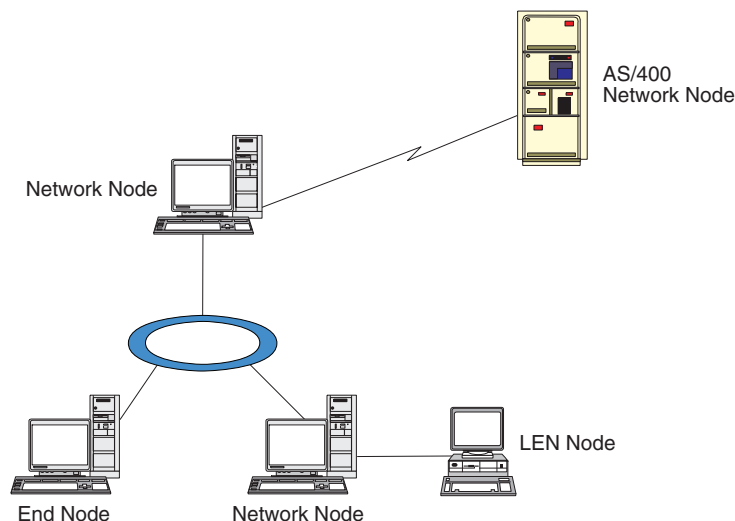


Figure 7. CS Linux Nodes in an APPN Network

When the local node is part of an APPN network, configure it as an APPN network node if the node is to provide APPN routing services for other nodes. If other nodes provide routing services, configure the local node as an APPN end node. If the local node only communicates with one directly connected node (which can be of any type), configure the node as a LEN node.

Before you begin the node configuration, gather the following information:

- Type of APPN support (network node, branch network node, end node, or LEN node).
- Control point name (and alias, if different). Consult with your network planner to determine this name.
- Default Node ID. (You can override this default when configuring an individual communications link.)

To configure the node, perform the following steps from the Node window:

1. Select **Configure node parameters** from the **Services** menu, or double-click on the Node box in the top-right corner of the Node window. CS Linux displays the Node Parameters dialog.
2. Specify the level of APPN support, the control point name, and (if necessary) the default node ID.
3. Click on the **OK** button to define the node. When you define the node, CS Linux automatically defines a default LU with the same name as the control point.

To exit without saving the values you have entered, click on the **Cancel** button.

---

## Configuring Connectivity

For a CS Linux node to communicate with other nodes, you must configure connectivity with at least one adjacent node. A connecting link can be configured to carry dependent traffic, independent traffic, or both.

You can have adapter cards for one or more link protocols installed in your computer. Much of the information you need to enter to configure connectivity depends on the link protocol you are using. For a list of the link protocols supported by CS Linux, see “Installation Requirements” on page 17.



To configure a link, you need to define a port and (in most cases) a link station. When using the Motif administration program, a DLC (data link control) is automatically configured as part of the configuration for the port. In addition, you have the option of defining the port as part of a connection network.

The links that you need to configure depend on what you are trying to achieve, and on whether your network is an APPN network. The information required depends on the link protocol, and on whether the link is for dependent traffic, independent traffic, or both.

As examples, this section explains how to configure the following types of links:

- Link supporting both dependent and independent traffic into an APPN network using the Ethernet link protocol. This example also defines a connection network on the Ethernet port.
- Enterprise Extender link into an APPN network (note that Enterprise Extender links support only independent traffic).

For other link protocols, refer to *CS Linux Administration Guide* or the online help for the Motif administration program.

### Configuring an Ethernet Link to Support Dependent and Independent Traffic

This example shows how to configure an Ethernet link supporting both dependent and independent traffic into an APPN network. In addition, it defines a connection network on the Ethernet port.

For an Ethernet port, you need the following information:

- SNA port name (you can generally use the default). If you have multiple Ethernet network adapter cards, you also need to supply the Ethernet card number. You also need to specify the local SAP (service access point) number (normally 04 for Intel and OSA2 adapters). For an OSA-Express adapter, the local SAP number must match that defined in the OSA/SF for the I/O device addresses that correspond to the ethX interface on this Linux image.
- Whether the port should activate automatically when the node is started.
- Connection network name (must be the same on all ports in the same connection network).

For an Ethernet link station, you need the following additional information:

- Activation method (by administrator, on node startup, or on demand).
- Type of traffic supported (for this example, both dependent and independent).
- Remote node control point name (only needed for a LEN node).
- Remote node type (network node, end node, or discover).
- Remote node role (for this example, downstream SNA gateway or passthrough DLUR).
- To configure a selective link station, you need the MAC (medium access control) address and the SAP number (normally 04) for the remote station. If you do not supply address information and you specify *By administrator* for the *Activation* field, the link station is a nonselective listening link station.

To configure the Ethernet link, perform the following steps from the Node window:

1. Configure the port:

## Configuring Connectivity

- a. Select the Connectivity pane of the window.
  - b. Select **New port** from the **Connectivity** submenu on the **Services** menu (or click on the **New** button in the button bar).
  - c. On the resulting dialog, select the protocol type from the option menu, then choose to define a port.  
When you click on the **OK** button, CS Linux displays the Ethernet SAP dialog.
  - d. Enter appropriate values in the fields on the dialog.
  - e. Click on the **OK** button to define the port.  
The port appears in the Connectivity pane of the Node window.
2. Define a link station on the port:
    - a. Make sure you have selected the port to which the link station is being added in the Connectivity pane of the Node window.
    - b. Select **New link station** from the **Connectivity** submenu on the **Services** menu (or click on the **New** button in the button bar).
    - c. Click on the **OK** button.  
CS Linux displays the Ethernet Link Station dialog.
    - d. Enter appropriate values in the fields on the dialog.
    - e. Click on the **OK** button to define the link station.  
The link station appears beneath the port to which it belongs in the Connectivity pane of the Node window.

## Configuring an Enterprise Extender Link

This example shows how to configure an Enterprise Extender link into an APPN network. Note that Enterprise Extender links support only Independent LU traffic.

For an Enterprise Extender port, you need the following information:

- SNA port name (you can generally use the default). If you have multiple network adapter cards running IP, you also need to supply the IP interface name you want to use (such as eth0).
- Whether the port should activate automatically when the node is started.

For an Enterprise Extender link station, you need the following additional information:

- Activation method (by administrator, on node startup, or on demand).
- Remote node type (network node, end node, or discover).
- To configure a selective link station, you need the IP hostname or IP address for the remote station. If you do not supply this information and you specify *By administrator* for the *Activation* field, the link station is a nonselective listening link station.

To configure the Enterprise Extender link, perform the following steps from the Node window:

1. Configure the port:
  - a. Select the Connectivity pane of the window.
  - b. Select **New port** from the **Connectivity** submenu on the **Services** menu (or click on the **New** button in the button bar).
  - c. On the resulting dialog, select the protocol type from the option menu, then choose to define a port.

When you click on the **OK** button, CS Linux displays the IP Port dialog.

- d. Enter appropriate values in the fields on the dialog.
- e. Click on the **OK** button to define the port.

The port appears in the Connectivity pane of the Node window.

2. Define a link station on the port:

- a. Make sure you have selected the port to which the link station is being added in the Connectivity pane of the Node window.
- b. Select **New link station** from the **Connectivity** submenu on the **Services** menu (or click on the **New** button in the button bar).
- c. Click on the **OK** button.

CS Linux displays the IP Link Station dialog.

- d. Enter appropriate values in the fields on the dialog.
- e. Click on the **OK** button to define the link station.

The link station appears beneath the port to which it belongs in the Connectivity pane of the Node window.

---

## Configuring APPC Communication

APPC applications and CPI-C applications require that you configure APPC first. An APPC application uses the node's LU type 6.2 resources to communicate with another APPC or CPI-C application on a host or peer computer, using a specified mode.

