



## Cisco SCMS SM CNR LEG Reference Guide

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*Cisco SCMS SM CNR LEG Reference Guide*

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## About This Guide

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Revised: May 30, 2007, OL-7201-05

This document explains how to install and configure the Cisco Network Registrar (CNR) Login Event Generator (LEG) on the Solaris and Windows NT/2000 platforms.

This introduction provides information about the following topics:

- [Audience](#)
- [Document Revision History](#)
- [Organization](#)
- [Document Conventions](#)
- [Related Publications](#)
- [Obtaining Documentation, Obtaining Support, and Security Guidelines](#)

## Audience

This document is intended for System Administrators and Integrators who are responsible for the installation, configuration, and maintenance of the CNR LEG component. The administrator or system integrator should be familiar with the CNR extensions concept and with Cisco Service Control Subscriber Management and Subscriber Integration concepts.

## Document Revision History

Cisco Service Control Release	Part Number	Publication Date
Release 3.1.0	OL-7201-05	May, 2007

### Description of Changes

- Addition of section detailing log messages. See [CNR Log Messages](#).

Cisco Service Control Release	Part Number	Publication Date
Release 3.0.5	OL-7201-04	November, 2006

**Description of Changes**

- Updated for release 3.0.5.

Cisco Service Control Release	Part Number	Publication Date
Release 3.0.3	OL-7201-03	May, 2006

**Description of Changes**

- Updated for release 3.0.3.

Cisco Service Control Release	Part Number	Publication Date
Release 3.0	OL-7201-02	December, 2005

**Description of Changes**

- Reorganization of documentation. No major changes or new features were added to this revision.

Cisco Service Control Release	Part Number	Publication Date
Release 2.5.7	OL-7201-01	May, 2005

**Description of Changes**

- This is the first version of this document.

## Organization

The major sections of this guide are as follows:

*Table 1*

Chapter	Title	Description
Chapter 1	<a href="#">About the CNR LEG</a>	Describes the Subscriber Manager CNR LEG software module and the terms and concepts used in this guide.
Chapter 2	<a href="#">Installing the CNR LEG</a>	Details the CNR LEG installation procedures for both Widows and Solaris platforms. It also describes the uninstall procedure.
Chapter 3	<a href="#">Configuring the CNR LEG and the SM</a>	Describes the configuration for the CNR LEG and the Subscriber Manager using the CNR LEG.
Chapter 4	<a href="#">CNR LEG Functional Specification</a>	Describes the log messages written to the CNR Log.
Appendix A	<a href="#">CNR Log Messages</a>	Describes the CNR LEG design, logging, tracing, and operations performed by the CNR LEG.

# Document Conventions

This guide uses the following conventions:

- **Bold** is used for commands, keywords, and buttons.
- *Italics* are used for command input for which you supply values.
- Screen font is used for examples of information that are displayed on the screen.
- **Bold screen** font is used for examples of information that you enter.
- Vertical bars ( | ) indicate separate alternative, mutually exclusive elements.
- Square brackets ( [ ] ) indicate optional elements.
- Braces ( { } ) indicate a required choice.
- Braces within square brackets ( [{} ] ) indicate a required choice within an optional element.



---

**Note**

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

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**Timesaver**

Means the *described action saves time*. You can save time by performing the action described in the paragraph.

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**Caution**

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

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**Warning**

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

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## Related Publications

Use this *Cisco SCMS SM CNR LEG Reference Guide* in conjunction with the following Cisco documentation:

- *Cisco SCMS Subscriber Manager User Guide*
- *Cisco Service Control Application for Broadband User Guide*

# Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>





# CHAPTER 1

## About the CNR LEG

---

This module describes the Subscriber Manager CNR LEG software module and the terms and concepts used in this guide.

The Cisco Network Registrar (CNR) Login Event Generator (LEG) is a software module that forwards login and logout events from the CNR to the Cisco Service Control Management Suite Subscriber Manager (SCMS SM). The CNR LEG is actually a CNR extension developed in C++. The extension points used by CNR LEG are:

- `init-entry`
- `post-send-packet`
- `post-packet-decode`

## The CNR LEG Module

The CNR LEG module requires the use of option 82 sub-option 2 (Relay-Agent-Information Option with the Remote-Id sub-option), which contains the CM-MAC, in all DHCP requests. If option 82 does not exist in a renewal transaction, an attempt to extend the lease based solely on the IP address is performed. This will succeed only if the IP address was previously logged in to the Subscriber Manager (SM) by the LEG, in the event of a full DHCP transaction, or via other interfaces to the SM.

The CNR LEG protects the SM and the connection to the SM from any DHCP Denial of Service (DoS) attacks, which are performed on the CNR. To reduce the login rate to the SM, the LEG ignores identical DHCP requests that are approved by the CNR. The requests are sent to the CNR in short time intervals.

