

## Chapter 34

# Open Systems Interconnection (OSI)

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## Introduction

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The OSI Network Layer consists of the following network services:

- Connection-Oriented Network Service (CONS)
- Connectionless mode Network Service (CLNS)

The following routing protocols are part of the OSI Network Layer:

- End System to Intermediate System routing exchange protocol (ESIS)
- Intermediate System to Intermediate System routing exchange protocol (ISIS)
- Inter-Domain Routing Protocol (IDRP)

This chapter addresses the implementation of CLNS, ESIS, and ISIS. It does not address the implementation of CONS or IDRP.

## ISO NSAP (Network Service Access Point) Addresses

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ISO addresses defined in ISO 8348-Add2 for IS-IS can be thought of as a sequence of variable bytes up to 20 bytes long. The addresses are divided into several separate parts depending on the interpretation of the addresses specified for the routing domain.

Source and destination addresses for Protocol Data Units (PDUs) are preceded by an address length indicating the length of the corresponding address field.

For example, the OSI network specifies the following NSAP format:

- 5 bytes of Domain part
- 2 bytes of area address
- 6 bytes of System ID and
- 1 byte of system selector

In the context of ES-IS and IS-IS, NSAP addresses are interpreted as:

- n bytes of area address (variable)
- 6 bytes of system ID
- 1 byte selector
- NSAP Address Representation

Dotted hexadecimal notation is used in commands to represent NSAP addresses. In this format, NSAP addresses are represented as:

- ww.xxxx.xxxx.xxxx.xxxx.xxxx.yyyy.yyyy.yyyy.zz.
- ww: domain part
- xx: area part
- yy: system ID part
- zz: selector part

where all “ww”, “xx”, “yy” and “zz” are hexadecimal bytes.

Note that the area part of the address is of variable length. Therefore the whole NSAP address has a variable length of not less than 8 bytes (1 byte for the domain part, 6 bytes for the system ID, and a 1 byte for the selector part).

An NSAP address is interpreted as: 1 byte for the domain part, a variable number of bytes for the area part, 6 bytes of system ID part, and 1 byte selector. Refer to examples in the following table.

Table 34-1: Interpreting NSAP addresses

NSAP Address Example	Interpretation
47.0004.004D.0003.4300.2233.1177.00	Domain part: 47 Area part: 0004.004D.0003 Area address: 47.0004.004d.0003 System ID: 4300.2233.1177 Selector: 00
47.0004.4300.2233.1177.00	Domain part: 47 Area part: 0004 Area address: 47.0004 System ID: 4300.2233.1177 Selector: 00 - selector part
47.2233.1177.00	An invalid NSAP address (too short)
47.0004.004D.0003.1272.3320.1111.1134.4 300.2233.1177.00	An invalid NSAP address (too long)

An NSAP address prefix may be used to define which addresses can be accessed via a specified route. The prefix consists of the first  $n$  bytes of the NSAP address. These “reachable addresses” must be defined in the Reachable Address Database. A reachable address, therefore, defines a group of NSAP addresses with the same prefix that are able to be reached via a specified route.

## ISO on the Router

---

ISO have published a range of standards and reports relating to OSI. Not all of the standards and reports are mandatory, and this section outlines the mandatory as well as the optional standards and reports supported by the router.

### Mandatory CLNS Standards

All mandatory parts of the ISO standards for Connectionless Mode Network Service (CLNS) have been implemented. Relevant standards are:

#### ISO 8473-1: CLNS Protocol Specification

The protocol in this standard may be used between Network entities in end systems, between Network entities in intermediate systems, or between a Network entity in an end system and a Network entity in an intermediate system. In an end system, the router provides the connectionless-mode network service defined in CCITT Rec. X.213 and ISO/IEC 8248.

#### ISO 8473-2: CLNS over ISO 8802 Subnetworks

This standard specifies the way in which the underlying service assumed by the protocol defined in ISO/IEC 8473-1 is provided. The service is provided by a subnetwork that conforms to ISO/IEC 8802 through the operation of a SubNetwork Dependent Convergence Function (SNDCF). The SNDCF function is described in ISO/IEC 8648. The SNDCF specified in the ISO standard may be used with any ISO/IEC 8802 compliant subnetwork that provides the Logical Link Control Sublayer Interface service defined by ISO/IEC 8802-2.

#### ISO 8348: Network Service Definition

This standard defines the boundary layer service provided by the Network Layer to the Transport Layer. It provides definitions of how the layers interact and support each other.

Section 2 of this standard – Definition of the Connection-Mode Service – is not supported.

#### ISO 8343/Add2: Network Layer (NSAP) Addressing using preferred binary encoding

This standard defines the OSI Network Service.

#### ISO 8648: Internal Organisation of the Network Layer

This standard defines the internal organisation of the Network Layer.

#### ISO TR 9575: OSI Routing Framework

This Technical Report describes the framework, concepts, and terminology used in OSI routing protocols.

## ISO TR 9577: Protocol Identification in the Network Layer

This Technical Report describes how to discriminate between multiple network-layer protocols running on the same medium.

## Optional Sections of CLNS Standards

The following optional sections of CLNS have also been implemented.

### Lifetime Control

The PDU lifetime control function assesses whether a received PDU's assigned lifetime has expired. If its lifetime has expired, the PDU is discarded. If its lifetime has not expired, the PDU may be forwarded.

### Segmentation

Segmentation is performed when the length of a PDU is greater than the maximum data unit size supported by the underlying service to be used to transmit the PDU.

### Reassembly

Reassembly reconstructs PDUs that were fragmented by the segmentation process.

### Error Reporting

When a PDU is discarded, Error Reporting attempts to return an Error Report PDU to the source network entity of the discarded PDU.

### ECHO

Echo request and Echo response is invoked by Network Layer Management to obtain information about the dynamic state of the Network Layer with respect to the reachability of specific network entities. This process clarifies the characteristics of the path or paths that can be created between network entities through the operation of Network Layer routing functions.

### Route Recording

Route Recording records the path taken by a PDU as it traverses a series of intermediate systems.

### Quality of Service

The quality of service maintenance function provides information to network entities in intermediate systems. The information may be used to make routing decisions where such decisions affect the overall quality of service provided to network users.

### Basic Congestion Notification

Intermediate systems may inform the destination network entity of congestion through the use of a flag in the QoS maintenance parameter in the options part of the PDU header. This allows network users to take appropriate action when congestion is experienced within the network service provider.

The following optional parts of CLNS are **not** supported:

- Security
- Source Routing
- Priority
- TRACE

## Mandatory ESIS Standards

All mandatory parts of the End System to Intermediate System routing exchange protocol (ESIS) have been implemented. ESIS is defined in:

### ISO 9542: End System to Intermediate System Routing Exchange Protocol (ESIS)

This standard specifies a protocol used by Network Layer entities operating ISO 8473 in End Systems (ES) and Intermediate Systems (IS) to maintain routing information.