Before you can configure APPC communication, you must perform the following configuration:

1. Configure the node as described in "Configuring the Node" on page 55.
2. Configure connectivity as described in "Configuring Connectivity" on page 56.

The remaining configuration steps depend on whether the configuration supports dependent traffic, independent traffic, or both:

### Independent APPC

Independent APPC uses independent LUs. Each LU-LU session involves a local LU and a partner LU.

For the local LU, you can use the predefined default LU associated with the node control point, or you can configure new local LUs.

The partner LU need not be configured at all if the CS Linux node is an end node or network node in an APPN network, because APPN can locate partner LUs dynamically. However, you do have to configure the partner LU if your network is not an APPN network or if the node is a LEN node. In this case, you must configure the remote node where the partner LU resides, then define the partner LU on the remote node.

### Dependent APPC

If the remote node is a host that does not support independent LU 6.2, configure for dependent traffic. For dependent APPC, you must configure a local LU.

If the applications use CPI-C, you may need to do additional CPI-C configuration after configuring APPC (see "Configuring for CPI Communications" on page 64). A CPI-C application uses the node's LU type 6.2 and mode resources to communicate with another APPC or CPI-C application on a host or peer computer. You define the same resources for a CPI-C application as for an APPC application.

## Configuring APPC Communication

In addition, if the TP on the CS Linux computer is the invoking TP, also known as the source TP (the TP that starts the conversation), you may need to define one or more side information entries for it, as described in “Configuring for CPI Communications” on page 64. Each of these entries provides information on a partner TP, the LU and mode resources used to access it, and any security information required.

This section explains how to configure a simple APPN network (using independent LU 6.2) that consists of a network node, an end node, and a LEN node, as described in “Configuring a Simple APPN Network.” (This scenario also shows how you can get status information for CP-CP sessions between two nodes.)

This section also explains how to configure dependent APPC communication, as described in “Configuring Dependent APPC” on page 64.

Both of these scenarios assume that APPC sessions use a standard mode and class-of-service (COS).

For information about configuring additional APPC information, such as modes, security, and invocable (target) TPs, refer to *CS Linux Administration Guide*.

## Configuring a Simple APPN Network

The simplest APPN network you can configure includes only two nodes: an APPN network node and an APPN end node. The network node handles session routing for the end node.

### Configuring a Network Node

This scenario assumes that you are using the control point LU and a standard mode, and that you are using a LAN link type (Token Ring, Ethernet). In this case, you can configure the network node simply by performing the following configuration tasks:

1. Configure the node as described in “Configuring the Node” on page 55. For the *APPN support* field, select the value Network node. Make a note of the control point name.
2. Configure connectivity as described in “Configuring Connectivity” on page 56. Configure the link to support independent traffic.

To contact this network node from an adjacent end node, you’ll need to know the MAC address and SAP number of the port on the network node. You can use the following procedure to get the MAC address on a CS Linux node:

1. Select the port on the Node window.
2. Click on the **Start** button to start the port.
3. Click on the **Status** button to get status information for the port. The Port Status dialog shows the MAC address and SAP number.
4. Make a note of the MAC address and SAP number so you can enter those values on the link station configuration dialog for the end node.

### Configuring an End Node

This scenario assumes that you are using the control point LU and a standard mode, and that you are using a LAN link type (Token Ring, Ethernet). In this case, you can configure the network node simply by performing the following configuration tasks:

1. Configure the node as described in “Configuring the Node” on page 55. For the *APPN support* field, select the value End node.
2. Configure connectivity as described in “Configuring Connectivity” on page 56. Configure the link to support independent traffic, and supply the following information for the link station:
  - Enter the name of the network node (see “Configuring a Network Node” on page 60) as the value for the *Remote node* field.
  - Enter the MAC address and SAP number for the port on the network node in the Contact Information pane on the link station configuration dialog.In an APPN network, a single link station to an adjacent network node can be used to communicate with any remote node in the network, so you do not need to configure a separate link station to each remote node.

### Verifying Connectivity between Two Nodes

This scenario assumes that you have configured a network node as described in “Configuring a Network Node” on page 60, and an end node as described in “Configuring an End Node” on page 60. You can perform the following procedure from the end node:

1. On the Node window, select the link station that connects to the adjacent network node.
2. Click on the **Start** button to start the link station.

When the link station is started, the CP-CP sessions between the two nodes are established automatically. Those sessions are displayed in the Independent Local LUs pane of the Node window.
3. To get status information for a session, select the session on the Node window and click on the **Status** button.

### Configuring an Independent APPC LU

In many cases, applications can use the local node’s control point LU, which is automatically defined when you configure the node. This is the default LU—if your application does not specify a particular LU, it can use this one. If the application uses the default LU, you do not need to define a local LU. Check the documentation for your APPC application, or contact the application programmer.

To configure an independent LU 6.2, you need the following information:

- Local LU name.
- Local LU alias (if an alias is used in a TP that this LU supports).

To configure an independent local LU, perform the following steps from the Node window:

1. Select the Independent Local LUs pane of the window.
2. Select **New independent local LU** from the **APPC** submenu on the **Services** menu (or click on the **New** button).

CS Linux displays the Local LU dialog.
3. Enter appropriate values in the fields on the dialog.
4. Click on the **OK** button to define the local LU. The independent LU appears in the Independent Local LUs pane of the Node window.

### Configuring Partner LUs for a LEN Node

You must define a remote node (and the partner LUs on the node) in the following situations:

## Configuring APPC Communication

- If the local node is a LEN node, you must define all of the remote nodes and any partner LUs on the remote node with which it communicates using APPC. A LEN node is not able to dynamically locate partner LUs; the remote node definition enables it to do so.
- If the local node is not part of an APPN network (for example, if you have two end nodes directly connected, with no network node server), LUs cannot be located dynamically. In this case, you must configure each partner LU.
- If the remote node is a LEN node and the local node is a network node that acts as the LEN node's network node server, you must define the LEN node (and its partner LUs) as a remote node on the network node server. This definition enables nodes in the rest of the APPN network to locate LUs on the LEN node.
- If the remote node is in a different APPN network, you must define the remote node because it cannot be dynamically located.

Do not define partner LUs if both the local and remote nodes are part of the same APPN network.

When you add a remote node definition, a partner LU with the same name as the remote node is automatically added; this is the control point LU for the remote node. If your application uses this partner LU, you do not need to add another partner LU, although you may want to add an LU alias for the partner LU. To add an alias, double click on the partner LU and enter the alias in the Partner LU Configuration dialog.

If your application uses an LU alias to refer to its partner LU, you should add a partner LU alias definition.

If either the local node or the remote node is a LEN node, you must define the partner LU as a child of the remote node, because a LEN node cannot take part in dynamic location of LUs. If your application uses the control point LU of the remote node as its partner LU, the control point LU was defined automatically when you defined the remote node.

You can use the Motif administration program to add a partner LU alias (see "Defining a Partner LU Alias" on page 63), add a definition of a partner LU on a specific remote node (see "Defining a Partner LU on a Remote Node" on page 63), or define multiple partner LUs using wildcards (see "Defining Multiple Partner LUs Using Wildcards" on page 63).

**Defining a Remote Node:** Before configuring a remote node, you need the following information:

- Fully qualified SNA network name of the node.

To configure a remote node, perform the following steps from the Node window:

1. Select the Remote Systems pane of the window.
2. Select **New remote node** from the **APPC** submenu on the **Services** menu (or click on the **New** button in the button bar, then select **Define remote node**). CS Linux displays the Remote Node Configuration dialog.
3. Enter appropriate values in the fields on the dialog.
4. Click on the **OK** button to define the remote node. The remote node appears in the Remote Systems pane of the Node window.