For additional information about extending the CNR functionality using extension points, see the *CNR CLI Reference Guide*.

The CNR LEG was carefully developed and thoroughly tested on Solaris and Windows platforms for both functional correctness and robustness. It does not jeopardize the stability or the reliability of the CNR.

## Terms and Concepts

This section defines terms and concepts that are necessary for understanding the CNR LEG and Subscriber Manager (SM) configuration and operation. More information about all items can be found in the *Cisco SCMS Subscriber Manager User Guide*.

- [Subscriber Mappings](#)

- [Subscriber Domain](#)
- [RPC Protocol \(PRPC\)](#)
- [Subscriber Mode](#)
- [DHCP DoS Attack Filter](#)
- [SM Cable Support Module](#)
- [SM C++ API](#)
- [Communication Link Failure Handling](#)
- [Subscriber Auto-logout](#)

## Subscriber Mappings

The main function of the CNR LEG is to provide the SM with network-ID-to-subscriber mappings in real time.

The SCE platform requires mappings between the network IDs (IP addresses) of the flows it encounters and the subscriber IDs. The SM database contains the network IDs that map to the subscriber IDs. The SCE network-ID-to-subscriber mappings are constantly updated from the SM database.

For information about the SCE platforms, see the *Cisco Service Control Engine Software Configuration Guide*.

## Subscriber Domain

The SM provides the option of partitioning SCE platforms and subscribers into subscriber domains. A subscriber domain is a group of SCE platforms that share a group of subscribers. Subscriber domains can be configured using the SM configuration file and can be viewed using the SM Command-Line Utility (CLU).

It is also possible to configure domain aliases. A domain alias is a synonym for the actual domain name in the SM. Domain aliases are configured in the SM configuration file.

For additional information about domains and domain aliases, see the “Configuration File Options” module of the *Cisco SCMS Subscriber Manager User Guide*.

## RPC Protocol (PRPC)

The CNR LEG communicates with the SM using a proprietary RPC (PRPC) protocol developed by Cisco. The SM Java, C, and C++ APIs also use PRPC. The CNR LEG uses the C++ API as its communication layer.

## Subscriber Mode

The Subscriber Mode defines which entity is referred to as the subscriber in the LEG and in the SM.

Cable providers usually prefer using the Cable Modem (CM) as the subscriber entity to be assigned multiple IP addresses (one per Customer Premises Equipment (CPE)).

The CNR LEG supports the CPE as Subscriber and CM as Subscriber (the default) modes, as defined by the configuration.

The CNR LEG works with the SM cable support module when operating in the “CPE as Subscriber” mode. For additional information about cable environment subscriber modes, see the “CPE as Subscriber in Cable Environment” module of the *Cisco SCMS Subscriber Manager User Guide* .

## DHCP DoS Attack Filter

The connection between the CNR LEG and the SM is a resource that should be protected against DHCP Denial of Service attacks. Such attacks are dispatched by sending a high rate of DHCP requests from a certain subscriber, which can cause the connection to overflow because of too many logon messages in a short period of time. The CNR LEG enables the administrator to use the filter that identifies such events of multiple identical DHCP requests and filters them to reduce the rate of logon messages to a predefined rate. The filter does not protect the CNR against attacks, but rather protects the connection to the SM.

## SM Cable Support Module

The cable support module is an SM component that executes an API friendly to cable environment integrations. The cable support module translates between the cable subscriber terminology (CPE, CM, and CMTS) and the generic subscriber terms used by the Cisco Service Control Management system. The CNR LEG uses PRPC to invoke the **cableLogin** and **cableLogout** operations that are performed by the cable support module API.

The SM cable support module is used only in the CPE as Subscriber mode.

For additional information about the cable support module, see the “CPE as Subscriber in Cable Environment” module of the *Cisco SCMS Subscriber Manager User Guide* .

## SM C++ API

The SM C++ API exposes a set of operations designed to enable subscriber integration with the Cisco system. The CNR LEG uses the SM C++ API as its basic communication layer.

For additional information about the C++ API, see the *Cisco SCMS SM C/C++ API Programmer Guide* .

## Communication Link Failure Handling

A keep-alive mechanism periodically checks the communication link (socket) between the CNR LEG and the SM. The communication link fails when the socket is closed or a keep-alive timeout occurs. You can configure the keep-alive timeout in the SM configuration file.

In cases where a LEG to SM link fails, you can configure the SM to clear the mappings of all the subscribers that are updated by the failed LEG.

To learn more about communication link failure handling, see the “Configuration File Options” module of the *Cisco SCMS Subscriber Manager User Guide* .

## Subscriber Auto-logout

The SM supports the configuration of an auto-logout timer (lease-time) for each subscriber. The timer is set when performing a subscriber **cableLogin** or **login** operation. The CNR LEG extracts and sets an auto-logout value from the DHCP IP lease expiration time option.