The protocol specified in this standard relies upon the provision of a connectionless-mode underlying service.

## Optional Sections of ESIS Standards

The following optional sections of ESIS have been implemented.

### Route Redirection

Route redirection information allows Intermediate Systems to inform End Systems of (potentially) better paths to use when forwarding NPDUs to a particular destination.

### Setable Timers

There are two types of setable timer: the Configuration Timer and the Holding Timer. The Configuration Timer determines how often a system reports its availability to other systems on the same subnetwork. The Holding Timer determines how long configuration and route redirection information is maintained. Both timers may be set using commands.

## Mandatory ISIS Standards

All mandatory sections of the Intermediate System to Intermediate System intra-domain routing protocol (ISIS) have been implemented. These parts are defined by the following documents:

### ISO 10589: Intermediate System to Intermediate System Intra-Domain Routing Protocol (ISIS)

This standard specifies a protocol used by Network Layer entities operating the protocol specified by ISO 8473 in Intermediate Systems to maintain routing information. The information is used for the purpose of routing PDUs within a single routing domain.

The protocol specified in this standard relies upon the provision of a connectionless-mode underlying service.

## Optional Sections of ISIS Standards

ISIS defines four routing metrics. The four metrics correspond to the four possible orthogonal qualities of service. While the default metric is mandatory, the other metrics (delay, expense, and error) are optional but have been implemented.

The stronger form of authentication defined in “draft-ietf-isis-hmac-00.txt -ISIS HMAC-MD5 Authentication” is an optional section of ISIS, and is **not** supported

## Layer 2 protocols supporting CLNS

CLNS is supported over the following Layer 2 protocols:

- Ethernet
- PPP

CLNS is not supported over the following Layer 2 protocols:

- X25T
- FR
- ISO 7776 LAPB
- IP/GRE Tunnelling

## CLNS circuits over dial-up PPP interfaces

To disable ESIS and ISIS on a CLNS circuit, use the **esis** and **isis** parameters in the **add clns circuit** and **set clns circuit** commands:

```
add clns circuit[=virtual-router-id] circuit=circ-id
    interface=interface esis=off isis=off

set clns circuit[=virtual-router-id] circuit=circ-id
    interface=interface esis=off isis=off
```

A CLNS circuit added on a dial-up PPP interface should use static routing and should not have ESIS or ISIS enabled. This is due to the “chatty” nature of ESIS and ISIS, which would keep the dial-up interface open continuously.

## SNMP

---

A MIB for managing the operation of the IS-IS and ES-IS protocols has been implemented under the Allied Telesis Enterprise MIB. The MIB is based on a draft revision of an IETF MIB dated September 1992 and titled “*Integrated IS-IS Management Information Base*”. Several additions have been made to this MIB to provide a more complete IS-IS and ES-IS management system.

## Configuration Examples

This section shows the following examples of OSI:

- [Two Routers and One OSI Area](#)
- [Three Virtual Routers and Three OSI Areas](#)

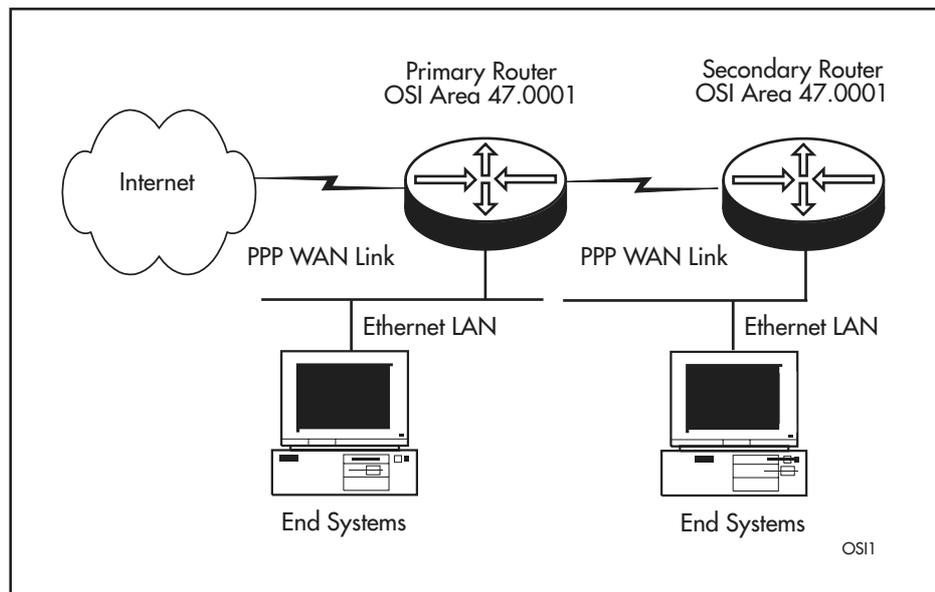
Circuits can be added or altered to meet network requirements.

### Two Routers and One OSI Area

The example includes one Ethernet onto a LAN, and two WAN links (one to another router, the other link to the Internet). Both routers are in the same OSI area (Figure 34-1).

The WAN links can use PPP interface links of any PPP type.

Figure 34-1: Two routers and one OSI area.



#### To configure the primary router

Perform these steps on the primary router. In this example the primary router is the router with a WAN link to the Internet.

##### 1. Create the WAN links.

Create the WAN link to the secondary router.

```
create ppp=0 over=syn0
```

Create the WAN link to the Internet.

```
create ppp=1 over=syn1
```

##### 2. Enable an OSI area.

```
ena clns area=47.0001
```

##### 3. Add the local LAN circuit to the OSI area.

```
add clns circ=1 int=eth0
```

**4. Add the remote office WAN circuit to the OSI area.**

```
add clns circ=2 int=ppp0
```

**5. Connect to the uplink WAN to the Internet.**

```
add clns circ=3 int=ppp0
```

The OSI network now functions. However, you may improve security by limiting sent and received traffic to level 2.

**6. Limit sent and received traffic to level 2.**

```
set clns circ=3 l2 only=yes
```

**To configure the secondary router**

Perform these steps on the secondary router. In this example the secondary router is the router without a WAN link to the Internet.