When you define a remote system, CS Linux automatically defines the control point LU on the remote node as a partner LU on the local node.



**Defining a Partner LU Alias:** To define a partner LU alias, you need the following information:

- Fully qualified partner LU name (SNA network name and LU name)
- Partner LU alias used by a local TP

To add a partner LU alias, perform the following steps from the Node window:

1. Select the Remote Systems pane of the window.
2. Select **APPC, New partner LUs**, and **Partner LU alias** from the **Services** menu (or click on the **New** button in the button bar, and select **Define partner LU alias**).

CS Linux displays the Partner LU Alias Configuration dialog.

3. Enter the partner LU name and alias on the dialog.
4. Click on the **OK** button to define the partner LU alias. The partner LU alias appears in the Remote Systems pane of the Node window (as part of the Network definition).

**Defining a Partner LU on a Remote Node:** To define a partner LU on a specific remote node, you need the following information:

- Fully qualified partner LU name.
- Partner LU alias (if an alias is used by a local TP).
- Fully qualified name of the node that contains directory information for the partner LU.

To add a partner LU definition for a specific remote node, perform the following steps from the Node window:

1. Select the remote node.
2. Select **APPC, New partner LUs**, and **Partner LU on remote node** from the **Services** menu (or click on the **New** button in the button bar, and select **Define partner LU on remote node**).

CS Linux displays the Partner LU Configuration dialog.

3. Enter the appropriate values in the fields on the dialog.
4. Click on the **OK** button to define the partner LU. The partner LU alias appears in the Remote Systems pane of the Node window, under the remote system to which it belongs.

**Defining Multiple Partner LUs Using Wildcards:** You can use wildcards to configure the location for a set of partner LUs that are all located on the same remote node and whose names start with the same characters. Using wildcards means that you do not need to configure each partner LU individually.

When you define partner LUs using wildcards, you must supply the following information:

- Wildcard partner LU name. The wildcard partner LU name consists of two type A EBCDIC strings, each of 1–8 characters, that match the fully qualified LU names of multiple partner LUs.

The first string can be a complete SNA network name that matches the network name for the partner LUs exactly, or a wildcard prefix that matches the beginning of the network name. If you enter a wildcard prefix for the network name, leave the second string blank.

If you supply a complete SNA network name for the first string, you can also enter a value for the second string. (You cannot enter the second string unless

## Configuring APPC Communication

you supplied a valid SNA network name for the first string.) The second string is treated as a wildcard prefix, which must match the start of the second part of the fully qualified partner LU names.

- Name of the node where the partner LUs are located.

To add multiple partner LUs, perform the following steps from the Node window:

1. Select the remote node for which you are defining the partner LUs.
2. Select **APPC, New partner LUs, and Wildcard partner LUs on remote node** from the **Services** menu (or click on the **New** button in the button bar, and select **Define wildcard partner LUs on remote node**).

CS Linux displays the Wildcard Partner LU Configuration dialog.

3. Enter the appropriate information in the fields on the dialog.
4. Click on the **OK** button to define the partner LUs. The partner LUs appear in the Remote Systems pane of the Node window, under the remote node to which they belong.

## Configuring Dependent APPC

To configure a dependent LU 6.2, you need the following information:

- Local LU name.
- Local LU alias (if an alias is used in a TP that this LU supports).
- Name of the link station that provides the connection to the host.
- LU number.
- Whether the LU should be assigned to the default pool for dependent LU 6.2.

If you are configuring dependent LUs of type 6.2 for use with APPC or CPI-C applications, you may wish to define them as members of the default pool. An application that does not specify a particular local LU is assigned an unused LU from the pool of LUs defined as default LUs.

To configure a dependent local LU, perform the following steps from the Node window:

1. Select a link station in the Connectivity pane of the window.
2. Select **New dependent local LU** from the **APPC** submenu on the **Services** menu (or click on the **New** button in the button bar, and select **New dependent local LU**).

CS Linux displays the Local LU dialog.

3. Enter appropriate values in the fields on the dialog.
4. Click on the **OK** button to define the local LU. The dependent LU appears in the Connectivity pane, below the link station to which it belongs.

---

## Configuring for CPI Communications

If you are supporting a CPI-C application that uses CPI-C symbolic destination names, you need to define the CPI-C side information. The side information associates the symbolic destination name with information about the partner TP, partner LU, mode, and security for the conversation.

To determine the symbolic destination name for CPI-C, consult the application developer (or for a third-party application, consult the product documentation).

Before configuring CPI-C side information, you need the following information:



- Symbolic destination name used by the TP
- Partner TP name
- Partner LU name or alias
- Mode name

To configure CPI-C side information, perform the following steps from the Node window:

1. Select **CPI-C** from the **APPC** sub-menu in the **Services** menu.  
CS Linux displays the CPI-C Destination Names window.
2. Click on the **New** button.  
CS Linux displays the CPI-C Destination Configuration dialog.
3. Enter appropriate values in the fields on the dialog.
4. Click on the **OK** button to define the CPI-C side information.

---

## Configuring LUA

The LUA API can be used for applications that use LU types 0–3 to communicate with a host computer. (For detailed information about the LUA API, refer to *CS Linux LUA Programmer's Guide*.)

Before configuring LUA, perform the following configuration:

1. Configure the node as described in “Configuring the Node” on page 55.
2. Configure connectivity for dependent traffic as described in “Configuring Connectivity” on page 56. (If you are using upstream SNA gateway or DLUR, configure the link to the upstream node instead of a direct link to the host.)

To configure LUA, you need the following information:

- LU name or LU pool name.
- LU number for each LU. The LU number must match the LU number configured on the host.

To configure LUA, define the LU using the following procedure:

1. Select the link station to the host in the Connectivity pane of the Node window.
2. Click on the **New** button.
3. On the resulting dialog, select **New LU for LUA**.
4. Enter appropriate values in the fields on the dialog. Specify an LU type of **Unrestricted**.
5. Click on the **OK** button. The LU appears in the Connectivity pane of the Node window, beneath the link station to the host.
6. If you are going to use any LU pools, define them as described in “Defining an LU Pool.”

## Defining an LU Pool

You can define LU pools to simplify user configuration and provide greater flexibility in establishing host sessions. For example, you can define several LUs in a single LU pool, then configure multiple LUA applications using this LU pool. This makes configuring the applications easier and enables any application to use any LU in the pool.

**Note:** You can assign a user's session either to a specific LU or to an LU pool.

## Configuring LUA

- If you assign the user's session to a specific LU that is in a pool, the session uses this LU if it is available; otherwise it uses any free LU from the pool, as though you had assigned it to the LU pool instead of the specific LU.
- If you want the user to use only a specified LU, so that the user's session cannot be established if the LU is already in use, ensure that the LU is not in a pool.

You can view the LU pools for the local CS Linux node using the LU Pools window. This window lists the LU pools configured on the local system, and enables you to select LUs to add to an LU pool.

You can add the following LU types to a pool for use by 3270 (do not mix LUs of different types in the same pool):

- 3270 display LU
- Unrestricted LU

Before you can add LUs to a pool, the LUs must be defined on the local node.

To configure an LU pool, perform the following steps from the Node window:

1. Select **LU Pools** from the **Windows** menu.  
CS Linux displays the LU Pools window.
2. Click on the **New** button.  
CS Linux displays the LU Pool Configuration dialog.  
The box on the right lists LUs that are not yet allocated to any pool. Any of these LUs with type Unrestricted LU can be included in the new pool for LUA.
3. Select the LU or LUs you wish to add to the pool, and click on the **New** button to move the selected LUs to the box on the left.  
To remove an LU from the box on the left, select it and click on the **Remove** button.
4. Click on **OK** to define the LU pool.  
All of the LUs in the box on the left are added to the LU pool.  
The pool appears in the LU Pools window.