## CHAPTER 2

# Installing the CNR LEG

---

This module describes the CNR LEG installation procedures for both Windows and Solaris platforms. It also describes the uninstall procedure.

- [Prerequisites](#)
- [Package Contents](#)
- [Installing the CNR LEG on Windows](#)
- [Installing the CNR LEG on Solaris](#)
- [Uninstalling the CNR LEG](#)

## Prerequisites

CNR LEG is operable with any CNR version 5.0 or later.

The platform requirements (OS/CPU/RAM/disk) are the same as the CNR requirements for both Windows and Solaris. See the *Cisco Network Registrar (CNR) Installation Guide* for platform requirements details.

## Package Contents

The CNR LEG distribution part of the SCMS-SM LEG distribution file and is located in the **CNR\_LEG** directory. The following table describes the contents of the CNR LEG distribution package supplied by Cisco.

**Table 2-1** File layout of CNR LEG distribution package

Root	Folder (under root)	File name	Notes
pkg-ext-dir			
		readme.cnrleg	Short description of CD content
	doc		
		cnrleg.cfg	Sample configuration file
	solaris		

**Table 2-1** File layout of CNR LEG distribution package

Root	Folder (under root)	File name	Notes
		libcnrleg.so	Solaris distribution in a single library file
	winnt		
		asn1ber.dll	
		asn1rt.dll	
		cnrleg.dll	

## Installing the CNR LEG on Windows



### Note

The directory in which the CNR is installed is referred to as **cnr-inst-dir**.

### SUMMARY STEPS

1. Extract the SM LEG distribution file
2. Locate the CNR LEG distribution tar file under the CNR LEG directory
3. Extract the CNR LEG distribution and copy the files
4. Configure the CNR LEG using the sample configuration file
5. Configure the SM
6. Register the CNR LEG with the CNR

### DETAILED STEPS

- 
- Step 1** Extract the SM LEG distribution file
- Step 2** Locate the CNR LEG distribution tar file under the CNR LEG directory
- Step 3** Extract the CNR LEG distribution and copy the files
- Unzip the CNR Package to **pkg-ext-dir**.
  - Copy all files under **pkg-ext-dir\winnt** to **<cnr-inst-dir>\Extensions\DHCP\Dex\**.
  - Copy the sample configuration file from **pkg-ext-dir\doc** to a directory of your choice, hereafter referred to as **cfg-dir**.
- Step 4** Configure the CNR LEG using the sample configuration file  
See [Information About Configuring the CNR LEG](#).
- Step 5** Configure the SM  
See [Information About Configuring the SM](#).
- Step 6** Register the CNR LEG with the CNR
- Run the CNR **<cnr-inst-dir>/bin/nrcmd** command-line utility.

- Log in to the CNR **nrcmd**CLU.

To log in, type the following command:

```
nrcmd[-C cluster] [-N user] [-P password]
```

- Configure the following:

```
nrcmd>extension smleg create dex cnrleg.dll cnrLegPostSendPacket
nrcmd>extension smleg set init-entry=cnrLegInitEntry
nrcmd>extension smleg set init-args=cfg-dir/cnrleg.cfg
nrcmd>dhcp attachExtension post-send-packet smleg 1
Any sequence number can be used for this command
nrcmd>extension smlegext create dex cnrleg.dll cnrLegPostPacketDecode
nrcmd>dhcp attachExtension post-packet-decode smlegext 1
Any sequence number can be used for this command
nrcmd>save
nrcmd>server DHCP reload
```



**Note** You must use the **cfg-dir** full path in the init-args argument.



**Note** You must use a slash (“/”) and not a back-slash (“\”) as the path separator.

## Installing the CNR LEG on Solaris

### SUMMARY STEPS

1. Extract the SM LEG distribution file
2. Locate the CNR LEG distribution tar file under the CNR LEG directory
3. Extract the CNR LEG distribution and copy the files
4. Configure the CNR LEG using the sample configuration file
5. Configure the SM
6. Register the CNR LEG with CNR

### DETAILED STEPS

- 
- Step 1** Extract the SM LEG distribution file
- Step 2** Locate the CNR LEG distribution tar file under the CNR LEG directory
- Step 3** Extract the CNR LEG distribution and copy the files
- Extract the CNR Package to **pkg-ext-dir**. For example:  

```
#>tar xvf cnr-leg-dist.tar
```
  - Copy **libcnrleg.so** under **pkg-ext-dir/solaris** to **<cnr-inst-dir>/extensions/dhcp/dex**.
  - Copy the sample configuration file from **pkg-ext-dir/doc** to a directory of your choice, hereafter referred to as **cfg-dir**.

**Step 4** Configure the CNR LEG using the sample configuration file

See [Information About Configuring the CNR LEG](#)

**Step 5** Configure the SM

See [Information About Configuring the SM](#).