**1. Create the WAN links.**

Create the WAN link to the primary router.

```
create ppp=0 over=syn0
```

**2. Enable the OSI CLNS area.**

```
ena clns area=47.0001
```

**3. Add the local LAN to the OSI area.**

```
add clns circ=1 int=eth0
```

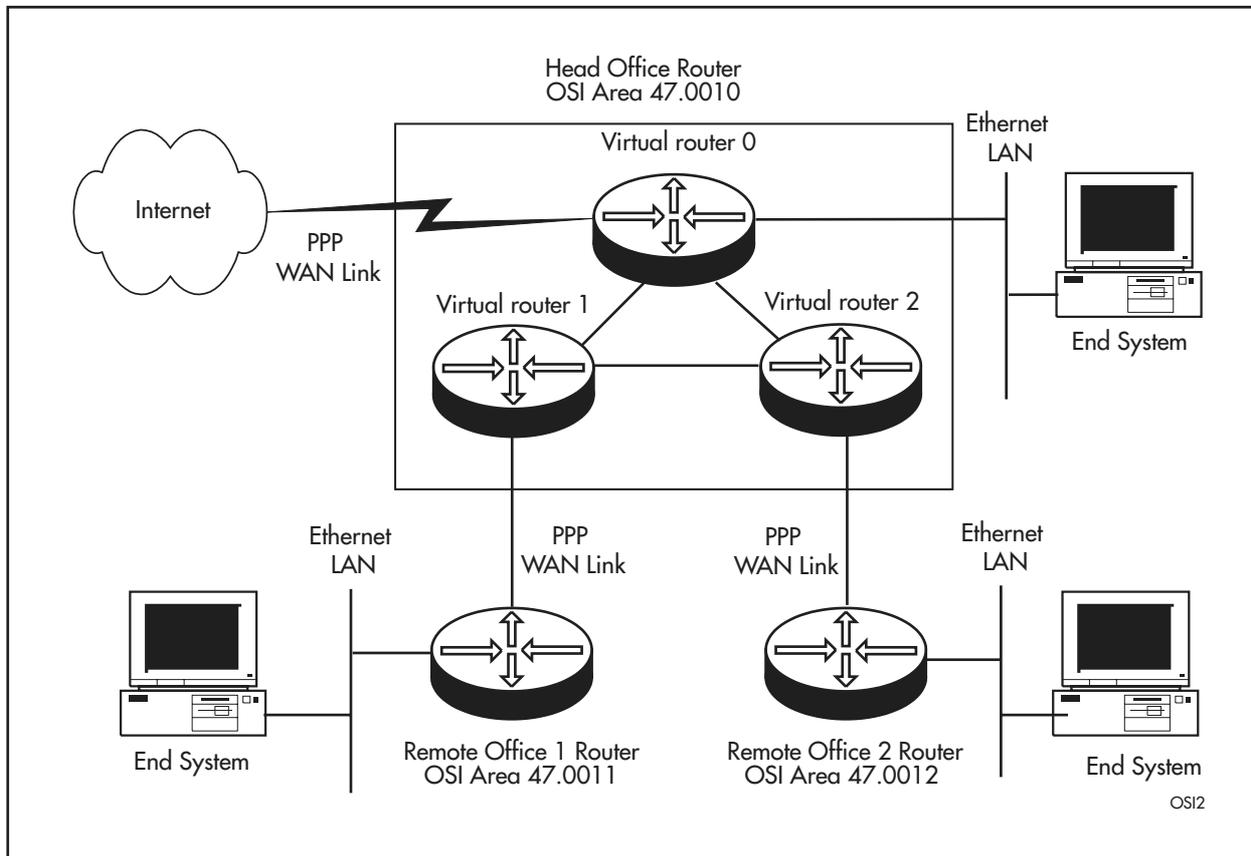
**4. Add the remote LAN to the OSI area.**

```
add clns circ=2 int=ppp0
```

## Three Virtual Routers and Three OSI Areas

The example shows how to configure a router with three virtual CLNS routers, with each virtual router in a different OSI area. A typical scenario might be where a single head office router is connected via WAN links to two remote office routers (Figure 34-2). The WAN links in this example use PPP over a synchronous interface, but could be any type of PPP.

Figure 34-2: Three virtual routers and three OSI areas.



### To configure the head office router

#### 1. Create the WAN links.

```
create ppp=0 over=syn0
create ppp=1 over=syn1
create ppp=2 over=syn2
```

#### 2. Create the head office virtual router.

Enable an OSI area.

```
ena clns=0 area=47.0010
```

Add a circuit to the head office LAN.

```
add clns=0 circ=1 int=eth0
```

Add a circuit for the head office WAN uplink.

```
add clns=0 circ=2 int=ppp0
```

**3. Create a virtual router for remote office 1.**

Enable an OSI area.

```
ena clns=1 area=47.0011
```

Add a circuit for the WAN link to remote office 1.

```
add clns=1 circ=1 int=ppp1
```

**4. Create a virtual router for remote office 2.**

Enable an OSI area.

```
ena clns=2 area=47.0012
```

Add a circuit for the WAN link to remote office 2.

```
add clns=2 circ=1 int=ppp2
```

**5. Connect the head office virtual router to the remote office virtual routers.**

Connect the head office router to the remote office 1 router.

```
add clns=0 circ=3 int=virt1
```

Connect the head office router to the remote office 2 router.

```
add clns=0 circ=4 int=virt2
```

**6. Connect the remote office virtual routers to the head office virtual router.**

```
add clns=1 circ=2 int=virt0
```

```
add clns=2 circ=2 int=virt0
```

The virtual router network now functions. However, you may reduce the number of hops by connecting the remote offices.

**7. Connect the remote offices.**

```
add clns=1 circ=3 int=virt2
```

```
add clns=2 circ=3 int=virt1
```

**To configure the remote office routers****1. Create the WAN links.**

```
create ppp=0 over=syn0
```

**2. Enable the OSI CLNS area.**

At remote office 1, enable an OSI area.

```
ena clns area=47.0011
```

At remote office 2, enable an OSI area.

```
ena clns area=47.0012
```

**3. Add the local LAN to the OSI area.**

```
add clns circ=1 int=eth0
```

**4. Add the WAN link to the head office.**

```
add clns circ=2 int=ppp0
```

## Command Reference

---

This section describes the commands available to configure and monitor OSI on the router.

The shortest valid command is denoted by capital letters in the Syntax section. See [“Conventions” on page lxv of About this Software Reference](#) in the front of this manual for details of the conventions used to describe command syntax. See [Appendix A, Messages](#), for a complete list of error messages and their meanings.

### add clns adjacency

---

**Syntax** `ADD CLNS[=virtual-router-id] ADJacency=nsap-system-id  
CIRCUit=circ-id [ETHernetaddress=macadd]`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-system-id* is the system ID part of an NSAP address.
- *circ-id* is an integer from 1 to 255.
- *macadd* is an Ethernet MAC address in dashed hexadecimal notation.

**Description** This command adds a static end system adjacency entry to the adjacency database of the specified CLNS virtual router.

The **clns** parameter specifies which virtual router the adjacency is to be added to. The default is 0.

The **adjacency** parameter specifies the system ID of the end system that is adjacent to the router.

The **circuit** parameter specifies the circuit over which the adjacent end system can be reached. The circuit must be over either a PPP or Ethernet interface. The circuit must not be over a virtual interface.

The **ethernetaddress** parameter specifies the ethernet MAC address of the adjacent end system if it is reached from the router via a broadcast interface (such as Ethernet). The **ethernetaddress** parameter should not be present if the circuit is not over an Ethernet interface.