---

## Configuring SNA Gateway

In addition to providing direct access to a host computer, CS Linux can provide SNA gateway facilities. This feature enables other computers to access a host computer through a CS Linux node, instead of requiring a separate connection to the host from each computer.

The SNA gateway feature is shown in Figure 8 on page 67.

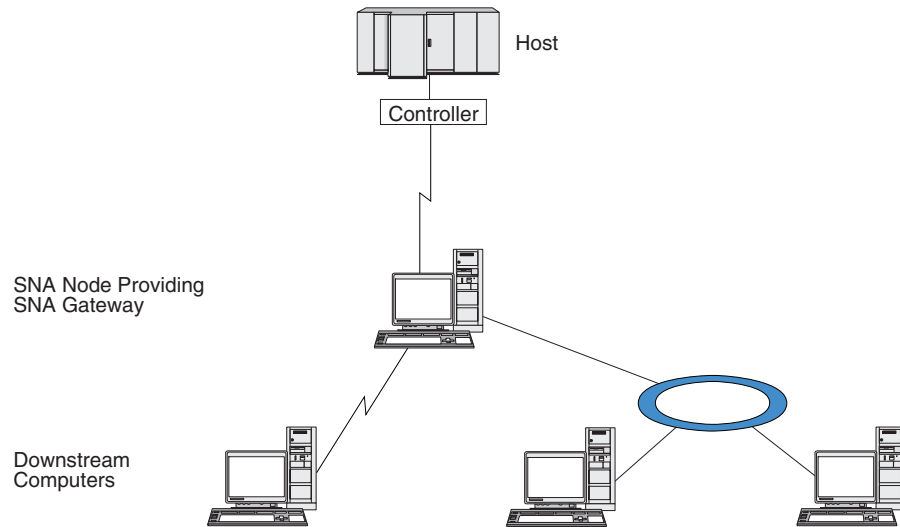


Figure 8. SNA Gateway

The downstream computer must contain an SNA PU type 2.0 or 2.1 to support dependent LUs. For example, the downstream computer could be another CS Linux computer or a PC running Communications Server for Windows NT.

When the local CS Linux node uses the SNA gateway feature, all the data transferred between the host and the downstream computer is routed through the local node. This enables a downstream computer to share a host connection with CS Linux or with other downstream computers, instead of requiring a direct link. For example, you could set up several downstream computers connected to CS Linux over a local token ring network, so that they could all access the same long-distance leased line from CS Linux to the host.

Using SNA gateway also simplifies the configuration at the host, because you do not need to define the downstream computers and the communication links to them. The host configuration needs to include only the CS Linux computer and its host communication link; the LUs at the downstream computers are configured as part of the resources of the CS Linux computer. The host computer is not aware that SNA gateway is being used.

Before configuring SNA gateway, you must perform the following configuration tasks:

- Define the local node as described in “Configuring the Node” on page 55.
- Configure a port and link station for dependent traffic between the local node and the host, as described in “Configuring Connectivity” on page 56. Also, configure ports and link stations for dependent traffic between the local node and the downstream nodes. If you need to support downstream LUs that are not defined in advance, you can define a template on the port to support implicit PUs and downstream LUs (see “Supporting Implicit Downstream LUs” on page 68).
- Define the LUs on the local node that are used for communication with the host (upstream LUs). Define the upstream LUs as LU type 0–3 with an LU type of Unrestricted (unknown). (The LUs on downstream nodes can be any LU type.)
- If you are going to use any LU pools, define them as described in “Defining an LU Pool” on page 65.

### Supporting Implicit Downstream LUs

To support downstream LUs that are not predefined to CS Linux, you can define a template on the port for implicit downstream PUs and LUs (for basic port configuration, see “Configuring Connectivity” on page 56). These templates provide support for downstream LUs without requiring that you configure an LU on the local node to support every LU on a downstream node.

Before configuring a downstream LU for SNA gateway, you need the following information:

- Range of LU numbers to support downstream LUs.
- Host LU name.

To define a template for implicit downstream LUs, perform the following steps:

1. If you have already configured the port, double-click on the port definition in the Connectivity pane of the Node window. CS Linux displays the port configuration dialog.

If you have not already configured the port, do so now:

- a. Select the Connectivity pane on the Node window.
- b. Click on the **New** button.
- c. On the resulting dialog, choose to define a port and select the link protocol type.  
CS Linux displays the port configuration dialog.
- d. Enter the basic port parameters as described in “Configuring Connectivity” on page 56.

2. Click on the **Advanced** button at the bottom of the dialog.

CS Linux displays the Port Parameters dialog. The lower pane shows settings that affect downstream LU templates.

3. Select the *Configure downstream LUs for implicit PU access* option.
4. Click on **OK**.

CS Linux displays the Downstream LU Template Configuration dialog.

5. Enter appropriate values in the fields on the dialog.
6. Click on **OK** to define the implicit downstream LU template.

### Defining Downstream LUs

Before configuring a downstream LU for SNA gateway, you need the following information:

- LU name for each downstream LU. (This is a local identifier, and does not have to match the configuration of the downstream system.)
- LU number for each downstream LU.
- Link station to the downstream node.
- Upstream LU name (for the host LU).

To configure a downstream LU for SNA gateway, perform the following steps:

1. Select the link station to the downstream node in the Connectivity pane of the Node window.
2. Click on the **New** button.
3. Select **New downstream LU** and click on **OK**.  
CS Linux displays the Downstream LU dialog.
4. Enter appropriate values in the fields on the dialog.

5. Click on **OK** to define the downstream LU.

The LU definition appears in the Connectivity pane of the Node window, below the link station to the downstream node.

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## Configuring DLUR

In addition to providing direct access to a host computer, CS Linux can provide dependent LU requester (DLUR) facilities. This feature enables sessions for dependent LUs to span multiple nodes in an APPN network, instead of requiring a direct connection to the host.

Normally, a dependent LU session requires a direct communications link to the host computer. If many nodes (including a host node) are connected together in an APPN network, some of them may not have a direct connection to the host, but only an indirect connection through another node. It is not possible to establish dependent LU sessions to the host from LUs in these indirectly connected nodes.

Dependent LU requester (DLUR) is an APPN feature designed to overcome this limitation.

DLUR on an APPN node (such as a CS Linux node) works in conjunction with dependent LU server (DLUS) at the host, to route sessions from dependent LUs on the DLUR node across the APPN network to the DLUS host. The route to the host can span multiple nodes and can take advantage of APPN's network management, dynamic resource location, and route calculation facilities. DLUR must be available on the node where the LUs are located, and DLUS must be available on the host node, but DLUR is not required on any intermediate nodes in the session route.

If the CS Linux DLUR node is a network node or a Branch Network Node, it can also provide passthrough DLUR facilities for dependent LUs on downstream computers connected to the CS Linux node. These LUs can use DLUR on the CS Linux node to access the host across the network, in the same way as for LUs internal to the node. The downstream computers do not run DLUR, and indeed do not need to be aware that DLUR is being used.

Figure 9 on page 70 shows a CS Linux server configured as an APPN network node, implementing passthrough DLUR to support sessions between LUs on the host (the upstream node) and LUs on the nodes in the APPN network (downstream nodes).