**Step 6** Register the CNR LEG with CNR

- Run the CNR `<cnr-inst-dir>/bin/nrcmd` command-line utility.
- Log in to the CNR `nrcmd` CLU.

To log in, type the following command:

```
nrcmd[-C cluster] [-N user] [-P password]
```

- Configure the following:

```
nrcmd>extension smleg create dex libcnrleg.so cnrLegPostSendPacket
nrcmd>extension smleg set init-entry=cnrLegInitEntry
nrcmd>extension smleg set init-args=cfg-dir/cnrleg.cfg
nrcmd>dhcp attachExtension post-send-packet smleg 1
Any sequence number can be used for this command
nrcmd>extension smlegext create dex libcnrleg.so cnrLegPostPacketDecode
nrcmd>dhcp attachExtension post-packet-decode smlegext 1
Any sequence number can be used for this command
nrcmd>save
nrcmd>server DHCP reload
```



**Note**

You must use the `cfg-dir` full path in the `init-args` argument.



**Note**

You must use a slash (“/”) and not a back-slash (“\”) as the path separator.

## Uninstalling the CNR LEG

This section explains how to uninstall the CNR LEG. The uninstall procedure is applicable for both Windows and Solaris platforms.

**Step 1** Un-register CNR LEG from CNR

- Run the CNR `<cnr-inst-dir>/bin/nrcmd` command-line utility.
- Log in to the CNR `nrcmd` CLU.

To log in, type the following command:

```
nrcmd[-C cluster] [-N user] [-P password]
```

- Configure the following:

```
nrcmd>dhcp detachExtension post-send-packet 1
nrcmd>extension smleg delete
nrcmd>dhcp detachExtension post-packet-decode 1
nrcmd>extension smlegext delete
nrcmd>save
nrcmd>server DHCP reload
```

**Step 2** Delete the LEG distribution files

- Delete all files copied to `<cnr-inst-dir>/extensions/dhcp/dex`



- Delete the configuration file ( **cfg-dir/cnrleg.cfg** ).
-





## CHAPTER 3

# Configuring the CNR LEG and the SM

---

This module explains how to configure the CNR LEG and to configure the Subscriber Manager to use the CNR LEG module.

- [Information About Configuring the CNR LEG](#)
- [Information About Configuring the SM](#)

## Information About Configuring the CNR LEG

The CNR configuration file offers the following configuration options to the user:

- SM IP address—The IP address of the SM
- SM port—The TCP port on which the SM PRPC server listens
- Subscriber mode—The subscriber entity to be used by the LEG: CM as subscriber (default) or CPE as subscriber
- Lease time option—The DHCP option number from which to extract the lease expiration time that is to be sent to the SM
- Attack filter parameters—Defines whether the DHCP DoS attack protection is on and defines how to perform the filtering

## Information About Setting the SM IP Address and Port

- [Setting the SM IP Address and Port](#)
- [SM IP Address and Port Example](#)

### Setting the SM IP Address and Port

You must set the SM IP address correctly in order for the LEG to operate.

The default PRPC TCP port number generally does not need to be changed. The SM port default is TCP 14374.

The SM PRPC port can be retrieved from the SM configuration file. For additional information, see the "Configuration File Options" module of the *Cisco SCMS Subscriber Manager User Guide*.

## SM IP Address and Port Example

The following example is a portion of a sample CNR configuration file showing how to configure the SM IP address and port:

```
[sm]
# SM IP address
ip_address= 216.239.37.99
# SM PRPC Server port. default 14374
#port=14374
```

## Information About Setting the Subscriber Mode

- [Setting the Subscriber Mode](#)
- [Subscriber Mode Example](#)

### Setting the Subscriber Mode

The LEG can operate in one of two modes:

- **CM as Subscriber**—Each CPE login/logout/lease extension triggers a logon operation to the SM using the corresponding CM MAC as the subscriber ID.
- **CPE as Subscriber**—Each CPE is a separate subscriber entity. Each CPE login/logout/lease extension triggers a logon operation to the SM using both the CPE MAC and the CM MAC as the subscriber ID.