**Examples** To add a static adjacency with system ID 1d2b.345a.975d, reachable over circuit 1 with MAC address 00-00-cd-00-0d-01, to CLNS virtual router zero, use the command:

```
add clns adj=1d2b.345a.975d circ=1 eth=00-00-cd-00-0d-01
```

**Related Commands** [delete clns adjacency](#)  
[purge clns](#)  
[show clns adjacency](#)

## add clns area

---

**Syntax** `ADD CLNS[=virtual-router-id] AREa=nsap-area-address`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-area-address* is an OSI NSAP area address.

**Description** This command adds an area NSAP address to a CLNS virtual router.

The **clns** parameter specifies the identity number of the virtual router that the area address is to be added to. The default is **0**.

The **area** parameter specifies the NSAP area address that is to be added to the virtual router. The area address should be no more than 13 bytes long.

**Examples** To add an area NSAP address of 47.12ac.5689.1235.acdb to the CLNS virtual router with identifier 0, use the command:

```
add clns=0 are=47.12ac.5689.1235.acdb
```

**Related Commands** [delete clns area](#)  
[enable clns](#)  
[show clns area](#)

## add clns circuit

**Syntax** ADD CLNS[=*virtual-router-id*] CIRCUIT=*circ-id*  
 INTERFACE=*interface* [IIHping=1..65535]  
 [L1DEFmetricval=1..63] [L1DELMetricval=0..63]  
 [L1EXPmetricval=0..63] [L1ERRmetricval=0..63]  
 [L2DEFmetricval=1..63] [L2DELMetricval=0..63]  
 [L2EXPmetricval=0..63] [L2ERRmetricval=0..63]  
 [ISIS={ON|OFF|YES|NO|TRUE|FALSE}] [L2Only={ON|OFF|YES|NO|TRUE|FALSE}] [L1Priority=1..127] [L2Priority=1..127]  
 [ESIS={ON|OFF|YES|NO|TRUE|FALSE}] [ISConfint=1..65535]  
 [PORT=*port*] [VLantag=1..4094]

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.
- *interface* is a valid interface name.
- *port* is the port number on a VLAN that this circuit runs over.

**Description** This command adds a circuit to a CLNS virtual router.

The **clns** parameter specifies the CLNS virtual router the interface is to be added to. The default is 0.

The **circuit** parameter specifies an identifier for the circuit.

The **interface** parameter specifies the interface that provides the circuit for the CLNS virtual router. The interface type **virt** specifies a virtual point to point interface to another CLNS virtual router. **virtn** specifies an interface to CLNS virtual router n. In order for packets to be passed between the two virtual routers via this circuit an equivalent virtual circuit must be added to the peer virtual router. Valid interfaces are:

- eth (such as eth0)
- PPP (such as ppp0)
- VLAN (such as vlan1)
- virtual interface (such as virt9)

The interface must already exist. To see a list of all currently available interfaces, use the [show interface command on page 9-72 of Chapter 9, Interfaces](#).

The **iihping** parameter specifies the period in seconds between IIH PDUs. It is also used as the period between ISH PDUs when polling the ES configuration. The default is 10.

The **l1defmetricval** parameter specifies the value for the L1 default metric. The default is 20.

The **l1delmetricval** parameter specifies the value for the L1 delay metric. The default is 20.

The **l1expmetricval** parameter specifies the value for the L1 expense metric. The default is 20.

The **l1errmetricval** parameter specifies the value for the L1 error metric. The default is 20.

The **l2defmetricval** parameter specifies the value for the L2 default metric. The default is **20**.

The **l2delmetricval** parameter specifies the value for the L2 delay metric. The default is **20**.

The **l2expmetricval** parameter specifies the value for the L2 expense metric. The default is **20**.

The **l2errmetricval** parameter specifies the value for the L2 error metric. The default is **20**.

The **isis** parameter specifies whether ISIS PDUs are transmitted and received on this interface. The default is **yes**.

The **l2only** parameter specifies whether the interface is to be used for level 2 ISIS PDUs. If **yes**, level 2 ISIS PDUs are transmitted on the interface; level 1 ISIS PDUs are discarded. The default is **no**.

The **l1priority** parameter specifies priority for the router becoming the LAN L1 Designated Intermediate System for a broadcast interface. This parameter can be specified only for a broadcast interface. The default is **64**.

The **l2priority** parameter specifies priority for the router becoming the LAN L2 Designated Intermediate System for a broadcast interface. This parameter can be specified only for a broadcast interface. The default is **64**.

The **esis** parameter specifies whether ES-IS packets are to be sent and received over this circuit. If the circuit connects the router to an End System (or in the case of a broadcast circuit, a number of End Systems), this parameter should be set to **on**. If there are no End Systems on the circuit, this parameter may be set to **off**. The default is **on**.

The **isconfint** parameter specifies the value for the IS configuration timer. It determines how often an Intermediate System reports configuration information to End Systems. The default is **10**.

The **port** parameter specifies the port on the VLAN over which the circuit is to be created. Packets are transmitted and received on this port. The **port** parameter can be used when the interface is a VLAN and the **vlan tag** parameter is not specified. This port must be a member of that VLAN. There is no default.

The **vlan tag** parameter specifies the Ethernet Virtual LAN (VLAN) to be used by the circuit. This parameter can be used for an Ethernet interface only. There is no default.

**Examples** To add a circuit, with identifier 5, that uses interface eth0 to CLNS virtual router 0, use the command:

```
add clns=0 circ=5 int=eth0
```

To add a circuit, with identifier 5, that uses interface vlan2 to CLNS virtual router 0, and the port number is port 7 on that VLAN, use the command:

```
add clns=0 circ=5 int=vlan2 po=7
```

**Related Commands**

- [delete clns circuit](#)
- [disable clns circuit](#)
- [enable clns circuit](#)
- [purge clns](#)
- [set clns circuit](#)
- [show clns ra](#)

## add clns ra

---

**Syntax** ADD CLNS[=*virtual-router-id*] RA=*nsap-prefix*  
 CIRCUit=*circ-id* SOURCE={NONE|EXPLICIT}]  
 [ETHernetaddress=*macadd*] [DEFMetricval=1..63]  
 [DEFMType={INTernal|EXTERNAL}] [DELMetricval=0..63]  
 [DELMType={INTernal|EXTERNAL}] [EXPMetricval=0..63]  
 [EXPMTType={INTernal|EXTERNAL}] [ERRMetricval=0..63]  
 [ERRMType={INTernal|EXTERNAL}]

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-prefix* is an OSI NSAP address prefix.
- *circ-id* is an integer from 1 to 255.
- *macadd* is an Ethernet MAC address in dashed hexadecimal notation.

**Description** This command adds a static reachable address (RA) to the routing table of the specified CLNS virtual router.

The **clns** parameter specifies the virtual router that the RA is being added to. The default is **0**.

The **ra** parameter specifies the NSAP reachable address prefix that the static RA defines a path to.

The **circuit** specifies the circuit over which the address prefix can be reached.