## Configuring DLUR

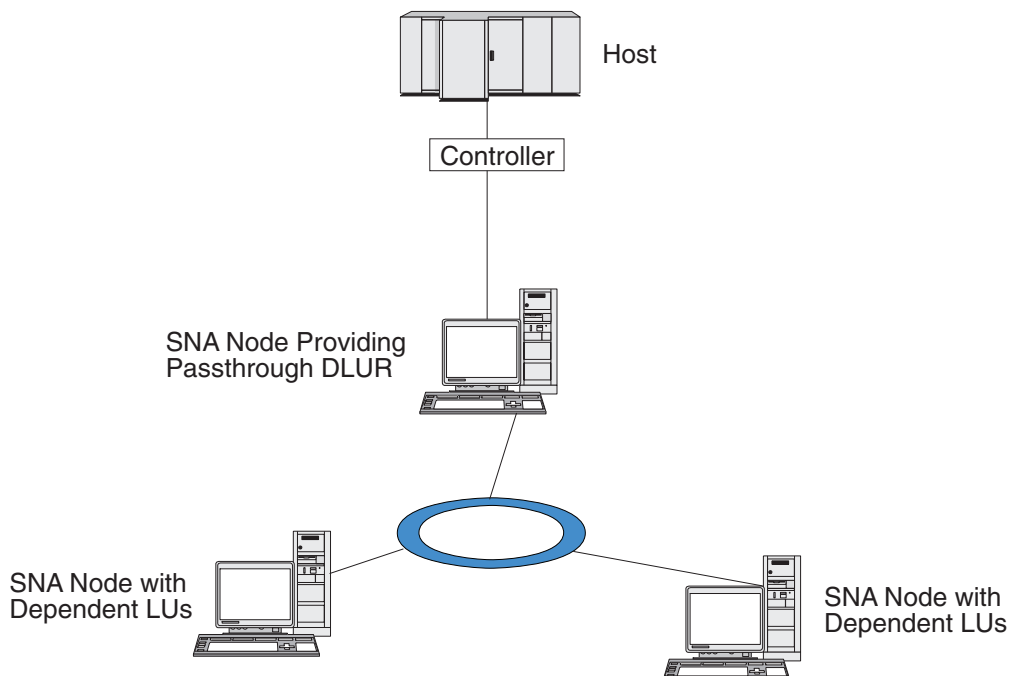


Figure 9. CS Linux Node Providing DLUR

### Note:

1. You cannot configure DLUR on a LEN node.
2. You can configure passthrough DLUR only on a network node or a Branch Network Node.
3. If you are using Branch Extender, you cannot configure DLUR on an end node in the branch (with a Branch Network Node as its network node server). However, you can support dependent LU applications from this node by configuring passthrough DLUR on the Branch Network Node (so that the end node in the branch does not run DLUR, but uses passthrough DLUR on the Branch Network Node).

The tasks you need to perform to configure DLUR depend on whether the dependent LUs are on the local node or on downstream nodes.

## Configuring DLUR Support on the Local Node

You need the following information for this task:

- PU ID for the PU on the local node.
- PU name. (This is a local identifier, and does not have to match the host configuration.)
- Name of the DLUS on the host.
- LU name, LU number, and LU type for each downstream LU. The LU number must match the number configured on the host.

To configure DLUR support on the local node, you must perform the following configuration tasks:

1. Define the local node as described in “Configuring the Node” on page 55. If you are providing passthrough DLUR support for downstream nodes, define the node as an APPN network node or branch network node.

2. Configure connectivity to the APPN network. APPN connectivity requires at least a port and link station for independent traffic between the local node and the adjacent APPN network node, as described in “Configuring Connectivity” on page 56.
3. Define a DLUR PU on the local node (the DLUR PU supports connectivity to the host).

To configure the DLUR PU, perform the following steps from the Node window:

  - a. Select the **Services** menu, then the **Connectivity** submenu, then **New DLUR PU** (or click on the **New** button in the button bar, then select **DLUR PU**).  
When you click on the **OK** button, CS Linux displays the DLUR PU Configuration dialog.
  - b. Enter appropriate values in the fields on the dialog.
  - c. Click on the **OK** button to define the DLUR PU.

The DLUR PU appears in the Connectivity pane below the DLUR item.
4. To configure DLUR to support LUs on the local node, you must add the LUs on the local node. The LUs must be configured to support LUA, as described in “Configuring LUA” on page 65. Depending on the requirements of the user applications supported by the LUs, you may also need to perform further configuration.

### Configuring Passthrough DLUR Support for Downstream Nodes

You need the following information for this task:

- Downstream PU name for each downstream node, or for each PU on the downstream node. (This is a local identifier, and does not have to match the host configuration.)
- Name of the DLUS on the host.

To configure passthrough DLUR support for downstream nodes, you must perform the following configuration tasks:

1. Define the local node as an APPN network node (see “Configuring the Node” on page 55).
2. Configure connectivity to the downstream nodes. Configure ports and link stations for dependent traffic between the local node and each downstream node, as described in “Configuring Connectivity” on page 56. (You do not need to define a DLUR PU to support passthrough DLUR for downstream nodes.)
3. A downstream node can support multiple PUs. In this case, each downstream PU is associated with a different link, so you need to configure multiple links between the CS Linux DLUR node and the downstream node, and you need to know the downstream PU name for each link.

---

### Configuring TN Server

3270 emulation programs that communicate over TCP/IP (rather than over an SNA network) are referred to as TN3270 programs (Telnet 3270 emulation programs).

TN3270 programs can also include support for TN3270E (Telnet 3270 standard extensions). TN3270E is an open protocol that supports 3270 device emulation (including both terminals and printers) using Telnet. It enables a Telnet client to

## Configuring TN Server

select a particular device (by specifying the LU name), and provides enhanced support for various functions, including the ATTN and SYSREQ keys and SNA response handling.

**Note:** This guide uses the term TN3270 for information that applies equally to the TN3270, TN3287, and TN3270E protocols.

CS Linux TN server provides access to 3270 host computers for TN3270 users on other computers. TN server enables TN3270 users to share a host connection with CS Linux or with other TN3270 users, instead of requiring a direct link. TN server also enables TN3270 users to access hosts that are not running TCP/IP.

A CS Linux node that provides TN server support for TN3270 clients is shown in Figure 10. The TN server node and the clients communicate through the TCP/IP network.

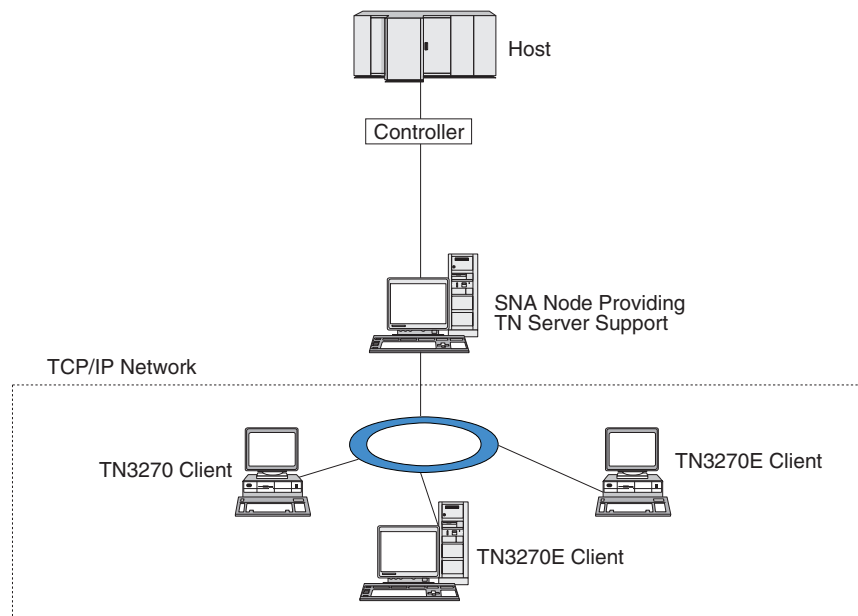


Figure 10. CS Linux Node Configured for TN Server

The CS Linux TN server feature provides an association between a TN3270 user and CS Linux 3270 LU. All data from the TN3270 user is routed to the LU. This means that the configuration for both the host and the TN3270 user is as though they were connected directly; neither needs to be aware that data is being routed through TN server.