### Subscriber Mode Example

The following example is a portion of a sample CNR configuration file showing how to configure the Subscriber Mode:

- **CM as Subscriber:**
  - [general]
 

```
# defines who is the subscriber to refer to the CM or the CPE.
# default: cm_as_subscriber optional values: cm_as_subscriber \
# cpe_as_subscriber
subscriber_mode=cm_as_subscriber
```
- **CPE as Subscriber:**
  - [general]
 

```
# defines who is the subscriber to refer to the CM or the CPE.
# default: cm_as_subscriber optional values: cm_as_subscriber \
# cpe_as_subscriber
subscriber_mode=cpe_as_subscriber
```

## Information About Setting the Attack Filter Parameters

- [Setting the Attack Filter Parameters](#)
- [Attack Filter Example](#)

## Setting the Attack Filter Parameters

To enable the DHCP Denial of Service (DoS) attack protection, the enabled option must be set. The attack filter has two parameters that define its operation:

- The **timeout** parameter defines the minimal interval in seconds between identical DHCP requests (login/renew transactions). If two identical requests reach the CNR within the time interval specified in this parameter, the LEG ignores the second request. The CNR does not trigger the second login to the SM.
- The **num\_of\_entries** parameter defines the number of DHCP transaction information entries that the attack filter can hold at any given time. This parameter affects the amount of memory allocated by the LEG for the DoS attack protection filter. Change this parameter only if the LEG supports a high transaction rate.

## Attack Filter Example

The following example is a portion of a sample CNR configuration file showing how to configure the attack filter parameters:

```
[attack filter]
# enable or disable the attack filtering mechanism in the LEG
# can be set to true or false. default true.
enabled=true
# minimum time in seconds between DHCP login/renew transactions of
# the same subscriber with the same IP. default = 10 seconds
timeout=10
# the number of attack transactions detected on this user that
# should generate a log message. setting 0 disables this logging.
# note: the first attack detection is always logged (unless
# logging is disabled)
# default: log every 100 attack transactions.
log_interval=100
```

## Information About Setting the Lease Time Option

- [Setting the Lease Time Option](#)
- [Lease Time Option Example](#)

## Setting the Lease Time Option

To enable subscriber auto-logout at lease time expiration on the SM, the lease\_time option must be set. The CNR LEG can extract the IP address lease expiration from one of the following DHCP option numbers:

- 51 (default)
- 58
- 59

For additional information about the auto-logout mechanism, see [Information About Configuring Auto-logout](#).

## Lease Time Option Example

The following example is a portion of a sample CNR configuration file showing how to configure the lease time option:

```
lease_time_option=51
```

## Information About Configuring the SM

Use the SM configuration file to configure the Subscriber Manager. For additional information, see the “Configuration File Options” module of the *Cisco SCMS Subscriber Manager User Guide*.

- [Information About Configuring SM-LEG Failure Handling](#)
- [Information About Setting Domain Aliases](#)
- [Information About Configuring Auto-logout](#)
- [Configuring the PRPC Server](#)

## Information About Configuring SM-LEG Failure Handling



### Note

It is **important** to properly configure SM-LEG failure handling on the SM before continuing with the CNR LEG configuration. For information about configuring the SM, See the “Configuration File Options” module of the *Cisco SCMS Subscriber Manager User Guide*.

In order to configure the failure handling, you must do the following in the configuration file:

- Activate SM-LEG Failure Handling
- Set LEG-Domains associations

## Information About Activating SM-LEG Failure Handling

### Activating SM-LEG Failure Handling

By default, SM-LEG failure handling is not activated. In order to activate it you must set the **clear\_all\_mappings** parameter to **true**. If required, you can also change the **timeout** value.

### SM-LEG Failure Handling Example

The following example is a portion of a sample **p3sm.cfg** configuration file showing how to configure SM-LEG failure handling:

```
[SM-LEG Failure Handling]
# The following parameter defines the behavior of the SM in case of
# LEG-SM connection failure.
# This parameter is relevant only for cases SM and LEG are running
# on different machines.
# Note that this parameter defines a behavior that is similar for
# ALL connected LEGs. If the parameter is set to true then in case
# of LEG-SM connection failure that is not recovered within the
# defined timeout, the mappings of all subscribers in the domains
# defined in the 'LEG-Domains Association' section for the LEG
# that was disconnected, will be removed.
#
```

```
# IMPORTANT: LEG Domains must be defined in the following section
# in case this parameter is set to 'true'.
#
# Optional values: [true/false]. Default: false.
clear_all_mappings=true
# The following parameter defines the time in seconds from a LEG-SM
# connection failure until clearing the mappings in the SM database.
# Default value: 60.
timeout=60
```

## Information About Setting LEG-Domains Associations

- [Setting LEG-Domains Associations](#)
- [LEG-Domains Association Example](#)

### Setting LEG-Domains Associations

You must set LEG-Domains associations in order for the SM-LEG failure handling to work. The CNR-LEG name to be used in this section is a concatenation of the hostname of the machine on which the LEG is installed and the suffix “.CNR.LEG”.

An alternate way to retrieve the CNR-LEG name is by using the p3rpc utility. This utility displays all clients currently connected to the PRPC server, including the CNR.

Use the **p3rpc** CLU to retrieve the CNR LEG name:

```
>p3rpc -show-client-names
```

### LEG-Domains Association Example

If the hostname of the machine on which the LEG is installed is **netserv5**, use **netserv5.CNR.LEG** for the LEG name in the configuration file. The following example assumes that the name of the subscriber domain associated with the CNR LEG is **subscribers**.