The **snp source** parameter specifies how to determine the SNPA address to which PDUs for this reachable address prefix should be forwarded. If **none**, the SNPA address is implied by the nature of the subnetwork (i.e., a PPP link). If **explicit**, the SNPA address is given by the **ethernetaddress** parameter. The default is **none**.

The **ethernetaddress** parameter specifies the Ethernet MAC address where PDUs with this destination NSAP prefix should be forwarded. This parameter should be used if the value for the **snp source** parameter is **explicit**.

The **defmetricval** parameter specifies the default metric for reaching the specified NSAP prefix via this static route. The default is **20**.

The **defmtype** parameter specifies whether the default metric is internal or external. The default is **internal**.

The **delmetricval** parameter specifies the delay metric value for reaching the specified NSAP prefix via this static route. The default is **20**.

The **delmtype** parameter specifies whether the delay metric is internal or external. The default is **internal**.

The **expmetricval** parameter specifies the expense metric value for reaching the specified NSAP prefix via this static route. The default is **20**.

The **expmtype** parameter specifies whether the expense metric is internal or external. The default is **internal**.

The **errmetricval** parameter specifies the error metric value for reaching the specified NSAP prefix via this static route. The default is **20**.

The **errmtype** parameter specifies whether the error metric is internal or external. The default is **internal**.

**Examples** To create a static route that points to one or more systems with NSAP prefixes of 47.12ac.5689.1235.acdb, reachable via circuit 1 (which is over a PPP link), use the command:

```
add clns ra=47.12ac.5689.1235.acdb circu=1
```

**Related Commands** [delete clns ra](#)  
[purge clns](#)  
[set clns ra](#)  
[show clns ra](#)  
[show clns route](#)

## delete clns adjacency

---

**Syntax** DELEte CLNS[=*virtual-router-id*] ADJacency=*nsap-system-id*

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-system-id* is the system ID part of an NSAP address.

**Description** This command deletes a static adjacency entry from the adjacency database of the specified CLNS virtual router.

The **clns** parameter specifies which virtual router the adjacency is to be deleted from. The default is **0**.

The **adjacency** parameter specifies the system ID of the end system that is adjacent to the router.

**Examples** To delete a static adjacency with system ID 1d2b.345a.975d from CLNS virtual router zero, use the command:

```
del clns adj=1d2b.345a.975d
```

**Related Commands** [add clns adjacency](#)  
[purge clns](#)  
[show clns adjacency](#)

## delete clns area

---

**Syntax** `DELEte CLNS[=virtual-router-id] AREa=nsap-area-address`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-area-address* is an OSI NSAP area address.

**Description** This command deletes an area NSAP address from a CLNS virtual router.

The **clns** parameter specifies the identity number of the virtual router that the area address is to be deleted from. The default is **0**.

The **area** parameter specifies the area NSAP address that is to be deleted from the virtual router.

Note that a CLNS virtual router requires at least one area NSAP address configured at all times.

**Examples** To delete an area NSAP address of 47.12ac.5689.1235.acdb from the CLNS virtual router with identifier 0, use the command:

```
del clns=0 are=47.12ac.5689.1235.acdb
```

**Related Commands** [add clns area](#)  
[show clns area](#)

## delete clns circuit

---

**Syntax** `DELEte CLNS[=virtual-router-id] CIRCUit=circ-id`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.

**Description** This command deletes an interface from a CLNS virtual router.

The **clns** parameter specifies the virtual router from which the interface is to be deleted. The default is **0**.

The **circuit** parameter specifies the circuit that is to be deleted.

**Examples** To delete circuit 5 from CLNS virtual router 0, use the command:

```
del clns circu=5
```

**Related Commands** [add clns circuit](#)  
[set clns circuit](#)  
[show clns ra](#)

## delete clns ra

---

**Syntax** `DELEte CLNS[=virtual-router-id] CIRCUit=circ-id  
RA=nsap-prefix`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-prefix* is an OSI NSAP address prefix.
- *circ-id* is an integer from 1 to 255.

**Description** This command deletes a static route from the routing table of the specified CLNS virtual router.

The CLNS parameter specifies the virtual router that the route is being deleted from. The default is 0.

The **ra** parameter specifies the NSAP address prefix that the static route defines a path to.

The **circuit** specifies the circuit over which the address prefix can be reached. This parameter is required for positive identification of the RA.

**Examples** To delete a static route that points to a router with an NSAP prefix of 47.12ac.5689.1235.acdb.4298.1d70.0000.00 at the remote end of a PPP link attached to interface ppp0, use the command:

```
del clns ra=47.12ac.5689.1235.acdb.4298.1d70.0000.00 circ=1
```

**Related Commands** [add clns ra](#)  
[set clns ra](#)  
[show clns ra](#)  
[show clns route](#)

## disable clns circuit

---

**Syntax** `DISable CLNS[=virtual-router-id] CIRCUit=circ-id`

where

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.

**Description** This command disables CLNS packet transmission and reception on a particular interface associated with the CLNS virtual router. Circuits are enabled by default.

The **clns** parameter specifies which virtual router the interface is associated with. The default is **0**.

The **circuit** parameter specifies the circuit to be disabled.

**Examples** To disable CLNS packet processing on the circuit with identifier 1 on CLNS virtual router 0, use the command:

```
dis clns circ=1
```

**Related Commands** [add clns circuit](#)  
[delete clns circuit](#)  
[enable clns circuit](#)  
[set clns circuit](#)  
[show clns ra](#)

## disable clns debug

---

**Syntax** `DISable CLNS[=virtual-router-id] DEBUg={ALL|ENGDEBUG|  
ENGTRACE|PACKET|PKT|TRACE|TRACEMORE} [,...]`

where *virtual-router-id* is an integer from 0 to 2

**Description** This command disables the CLNS debugging features.

The **clns** parameter specifies which virtual router debugging is to be disabled on. The default is **0**.

The **debug** parameter specifies which debugging features are to be disabled. See the **enable clns debug** command for a table of available options.

**Examples** To disable the CLNS packet debugging on CLNS virtual router 0, use the command:

```
dis clns deb=pkt
```

**Related Commands** [enable clns debug](#)

## enable clns

---

**Syntax** `ENable CLNS[=virtual-router-id] AREa=nsap-area-address  
SYStemid=nsap-system-id`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-area-address* is an OSI NSAP area address in the dotted hexadecimal notation.
- *nsap-system-id* is the system ID part of an NSAP address.

**Description** This command enables a CLNS virtual router for the first time. Once a virtual router has been enabled it is possible to assign interfaces to it allowing OSI IS-IS and ES-IS routing to be performed.

The **clns** parameter specifies the identifier of the virtual router. If no value for the CLNS parameter is specified it defaults to 0.

The **area** parameter specifies the NSAP area address of the CLNS virtual router.

The **systemid** parameter specifies the NSAP system ID to be used by this virtual router. The ID must be unique within its area. The default for this parameter is derived from the router's primary MAC address.