CS Linux TN server supports all TN3270 client emulation programs that correctly implement the protocols defined in IETF RFCs 1123, 1576, 1646, 1647, and 2355.

When a TN3270 program communicates with TN server, CS Linux identifies the program by the TCP/IP address of the computer where the TN3270 program is running. CS Linux cannot distinguish between two different TN3270 programs being used by different users on the same computer. In the CS Linux manuals, the term TN server user refers to the computer where a TN3270 program is running, not to an individual user of that program.



As shown in Figure 11, the host and the TN server user view the TN server configuration differently.

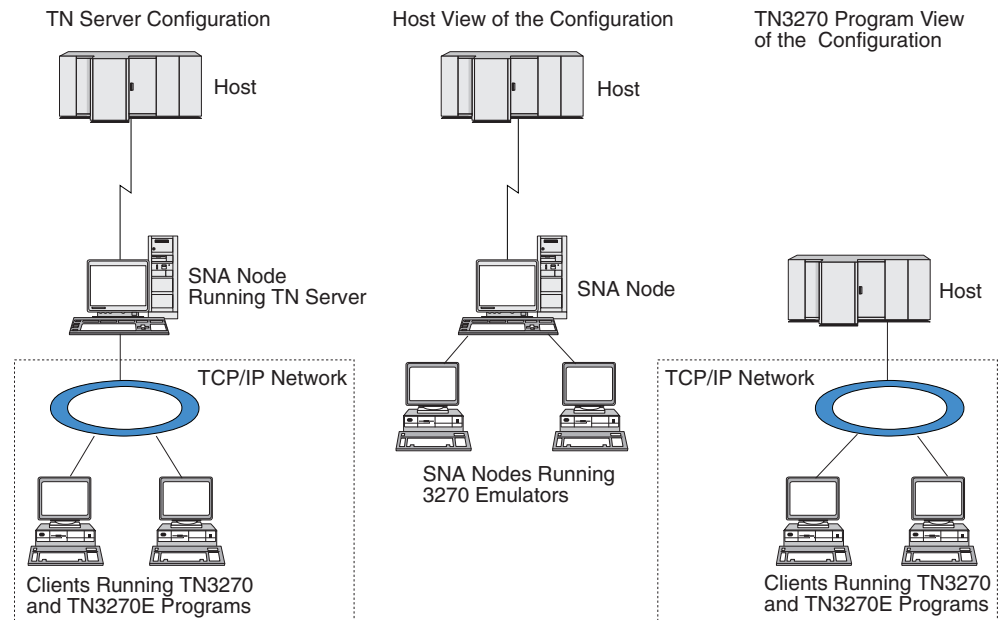


Figure 11. TN Server

Each TN server user connecting to CS Linux using the TN3270 Server feature is normally configured to access a single 3270 LU, and so is restricted to one host session at a time. However, you can also configure a TN server user to access a pool of 3270 LUs, instead of having a single dedicated 3270 LU for each user. This enables users to access as many sessions as there are available LUs in the pool.

Before you can configure TN server access, you must perform the following configuration tasks:

- Define the local node as described in “Configuring the Node” on page 55.
- Configure a port and link station for dependent traffic between the local node and the host, as described in “Configuring Connectivity” on page 56.

To configure TN server access, you must perform the following configuration tasks:

- Define the 3270 LUs on the local node that are used for communication with the host. To add the LUs, see “Defining 3270 LUs.”
- If you are going to use any LU pools, define them as described in “Defining an LU Pool” on page 74.

### Defining 3270 LUs

Before configuring the 3270 LU, gather the following information:

- LU name. (This is a local identifier, and does not have to match the host configuration.)
- LU number (or numbers for a range of LUs).
- LU type (3270 display model or 3270 printer).
- Pool name (if you are adding the LU to a pool).

To configure an LU of types 0–3 for a previously defined link station, perform the following steps from the Node window:

## Configuring TN Server

1. Select the link station to the host in the Connectivity pane of the window.
2. Click on the **New** button.
3. Select the LU type (**New 3270 display LU** or **New 3270 printer LU**) on the resulting dialog.

When you select this item and click on **OK**, CS Linux displays the LU Type 0–3 dialog.

4. Enter appropriate values in the fields on the dialog.
5. Click on **OK** to define the LU.

The LU appears in the Connectivity pane of the Node window, below the link station to the host.

## Defining an LU Pool

For 3270, you can define LU pools to simplify user configuration and provide greater flexibility in establishing host sessions. For example, you can define several 3270 LUs in a single LU pool, then configure multiple TN3270 clients using this LU pool. This makes configuring the 3270 sessions easier and enables any client to use any LU in the pool.

**Note:** You can assign a TN3270 client either to a specific LU or to an LU pool.

- If you assign the client to a specific LU that is in a pool, the client uses this LU if it is available; otherwise it uses any free LU from the pool, as though you had assigned it to the LU pool instead of the specific LU.
- If you want the client to use only a specified LU, so that the client's session cannot be established if the LU is already in use, ensure that the LU is not in a pool.

You can view the LU pools for the local CS Linux node using the LU Pools window. This window lists the LU pools configured on the local system, and enables you to select LUs to add to an LU pool.

You can add the following LU types to a pool for use by 3270 (do not mix LUs of different types in the same pool):

- 3270 display LU
- Unrestricted LU

Before you can add LUs to a pool, the LUs must be defined on the local node.

To configure an LU pool, perform the following steps from the Node window:

1. Select **LU Pools** from the **Windows** menu.  
CS Linux displays the LU Pools window.
2. Click on the **New** button.  
CS Linux displays the LU Pool Configuration dialog.  
The box on the right lists LUs that are not yet allocated to any pool. Any of these LUs can be included in the new pool.
3. Select the LU or LUs you wish to add to the pool, and click on the **New** button to move the selected LUs to the box on the left.  
To remove an LU from the box on the left, select it and click on the **Remove** button.
4. Click on **OK** to define the LU pool.  
All of the LUs in the box on the left are added to the LU pool.

The pool appears in the LU Pools window.

## Configuring TN3270 Server

Before configuring TN3270 server, you need the following information:

- Whether the server supports only TN3270, or also TN3270E (which includes TN3270 support).
- Whether a TN3270E client can request a specific LU.
- Display and printer LU names (or LU pool names) for each client. (Printer LU names are needed only if you are supporting TN3270E.)
- If only certain clients are permitted, or if you want to restrict certain clients to specific LUs, you need the TCP/IP name or address of the client.
- TCP/IP port number on the TN server node.
- Whether SSL data encryption, client authentication, and server authentication are required (this option is available only if you have installed the additional software required to support it).

To associate a display LU and printer LU, you also need the names of those LUs. A TN server association record defines an association between a printer LU and display LU, so that the TN3270E protocol can connect the two. You do not need to define an association record if you are not supporting TN3270E or if you are not supporting printer LUs.

The TN server defaults record defines parameters that are used on all TN3270 client sessions. You can define a single defaults record for each server.

To configure TN3270 server, perform the following steps from the Node window:

1. Define a TN server access record:
  - a. Select **TN Server** from the **Services** menu.  
CS Linux displays the TN Server window, which lists all the configured TN server access records in the upper pane and TN server association records in the lower pane.
  - b. Select the pane that contains TN3270 Server access records and click on the **New** button.  
CS Linux displays the TN Server Access dialog.
  - c. Enter appropriate values in the fields on the dialog.
  - d. Click on **OK** to define the TN server access record. The record appears in the TN Server window.
2. Define a TN server association record:
  - a. Select the pane that contains association records in the TN Server window and click on the **New** button.  
CS Linux displays the TN Server Association Record dialog.
  - b. Enter appropriate values in the fields on the dialog.
  - c. Click on **OK** to define the TN server association record. The record appears in the TN Server window.
3. If you need to force printer responses, specify a keep-alive method for all TN3270 sessions, specify how to access the external LDAP server that holds a revocation list used to check authorization for TN3270 clients, or use TN3270 SLP (Service Location Protocol), use the TN Server Advanced Parameters dialog to do this.