The following example is a portion of a sample **p3sm.cfg** configuration file showing how to set LEG-Domains associations.

```
[LEG-Domains Association]
# The following parameter defines domains that the mapping of all
# subscribers that belong to them will be cleared on LEG-SM
# connection failure. The key is the LEG NAME and the value is a
# comma separated list of domain names.
# A value of * in domain names stands for all the subscriber domains
# in the system.
# A value of * in LEG name means all the LEGs that are connected to
# the SM.
# LEG NAME1 = domain_name1, domain_name2
# LEG NAME2 = domain_name2, domain_name3
netserv5.CNR.LEG=subscribers
```

## Information About Setting Domain Aliases

- [Setting Domain Aliases](#)
- [Domain Aliases Example](#)

### Setting Domain Aliases

You must set domain aliases in order for the CNR LEG to operate correctly.

The CNR LEG uses the CMTS IP address for the subscriber domain name. You should make sure that all the CMTS IP addresses appear as an alias to exactly one subscriber domain. Use the SM configuration file to configure domain aliases.

**Note**

You do not have to configure domain aliases in those cases where each CMTS updates a single subscriber domain *and* you have configured the subscriber domain names in the SM to be the IP address of the matching CMTS.

## Domain Aliases Example

In this example, the SM is configured with the following:

- A single subscriber domain named **subscribers**
- Four CMTS devices with the following IP addresses:
  - 209.247.228.201
  - 209.247.228.202
  - 69.42.72.147
  - 69.42.72.148

The following example is a portion of a sample **p3sm.cfg** configuration file showing how to configure the domain aliases.

```
[Domain.subscribers]
# The following parameter defines domain aliases. When subscriber
# information is received from the LEG with certain alias the
# information will be distributed to the domain that matches this
# alias - domain that contains this alias in its aliases list.
#
# A typical alias could be a network device IP address. For example,
# each string in the values can be the IP address of a NAS or a
# CMTS.
#
# In order to distribute all subscriber operations on all unmapped
# domains to a certain domain use aliases=*. Note that only one
# domain section may include this alias.
aliases=209.247.228.201,209.247.228.202,69.42.72.147,69.42.72.148
```

## Information About Configuring Auto-logout

- [Configuring Auto-logout](#)
- [Auto-logout Example](#)

## Configuring Auto-logout

To automatically log out subscribers when their lease time expires, you must configure the SM auto-logout interval. After every auto-logout interval time, the SM checks which subscriber IP addresses have a lease time that has expired and begins to automatically remove these IP addresses from the system.

**Lease time** is the timeout defined by the LEG during the login operation of each IP address, based on the lease-time option. All subscriber login events will start a timer of **lease\_time** seconds. When the timer expires and the **grace\_period**, which is another configuration parameter, has also passed, the



subscriber's IP addresses are removed causing the subscriber to be removed from the SCE platform database. If the subscriber logs on with an existing IP address during the countdown period, the timer is reset and the countdown period restarts.

If the auto-logout value is set to zero (0), the SM's auto-logout mechanism is disabled.

If the auto-logout interval is set to a value greater than zero, the SM's auto-logout mechanism is enabled.



Note

The subscriber record (with no mappings) remains in the SM database, preserving the subscriber state.

## Auto-logout Example

The following example is a portion of a sample **p3sm.cfg** configuration file showing how to configure the auto-logout interval to 6 minutes:

```
[Auto Logout]
# The following parameter configures the time between each run of
# the auto-logout mechanism. After every "auto-logout" time
# interval, the SM checks which subscriber IP addresses have a lease
# time that has expired, and begins to automatically remove these IP
# addresses from the system (causing it to be removed from the SCE
# platform's database).
# Auto-logout should be activated when the LEG/API cannot provide
# logout indications.
auto_logout_interval=360
# The following parameter defines the grace period in seconds for
# subscriber auto logout. A subscriber will be logged out only after
# timeout period + grace period seconds.
grace_period=10
# The following parameter defines the maximum rate (logouts per
# second) that the auto-logout task will perform logouts from the
# system. This enables to spread the load of the logout operations
# over time, and reduce the performance impact on other operations.
# The value should be calculated so it spreads the logouts over at
# least half of 'auto_logout_interval' time. (default 50)
max_rate=50
```

## Configuring the PRPC Server

To enable the CNR LEG to communicate with the SM, the PRPC server must be up and running. The RPC server is started by default, therefore it does not require special configuration.

The following example is a portion of a sample **p3sm.cfg** configuration file showing the PRPC server configuration:

```
[RPC.Server]
# RPC server port (default 14374)
port=14374
```

To view the status of the PRPC server in the SM, use the **p3rpc**.

```
>p3rpc --show
```





## CHAPTER 4

# CNR LEG Functional Specification

---

This module describes the CNR LEG design, logging, tracing, and operations performed by the CNR LEG.