**Examples** To enable the CLNS virtual router with identifier 0 and NSAP area address 47.12ac.5689.1235.acdb, use the command:

```
ena clns are=47.12ac.5689.1235.acdb
```

**Related Commands**

- [add clns area](#)
- [delete clns area](#)
- [purge clns](#)
- [reset clns](#)
- [set clns](#)
- [show clns](#)
- [show clns area](#)

## enable clns circuit

---

**Syntax** ENable CLNS[=*virtual-router-id*] CIRCUit=*circ-id*

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.

**Description** This command enables CLNS packet transmission and reception on a particular circuit associated with a CLNS virtual router. Circuits are enabled by default.

The **clns** parameter specifies which virtual router the interface is associated with. The default is 0.

The **circuit** parameter specifies which circuit is to be enabled.

**Examples** To enable the CLNS circuit with identifier 1 on CLNS virtual router 0, use the command:

```
ena clns ciru=1
```

**Related Commands**

- [add clns circuit](#)
- [delete clns circuit](#)
- [disable clns circuit](#)
- [set clns circuit](#)
- [show clns ra](#)

## enable clns debug

---

**Syntax** `ENable CLNS [=virtual-router-id] DEBug={ALL|ENGDEBUG|ENGTRACE|PACKET|PKT|TRACE|TRACEMORE} [, ...]`

where *virtual-router-id* is an integer from 0 to 2

**Description** This command enables the CLNS debugging features.

The **clns** parameter specifies the virtual router where debugging is to be enabled. The default is **0**.

The **debug** parameter specifies the debugging features to enable. The debugging that results from each option is described in the following table.

Parameter	Meaning
ALL	Enables all CLNS debugging types
ENGDEBUG	Displays routing engine debug information
ENGTRACE	Displays information about the flow of data within the routing engine
PACKET	Displays CLNS packets that have been received and transmitted
PKT	Also displays CLNS packets that have been received and transmitted
TRACE	Displays information about the flow of data peripheral to the routing engine
TRACEMORE	Displays more detailed information about the flow of data peripheral to the routing engine

**Examples** To enable the CLNS packet debugging on CLNS virtual router 0, use the command:

```
ena clns=0 deb=pkt
```

**Related Commands** [disable clns debug](#)

## purge clns

---

**Syntax** PURge CLNS[=*virtual-router-id*]

where *virtual-router-id* is an integer from 0 to 2

**Description** This command clears the CLNS configuration on the specified virtual router. This also clears all the routing and adjacency tables. Purging leaves the virtual router disabled.

The **clns** parameter specifies which virtual router is to have its configuration purged. The default is 0.

**Examples** To clear the CLNS configuration on virtual router, use the command:

```
pur clns
```

**Related Commands** [reset clns](#)  
[show clns](#)

## reset clns

---

**Syntax** RESET CLNS[=*virtual-router-id*]

where *virtual-router-id* is an integer from 0 to 2

**Description** This command resets the CLNS virtual router to its manually configured state. Dynamically acquired information is deleted, including dynamic routes and adjacencies.

The **clns** parameter specifies the virtual router to reset. The default is 0.

**Examples** To reset CLNS virtual router 0, use the command:

```
reset clns
```

**Related Commands** [enable clns circuit](#)  
[set clns](#)  
[show clns](#)

## set clns

---

**Syntax** SET CLNS[=*virtual-router-id*] [AREAAddrmax=1..6]  
 [AREAMaxcheck={ON|OFF|YES|NO|TRUE|FALSE}]  
 [CSNPinterval=1..600] [ESHelloint=1..65535]  
 [IIHelloint=1..65535] [LLevel={L1|L2}]  
 [LSPMaxgenint=1..65535] [LSPMIngenint=1..65535]  
 [LSPmtu=512..1492] [MAXPathsplits=1..3]  
 [MINLSptxint=1..65535] [MINBRoadlsptxint=1..65535]  
 [PSNPinterval=1..65535] [WAITtime=1..65535]

where *virtual-router-id* is an integer from 0 to 2

**Description** This command changes the configuration of a CLNS virtual router.

The **clns** parameter specifies the identity number of the virtual router whose configuration is to be changed. The default is **0**.

The **areaaddrmax** parameter specifies the maximum number of area addresses permitted on the virtual router. The default is **3**.

The **areamaxcheck** parameter specifies whether checking of maximum area addresses is performed. If **yes** is specified, checking is performed. If **no** is specified, checking is not performed. The default is **on**.

The **csnpinterval** parameter specifies the interval, in seconds, between Complete Sequence Number PDUs. The default is **10**.

The **eshelloint** parameter specifies the value, in seconds, to be used for the suggested ES configuration timer in ISH PDUs when soliciting the ES configuration. The default is **10**.

The **iihelloint** parameter specifies the interval, in seconds, between the generation of IIH PDUs by the designated IS on a LAN. The default is **10**.

The **level** parameter specifies what kind of intermediate system the virtual router is. If **11** is specified, the router is a level 1 intermediate system. If **12** is specified, the router is a level 2 intermediate system. The default is **12**.

The **lspmaxgenint** parameter specifies the maximum time, in seconds, between generated LSPs. The default is **900**.

The **lspmingenint** parameter specifies the minimum time, in seconds, between generated LSPs. The default is **10**.

The **lspmtu** parameter specifies the maximum allowable size, in bytes, of LSPs and SNPs. The default is **1492**.

The **maxpathsplits** parameter specifies how many different paths with equal routing metric value can be used to simultaneously reach the same destination. The default is **2**.

The **minlsptxint** parameter specifies the minimum time in seconds between re-transmissions of an LSP. The default is **5**.

The **minbroadlsptxint** parameter specifies the minimum time, in milliseconds, between transmission of LSPs on broadcast circuits. The default is **33**.

The **psninterval** parameter specifies the interval, in seconds, between Partial Sequence Number PDUs. The default is 2.

The **waittime** parameter specifies the number of seconds to delay in Waiting State before entering On State. The default is 60.

**Examples** To set virtual router 0 to be a level 1 type intermediate system, use the command:

```
set clns=0 le=L1
```

**Related Commands**

- [add clns area](#)
- [delete clns area](#)
- [enable clns](#)
- [reset clns](#)
- [show clns](#)

## set clns circuit

---

**Syntax** SET CLNS[=*virtual-router-id*] CIRCUIT=*circ-id*  
 [IIH`pint`=1..65535] [L1DEF`metricval`=0..63]  
 [L1DEL`metricval`=0..63] [L1EXP`metricval`=0..63]  
 [L1ERR`metricval`=0..63] [L2DEF`metricval`=1..63]  
 [L2DEL`metricval`=0..63] [L2EXP`metricval`=0..63]  
 [L2ERR`metricval`=0..63] [ISIS={ON|OFF|YES|NO|TRUE|  
 FALSE}] [L2only={ON|OFF|YES|NO|TRUE|FALSE}]  
 [L1Priority=1..127] [L2Priority=1..127] [ESIS={ON|OFF|  
 YES|NO|TRUE|FALSE}] [ISConfint=1..65535]  
 [ESConfint=1..65535] [RDHint=1..65535]  
 [VLantag=1..4094]

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 0 to 255.