## Configuring TN Server

For more information about configuring SSL support for TN Server, refer to the IBM Communications Server Support web pages at <http://www.ibm.com/software/network/commserver/support/>.

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## Configuring TN Redirector

The CS Linux TN Redirector feature provides passthrough TCP/IP host access to TN3270, TN3270E, TN5250 and VT clients, referred to collectively as Telnet clients. The Telnet user communicates with CS Linux over a TCP/IP connection; CS Linux then communicates with the host over another TCP/IP connection. This allows you to use Secure Sockets Layer (SSL) security checking where necessary, and not on the complete user-to-host connection. For example:

- If clients are connecting to CS Linux over a TCP/IP LAN where checking is not required, but are connecting to a remote host that requires SSL, you can use SSL over the TCP/IP connection between CS Linux and the host. This means that security is checked once for all clients, and individual clients do not have to provide security information.
- If CS Linux is installed on the same site as the host, but clients are connecting in from external sites, you can use SSL over the client connections to CS Linux without having to install SSL software on the host.

## Configuring TN Redirector

Before you can configure TN Redirector access, you must define the local node as described in “Configuring the Node” on page 55. You also need the following information:

- If only certain clients are permitted, you need the TCP/IP name or address of the client.
- TCP/IP port number used by the client to connect to the TN Redirector node.
- TCP/IP name or address of the host.
- TCP/IP port number used by the TN Redirector node to connect to the host.
- Whether SSL data encryption, client authentication, and server authentication are required between the client and the TN Redirector node (this option is available only if you have installed the additional software required to support it).
- Whether SSL data encryption is required between the TN Redirector node and the host.

The TN redirector defaults record defines parameters that are used on all TN redirector client sessions. You can define a single defaults record for each client TCP/IP port number.

To configure TN redirector, perform the following steps from the Node window to define a TN redirector access record:

1. Select **TN Server** from the **Services** menu.  
CS Linux displays the TN Server window, which lists all the configured TN3270 server access records, TN3270 server association records, and TN Redirector access records.
2. Select the pane that contains TN Redirector access records and click on the **New** button.  
CS Linux displays the TN Redirector Access dialog.
3. Enter appropriate values in the fields on the dialog.
4. Click on **OK** to define the TN Redirector access record. The record appears in the TN Redirector pane of the TN Server window.

**Note:** The SNA node must be active in order to use TN Redirector, although it does not use any of the node's SNA resources.

---

### Disabling CS Linux

Disabling the CS Linux software automatically stops the CS Linux node and its associated connectivity components. Disabling CS Linux also stops any other processes (such as an LUA application) from using CS Linux resources on this server.

In general, you should stop individual services as users finish using them, and only disable the system when there is no CS Linux activity.

If you need to disable CS Linux while users are active, warn users that CS Linux is stopping, and give them time to finish their activities before you disable the software.

When you disable the CS Linux software, applications using the APPC, CSV, LUA, NOF, or MS APIs are notified by a `COMM_SUBSYSTEM_ABENDED` return code and CPI-C applications by a `CM_PRODUCT_SPECIFIC_ERROR` return code.

To disable the CS Linux software, enter the following command at the Linux command prompt:

```
sna stop
```

If CS Linux is disabled successfully, **sna stop** returns an exit code of 0. Any other exit code indicates that an error occurred and that the CS Linux software was not disabled. Refer to *CS Linux Diagnostics Guide* for more information about exit code values.

---

### Starting CS Linux Automatically

Bringing up CS Linux to fully working status can be viewed as several steps:

- Enabling the CS Linux software
- Initializing the SNA node
- Activating the ports and link stations configured on the node.

Each of these steps can be managed separately, and all steps can be done at boot time if necessary. The rest of this section describes these steps and explains how to control them at boot time.

### Enabling CS Linux

CS Linux requires several kernel modules to be loaded in order to operate. These modules are loaded when you first enable the CS Linux software, and are unloaded only when you change the kernel run level.

CS Linux also requires a number of daemons (programs) to be running. Until these daemons are running, you cannot configure or use CS Linux.

- To start the daemons and enable the CS Linux software, issue the command **sna start**.
- To stop the daemons and disable the CS Linux software, issue the command **sna stop**.

### Initializing the SNA node

When the CS Linux software has been enabled, you can configure the SNA node and its resources, typically using the Motif administration program `x snaadmin`. However, the node is not available for use until it is initialized. You can initialize it from the command-line administration program, using the command `snaadmin init_node`, or from the Motif administration program `x snaadmin`.

### Activating ports and link stations

Ports and link stations can be configured to start in different circumstances:

- By operator intervention only
- On demand (when an application starts that uses a resource on the link)
- On node start-up (when the command `snaadmin init_node` is issued, or when the node is started from the Motif administration program).

Starting by operator is the default, but you can change this for a particular port or link by using the command-line administration program or the Motif administration program.

**Note:** Starting a port enables that port to receive calls from other computers, but does not allow it to make outgoing calls. Starting a link station means that CS Linux attempts to contact the remote computer.

### Starting CS Linux at reboot time

In common with other Linux services, CS Linux is enabled at reboot. In other words, by default after a reboot, the command `sna start` is issued but the SNA node is not started.

This initialization is done in the CS Linux boot time initialization script, `/etc/rc.d/init.d/snastart`. As is conventional for start-up scripts, this is linked to `/etc/rc?.d/init.d/snastart` for the various boot levels.

You can edit `/etc/rc.d/init.d/snastart` to change what happens at reboot. The most common change is to add the initialization of the node. The command for this, `snaadmin init_node`, is already included in the file but commented out, so you simply need to uncomment it. By including this command, you also trigger the activation of any ports or link stations that are configured to be activated on node start-up.

Applications that use CS Linux should not be started until after the node has been initialized. If required, you can start these applications automatically at boot time, and add any other `snaadmin` commands that you need to run at boot time, in one of two ways:

- Add commands at the end of `/etc/rc.d/init.d/snastart`, after the `snaadmin init_node` command.
- Create an `/etc/rc?.d/init.d` script with a number greater than 95, which ensures that it will run after CS Linux is started, and add the commands to that script.

**Note:** Changes that you make to the `/etc/rc.d/init.d/snastart` file will not be saved when you upgrade CS Linux to a later version. Always ensure that you keep a copy of your changes, so that you can re-apply them after an upgrade.

---

## Chapter 8. Information Resources for CS Linux and SNA

This chapter describes the resources in the SNA library that provide information about SNA technology and the many networking products and services that IBM offers. It also describes information that is available in network forums.

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### SNA Library

The SNA library includes marketing brochures, books, user guides, and tutorials that provide both introductory and in-depth information about the following topics:

- SNA theory
- SNA products
- Product implementation
- Configuration of systems and networks
- SNA application programs and APIs
- Overall planning, performance, and tuning
- Problem diagnosis
- Network management
- Network security

All IBM publications can be ordered through your IBM representative, the IBM branch serving your locality, or by calling IBM directly at 1-800-879-2755.

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### Network-Accessible Information

To promote information exchange, IBM sponsors electronic forums and bulletin boards. It posts home pages on the Internet and provides online documentation that is also accessible on the World Wide Web.

#### Product Support over IBMLink™

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For more information about IBMLink, use <http://www.ibm.com>.