The purpose of this appendix is to provide insight into the CNR LEG operation and integration with CNR.

- [CNR LEG High Level Design](#)
- [Logging and Tracing](#)
- [Extensions Point Operation](#)

## CNR LEG High Level Design

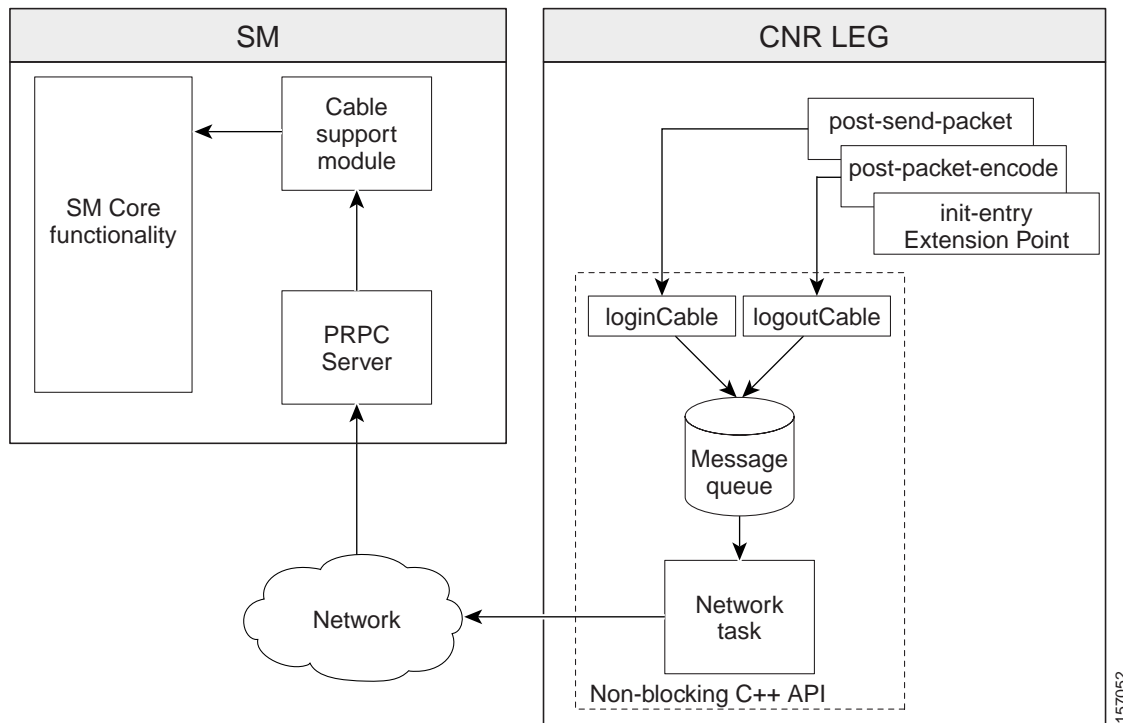
The CNR LEG uses extension points:

- `init-entry`
- `post-packet-decode`
- `post-send-packet`

When an extension point hook is called, the following sequence of events takes place:

1. The extension point hook performs the minimal computation necessary to extract all the required data and calls a Non-blocking C++ API operation.
2. The Non-blocking operation encodes a message and places it in a queue.
3. The Non-blocking C++ API network task reads messages from the message buffer and sends them over the network to the PRPC Server on the SM.
4. The PRPC Server decodes the message and passes it to the cable support module, which sets up the subscribers in the SM database using the SM core functionality.

Figure 4-1 CNR LEG High Level Design



The only operations performed in the context of the CNR extension dispatching thread are message creation and placement in a message queue. A separate thread performs the heavy network operations. Note that if for some reason the message queue is full, the message will be dropped to avoid the risk of creating a delay, which would damage CNR performance.

## Logging and Tracing

By default, the CNR LEG logs its messages to the CNR log. The LEG supports a debug mode and several trace levels. The LEG configuration file controls logging and tracing.



Note

Changes made to the LEG configuration file become effective only when the LEG is restarted.

## Extensions Point Operation

This section briefly describes the operations performed by the CNR LEG at each extension point.

- [init-entry](#)
- [post-send-packet](#)
- [post-packet-decode](#)

## init-entry

The extension point **init-entry** initializes and terminates the CNR LEG.