**Description** This command is used to change the CLNS configuration of an interface that is attached to a CLNS virtual router.

The **clns** parameter specifies the CLNS virtual router the interface is attached to. The default is 0.

The **circuit** parameter specifies an identifier for the circuit.

The **iihpint** parameter specifies the seconds between IIH PDUs. It is also used as the period between ISH PDUs when polling the ES configuration. The default is 10.

The **l1defmetricval** parameter specifies the value for the L1 default metric. The default is 20.

The **l1delmetricval** parameter specifies the value for the L1 delay metric. The default is 20.

The **l1expmetricval** parameter specifies the value for the L1 expense metric. The default is 20.

The **l1errmetricval** parameter specifies the value for the L1 error metric. The default is 20.

The **l2defmetricval** parameter specifies the value for the L2 default metric. The default is 20.

The **l2delmetricval** parameter specifies the value for the L2 delay metric. The default is 20.

The **l2expmetricval** parameter specifies the value for the L2 expense metric. The default is 20.

The **l2errmetricval** parameter specifies the value for the L2 error metric. The default is 20.

The **isis** parameter specifies whether ISIS PDUs are transmitted and received on this interface. The default is **yes**.

The **l2only** parameter specifies whether the interface is to be used only for level 2 ISIS PDUs. If **yes**, level 2 ISIS PDUs are transmitted on this interface; level 1 ISIS PDUs are discarded. The default is **no**.

The **l1priority** parameter specifies priority for the router becoming the LAN L1 Designated Intermediate System for a broadcast interface. This parameter can be specified only for a broadcast interface.

The **l2priority** parameter specifies priority for the router becoming the LAN L2 Designated Intermediate System for a broadcast interface. This parameter can be specified only for a broadcast interface.

The **esis** parameter specifies whether this interface connects the router to one or more End Systems. If **yes**, the interface connects the router to an End System (or in the case of a broadcast interface, a number of End Systems). The default is **yes**.

The **isconfint** parameter specifies the value for the IS configuration timer. It determines how often an Intermediate System reports configuration information to End Systems. The default is **10**.

The **esconfint** parameter specifies the suggested End System configuration timer value, which is advertised in IS Hello PDUs transmitted on the interface. The default is **600**.

The **rdhint** parameter specifies the holding time to be specified in Redirect PDUs transmitted on the interface. The default is **600**.

The **vlantag** parameter specifies which ethernet Virtual LAN (VLAN) is to be used by the circuit. This parameter can be used only for an Ethernet interface. There is no default.

**Examples** To change (to 50) the value for the level 1 default metric on circuit 5 (which is attached to the CLNS virtual router 0), use the command:

```
set clns=0 circ=5 l1def=50
```

**Related Commands**

- [add clns circuit](#)
- [delete clns circuit](#)
- [disable clns circuit](#)
- [enable clns circuit](#)
- [show clns circuit counters](#)

## set clns ra

---

**Syntax** SET CLNS[=*virtual-router-id*] RA=*nsap-prefix*  
CIRCUIT=*circ-id* ETHernetaddress=*macadd*

where:

- *virtual-router-id* is an integer from 0 to 2.
- *nsap-prefix* is an OSI NSAP address prefix.
- *circ-id* is an integer from 1 to 255.
- *macadd* is an Ethernet MAC address in dashed hexadecimal notation.

**Description** This command changes the Ethernet address that is used with a static reachable address (RA). This command can be used only for an Ethernet circuit, and requires a user with Security Officer privilege when the router is in security mode.

The **clns** parameter specifies the virtual router that the RA is defined for. The default is **0**.

The **ra** parameter specifies the NSAP reachable address prefix that the static RA defines a path to.

The **circuit** parameter specifies the circuit over which the address prefix can be reached. This parameter is present as an identifier of the RA and cannot be changed. It must be the same as the value specified when the RA was added.

The **ethernetaddress** parameter specifies the Ethernet MAC address to which PDUs with this destination NSAP prefix should be forwarded. This parameter should be used if the value for the **snpsource** parameter is **explicit**.

**Examples** To change the Ethernet address for a static RA with an NSAP prefix of 47.12ac.5689.1235.acdb.4298.1d70 on circuit 2 of virtual router 0, use the command:

```
set clns ra=47.12ac.5689.1235.acdb.4298.1d70 circ=2  
eth=00-00-cd-50-00-01
```

**Related Commands** [add clns ra](#)  
[delete clns ra](#)  
[show clns ra](#)  
[show clns route](#)

## show clns

**Syntax** SHow CLNS

**Description** This command displays a summary of all CLNS virtual routers that are configured on the router (Figure 34-3, Table 34-2).

Figure 34-3: Example output from the **show clns** command

CLNS Virtual Routers			
Router	Level	Area Addresses	System ID
0	L2	47.2222.3333 47.5678.5678	0000.cd00.a4d6
1	L2	47.2345.7890	0100.cd00.a4d6

Table 34-2: Parameters in output of the **show clns** command

Parameter	Meaning
Router	Virtual router identifier.
Level	Whether the virtual router is a level 1 (L1) or level 2 (L2) intermediate system.
System ID	6-byte number (in dotted hexadecimal form) that is used as the system ID part of the virtual router's NSAP address.
Area Addresses	List of the virtual router's area addresses.

**Examples** To display a summary of all the CLNS virtual routers configured on the router, use the command:

```
sh clns
```

**Related Commands**

- [enable clns circuit](#)
- [purge clns](#)
- [reset clns](#)
- [set clns](#)
- [show clns detail](#)

## show clns adjacency

**Syntax** SHow CLNS[=*virtual-router-id*] ADJacency

where *virtual-router-id* is an integer from 0 to 2

**Description** This command displays information about the CLNS adjacency database (Figure 34-4 on page 34-31, Table 34-3 on page 34-31).

The **clns** parameter specifies the virtual router's adjacency database information to display. The default is 0.

Figure 34-4: Example output from the **show clns adjacency** command

```

ES Adjacencies
Circ  SysID                Type      SNPA                State
-----
  1  2345.6782.ad12        Manual    00-00-cd-00-0d-01    UP

IS Adjacencies
Circ  SysID                Type      SNPA                Usage  HTime  Priority  State
-----
  1  0000.cd00.a0db        L1IS     00-00-cd-00-a0-db   L1L2   66080  1854     UP

Area Adjacencies
Circ  Area
-----
  1  47.1234.1234
  1  47.1234.2222

```

Table 34-3: Parameters in output of the **show clns adjacency** command

Parameter	Meaning
ES Adjacencies	Summary of end systems that are adjacent to the virtual router.
Circ (ES Adjacencies)	Circuit index of the circuit via which the end system is adjacent to the router.
SysID (ES Adjacencies)	The system ID of the adjacent system.
Type (ES Adjacencies)	"Manual" if the adjacency was added by the user, or "Auto" if the adjacency was added by the CLNS engine.
SNPA (ES Adjacencies)	Sub-network point of attachment of the end system.
State (ES Adjacencies)	The state of the adjacency (UP/DOWN). Adjacencies created manually always have this value set to UP.
IS Adjacencies	Summary of intermediate systems that are adjacent to the virtual router.
Circ (IS Adjacencies)	Circuit index of the circuit via which the intermediate system is adjacent to the router.
SysID (IS Adjacencies)	The system ID of the adjacent system.
Type (IS Adjacencies)	The type of the neighbouring system. Intermediate System (IS), Level 1 IS (L1IS), or Level 2 IS (L2IS).
SNPA (IS Adjacencies)	Sub-network point of attachment of the intermediate system.
Circ (Area Adjacencies)	Circuit index of the circuit via which the area is adjacent to the router.