#### Information in IBM Home Pages

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You can access information about IBM networking software, including CS Linux, by using <http://www.ibm.com/software/network>. Information about CS Linux is at <http://www.ibm.com/software/network/commserver>.

For more detailed information about support for CS Linux, use <http://www.ibm.com/software/network/commserver/support>.

## Network-Accessible Information

### Information for Downloading

On the World Wide Web, users can download Redbook publications by using <http://www.redbooks.ibm.com>.

Information on IBM software can be accessed at <http://www.ibm.com/software>, where you can link to pages about CS Linux and all of the IBM Software Servers.

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## Suggested Reading

For those who want to strengthen their understanding of SNA, the following books cover SNA theory and the use of CS Linux in practice. The books are helpful to both novices and experts who might need either a starting point for getting acquainted with SNA or an in-depth treatment of the subject.

- *Systems Network Architecture: Technical Overview* (GC30–3073)
- *IBM CS Linux Administration Guide*

If you have more specific interests, contact your local IBM representative.



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## Appendix A. Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully. The major accessibility features in Communications Server for Linux enable users to:

- Use assistive technologies such as screen readers and screen magnifier software
- Operate specific or equivalent features using only the keyboard, when these devices are supported by the underlying operating system
- Customize display attributes such as color, contrast, and font size

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### Using assistive technologies

Assistive technology products, such as screen readers, function with the user interfaces found in this product. Consult the assistive technology documentation for specific information when using such products to access Communications Server for Linux interfaces.



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## Bibliography

The following IBM publications provide information about the topics discussed in this library. The publications are divided into the following broad topic areas:

- CS Linux, Version 6.2
- Host Publisher
- Systems Network Architecture (SNA)
- Host configuration
- Virtual Telecommunications Access Method (VTAM)
- Advanced Program-to-Program Communication (APPC)
- Programming
- Other IBM networking topics

For books in the CS Linux library, brief descriptions are provided. For other books, only the titles, order numbers, and, in some cases, the abbreviated title used in the text of this book are shown here.

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### CS Linux Version 6.2 Publications

The CS Linux library comprises the following books. In addition, softcopy versions of these documents are provided on the CD-ROM. See *IBM CS Linux Quick Beginnings* for information about accessing the softcopy files on the CD-ROM. To install these softcopy books on your system, you require 9–15 MB of hard disk space (depending on which national language versions you install).

- *IBM CS Linux Quick Beginnings* (GC31-6768-00 and GC31-6769-00)  
This book is a general introduction to CS Linux, including information about supported network characteristics, installation, configuration, and operation.
- *IBM CS Linux Administration Guide* (SC31-6771-00)  
This book provides an SNA and CS Linux overview and information about CS Linux configuration and operation.
- *IBM CS Linux Administration Command Reference* (SC31-6770-00)  
This book provides information about SNA and CS Linux commands.
- *IBM CS Linux CPI-C Programmer's Guide* (SC31-6774-00)  
This book provides information for experienced "C" or Java programmers about writing SNA transaction programs using the CS Linux CPI Communications API.
- *IBM CS Linux APPC Programmer's Guide* (SC31-6773-00)  
This book contains the information you need to write application programs using Advanced Program-to-Program Communication (APPC).
- *IBM CS Linux LUA Programmer's Guide* (SC31-6776-00)  
This book contains the information you need to write applications using the Conventional LU Application Programming Interface (LUA).
- *IBM CS Linux CSV Programmer's Guide* (SC31-6775-00)  
This book contains the information you need to write application programs using the Common Service Verbs (CSV) application program interface (API).
- *IBM CS Linux MS Programmer's Guide* (SC31-6777-00)

This book contains the information you need to write applications using the Management Services (MS) API.

- *IBM CS Linux NOF Programmer's Guide* (SC31-6778-00)

This book contains the information you need to write applications using the Node Operator Facility (NOF) API.

- *IBM CS Linux Diagnostics Guide* (GC31-6779-00)

This book provides information about SNA network problem resolution.

- *IBM CS Linux APPC Application Suite User's Guide* (SC31-6772-00)

This book provides information about APPC applications used with CS Linux.

- *IBM Communications Server for Linux Glossary* (GC31-6780-00)

This book provides a comprehensive list of terms and definitions used throughout the IBM Communications Server for Linux library.

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## Publications for Host Publisher

The following books contain information about the Host Publisher feature that is included with CS Linux:

- *User's Guide for IBM Host Publisher, Version 2* (GC31-8728)
- *Planning and Installation Guide for Host Publisher, Version 2 for Windows NT, AIX<sup>®</sup> and Solaris* (SC31-8730)

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## Systems Network Architecture (SNA) Publications

The following books contain information about SNA networks:

- *Systems Network Architecture: Format and Protocol Reference Manual—Architecture Logic for LU Type 6.2* (SC30-3269)
- *Systems Network Architecture: Formats* (GA27-3136)
- *Systems Network Architecture: Guide to SNA Publications* (GC30-3438)
- *Systems Network Architecture: Network Product Formats* (LY43-0081)
- *Systems Network Architecture: Technical Overview* (GC30-3073)
- *Systems Network Architecture: APPN Architecture Reference* (SC30-3422)
- *Systems Network Architecture: Sessions between Logical Units* (GC20-1868)
- *Systems Network Architecture: LU 6.2 Reference—Peer Protocols* (SC31-6808)
- *Systems Network Architecture: Transaction Programmer's Reference Manual for LU Type 6.2* (GC30-3084)
- *Systems Network Architecture: 3270 Datastream Programmer's Reference* (GA23-0059)
- *Networking Blueprint Executive Overview* (GC31-7057)
- *Systems Network Architecture: Management Services Reference* (SC30-3346)
- *APPN Architecture and Product Implementations Tutorial* (GG24-3669)

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## Host Configuration Publications

The following books contain information about host configuration:

- *ES/9000, ES/3090 IOCP User's Guide Volume A04* (GC38-0097)
- *3174 Establishment Controller Installation Guide* (GG24-3061)
- *3270 Information Display System 3174 Establishment Controller: Planning Guide* (GA27-3918)
- *OS/390 Hardware Configuration Definition (HCD) User's Guide* (SC28-1848)



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## VTAM Publications

The following books contain information about VTAM:

- *VTAM V4R4 Network Implementation Guide* (SC31-8370)
- *VTAM V4R4 Diagnosis* (LY43-0078)
- *VTAM V4R4 Resource Definition Reference* (SC31-8377)

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## APPC Publications

The following books contain information about Advanced Program-to-Program Communication (APPC):

- *APPC Application Suite V1 User's Guide* (SC31-6532)
- *APPC Application Suite V1 Administration* (SC31-6533)
- *APPC Application Suite V1 Programming* (SC31-6534)
- *APPC Application Suite V1 Online Product Library* (SK2T-2680)
- *APPC Application Suite Licensed Program Specifications* (GC31-6535)
- *OS/390 Communications Server: APPC Application Suite User's Guide* (SC31-8085)

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## Programming Publications

The following books contain information about programming:

- *Common Programming Interface Communications Reference* (SC26-4399)
- *Communications Server for OS/2 Version 4 Application Programming Guide* (SC31-8152)

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## Other IBM Networking Publications

The following books contain information about other topics related to CS Linux:

- *Advanced Data Communications for Stores: Programming Reference and Operations Manual* (SH20-2406)
- *Local Area Network Concepts and Procedures* (SK2T-1306)
  - Volume 1 (SG24-4753)
  - Volume 2 (SG24-4754)
  - Volume 3 (SG24-4755)
  - Volume 4 (SG24-4756)
- *IBM Network Control Program Resource Definition Guide* (SC30-3349)
- *IBM Netview Operations* (SC30-3364)



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