During initialization, the CNR LEG performs the following operations:

- Reading the configuration file
- Initializing the LEG logging and tracing
- Creating a Non-blocking C++ API instance and connecting it to the SM
- Starting the C++ API network-task thread

During termination, the CNR LEG performs the following operations:

- Stopping and freeing the Non-blocking C++ API instance
- Stopping the C++ API network-task thread

## post-send-packet

The extension point **post-send-packet** sends the following **cableLogin** operations to the SM:

- Verifying that the request-dictionary is for DHCP REQUEST and the response dictionary is for DHCP ACK
- Extracting CM-MAC, CPE-MAC, and CMTS-IP from the request dictionary
- Extracting the assigned CPE-IP and lease time from the response dictionary
- In CM as Subscriber mode CM requests are ignored
- Calling the Non-blocking C++ API **cableLogin** or **login** operation with the parameters extracted
- If no CM-MAC (option 82) is found, an attempt to extend the lease based solely on the IP address is performed

## post-packet-decode

The extension point **post-packet-decode** sends the following **cableLogout** or **logout** operations to the SM:

- Verifying that the request dictionary is for either DHCP RELEASE or DHCP DECLINE
- Extracting CM-MAC, CPE-MAC, CPE-IP, and CMTS-IP from the request dictionary
- Calling the Non-blocking C++ API **cableLogout**\logout operation with the parameters extracted





# APPENDIX A

## CNR Log Messages

---

This module describes the log messages written to the CNR Log.

### Log Messages

The following messages are displayed during the LEG startup procedure. (This message is logged every time the DHCP server is restarted):

- "CNR LEG: init entry called - starting initialization" - CNR LEG initialization was called
- "CNR LEG: finished initialization successfully"

The following messages are displayed – containing the configuration or default parameters – at initialization:

- "CNR LEG: thread priority =<integer value>"
- "CNR LEG: buffer size =<integer value>"
- "CNR LEG: reconnect timeout =<integer value>"
- "CNR LEG: encoding =<encoding>"
- "CNR LEG: KA duration =<integer value>"
- "CNR LEG: session timeout =<integer value>"
- "CNR LEG: debug mode on =<integer value>"
- "CNR LEG: trace level =<integer value>"
- "CNR LEG: lease time option =<integer value>"
- "CNR LEG: SM port =<integer value>"
- "CNR LEG: SM IP =<IP address>"
- "CNR LEG: report errors on =<integer value>"
- "CNR LEG: CM as Subscriber =<integer value>"
- "CNR LEG: Attack-Filter on =<integer value>"
- "CNR LEG: Attack threshold <integer value>sec"
- "CNR LEG: Filter entries =<integer value>"
- "CNR LEG: Log filter every <integer value>attacks"
- "CNR LEG: DEBUG MODE ON - enabling trace level <trace level>"

The following messages are displayed if there is a configuration error:

- "CNR LEG: the file <filename>was not found" - configuration file was not found, you must fix the configuration or move the file to the correct location.

- "CNR LEG: no SM IP address in the configuration file - aborting" – the SM IP address is the only parameter that is required in the configuration file.
- "CNR LEG: invalid Attack Filter configuration parameters must be positive"
- "CNR LEG: unable to initialize the PRPC client - aborting"

The following messages are displayed every time the DHCP server is stopped:

- "CNR LEG: init entry called - starting un-initialization"
- "CNR LEG: finished uninitialization successfully"

The following messages are displayed when triggered by the attack filter:

- "**CNR LEG: Identified attack start of CM <name>, IP <IP address>- filtering (total attacks - <number of attacks>)**" – logged at detection of the attack. 'total attacks' refers to the total number of attacks detected from all devices by this LEG.
- "**CNR LEG: Identified attack number <attack number>of CM <name>, IP <IP address>- filtering (total attacks - <number of attacks>)**" – logged every 100 sequential attack-packets of a certain device.

The following messages are displayed in response to a device login or a renewal failure:

- "**CNR LEG: failed to extend lease IP <IP address>- probably buffer overflow**" – logged in CM as subscriber mode when the request does not contain option 82
- "**CNR LEG: CPE Login - failed to login CM <name>, IP <IP address>- probably buffer overflow**" – logged in CM as subscriber mode when the request contains option 82
- "**CNR LEG: CM Login - failed to login CM <name>, IP <IP address>- probably buffer overflow**" – logged in CPE as subscriber mode
- "**CNR LEG: CPE Login - failed to login CPE <name>, IP <IP address>- probably buffer overflow**" – logged in CPE as subscriber mode

The following messages are displayed in response to device logout failures:

- "**CNR LEG: CPE Logout - failed to logout IP <IP address>- probably buffer overflow**" – logged in CM as subscriber mode when the request does not contain option 82
- "**CNR LEG: CPE Logout - failed to logout CM <name>, IP <IP address>- probably buffer overflow**" – logged in CM as subscriber mode when the request contains option 82
- "**CNR LEG: CM Logout - failed to logout CM <name>, IP <IP address>- probably buffer overflow**" – logged in CPE as subscriber mode
- "**CNR LEG: CPE Logout - failed to logout CPE <name>, IP <IP address>- probably buffer overflow**" – logged in CPE as subscriber mode