Table 34-3: Parameters in output of the **show clns adjacency** command

Parameter	Meaning
Area	The adjacent area address.
Usage	The usage of the adjacency. Level 1 traffic only (L1), Level 2 traffic only (L2), or Level 1 and 2 traffic (L1L2).
Htimer	The holding time for this adjacency updated from received IIH PDUs.
Priority	Priority of the adjacent intermediate system for becoming the LAN (Level 1 or Level 2, depending on Type) Designated Intermediate System.
State (IS Adjacencies)	The state of the adjacency.
Area Adjacencies	Area addresses of adjacent intermediate systems as reported in IIH PDUs.

**Examples** To display information from the adjacency database of CLNS virtual router 0, use the command:

```
sh clns adj
```

**Related Commands** [add clns adjacency](#)  
[delete clns adjacency](#)

## show clns area

---

**Syntax** `SHoW CLNS[=virtual-router-id] AREa`

where *virtual-router-id* is an integer from 0 to 2

**Description** This command displays information about the NSAP area addresses associated with the virtual router (Figure 34-5 on page 34-33, Table 34-4 on page 34-33).

The **clns** parameter specifies the virtual router's area address information to display. The default is 0.

Figure 34-5: Example output from the **show clns area** command

```

Manual Area Addresses
-----
    47.2222.3333
    47.5678.5678

Union of Area Addresses
-----
    47.2222.3333
    47.5678.5678
  
```

Table 34-4: Parameters in output of the **show clns area** command

Parameter	Meaning
Manual Area Addresses	Set of manual area addresses configured on this intermediate system.
Union of Area Addresses	Union of the sets of area addresses reported in all Level 1 LSPs received by this instance of the protocol.

**Examples** To display information about the area addresses associated with CLNS virtual router 0, use the command:

```
sh clns are
```

**Related Commands**

- [add clns area](#)
- [delete clns area](#)
- [enable clns](#)
- [show clns](#)
- [show clns detail](#)

## show clns circuit

**Syntax** `SHoW CLNS[=virtual-router-id] CIRCUit[=circ-id]`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.

**Description** This command displays either a summary of all CLNS circuits on all virtual routers, or information about a specific circuit attached to the specified CLNS virtual router (Figure 34-6 on page 34-34, Table 34-5 on page 34-35).

The **clns** parameter specifies the virtual router's circuit information to display. The default is **0**.

The **circuit** parameter specifies the circuit's information to display. If no value is specified, summary information about all circuits attached to each CLNS virtual router is displayed (Figure 34-7 on page 34-36, Table 34-7 on page 34-37).

Figure 34-6: Example output from the **show clns circuit** command

Interface	eth0
Circuit State	Enabled
Type	broadcast
Hello Interval	3
L1 Metrics:	
Default	20
Delay	20
Expense	20
Error	20
L2 Metrics:	
Default	20
Delay	20
Expense	20
Error	20
IS-IS State	Enabled
L2 Only	No
L1 IS Priority	64
L2 IS Priority	64
L1 Allocated Circuit ID	0000.cd00.a4d6.05
L1 Designated IS	0000.cd00.a4d6
L2 Allocated Circuit ID	0000.cd00.a4d6.05
L2 Designated IS	0000.cd00.a4d6
Pt To Pt Circuit ID	0000.cd00.a4d6.05
Multicast Address Type	Group
ES-IS Configuration:	
ES-IS State	Enabled
IS Configuration Interval	10
Suggested ES Configuration Interval	600
Redirect PDU Hold Time	600

Table 34-5: Parameters in output of the **show clns circuit** command

Parameter	Meaning
Interface	The interface over which the circuit transmits and receives packets.
Circuit State	The operational state of the circuit.
Type	Either "broadcast" or "ptToPt". Broadcast if the circuit is over an Ethernet interface or ptToPt if the circuit is over a PPP interface or a virtual interface.
Hello Interval	The period, in seconds, between IIH PDUs.
L1 Metrics	Values for the L1 metrics for this circuit.
L2 Metrics	Values for the L2 metrics for this circuit.
IS-IS State	Whether the IS-IS protocol is enabled on this interface; one of "Yes" or "No".
L2 Only	"Yes" indicates that this circuit is to be used for level 2. "No" indicates that this circuit may be used for level 1 or 2.
L1 IS Priority	The priority for becoming LAN Level 1 Designated Intermediate System on a broadcast circuit.
L2 IS Priority	The priority for becoming LAN Level 2 Designated Intermediate System on a broadcast circuit.
L1 Allocated Circuit ID	The LAN ID allocated by the LAN Level 1 Designated Intermediate System.
L1 Designated IS	The ID of the LAN Level 1 Designated Intermediate System on this circuit.
L2 Allocated Circuit ID	The LAN ID allocated by the LAN Level 2 Designated Intermediate System.
L2 Designated IS	The ID of the LAN Level 2 Designated Intermediate System on this circuit.
Pt To Pt Circuit ID	The point to point ID of the circuit.
Multicast Address Type	Type of multicast address used for sending HELLO PDUs on this circuit. "Group" is the only defined value for this parameter.
ES-IS Configuration	Configuration of the ES-IS protocol on this circuit.
ES-IS State	State of the ES-IS protocol.
IS Configuration Interval	Value in seconds of how often an IS reports configuration information to ESs.
Suggested ES Configuration Interval	Value in seconds to be used for the suggested ES configuration timer value, advertised in IS Hellos generated by the system on this circuit.
Redirect PDU Hold Time	The holding time in seconds to be specified in Redirect PDUs generated by the system on this circuit.

Figure 34-7: Example output from the **show clns circuit** command when no **circuit** value is specified

Virtual Router	Circuit	Interface	SNPA	State
0	1	virt1	-	UP
	5	eth0	00-00-cd-00-a4-d6	UP
1	3	virt0	-	UP
	2	ppp0	-	DOWN
Virtual Interface Rx Queue Length				0

Table 34-6: Parameters in output of the **show clns circuit** command when no **circuit** value is specified

Parameter	Meaning
Virtual Router	ID of the virtual router to which the subsequent circuit belongs.
Circuit	ID of the circuit.
Interface	Type and instance of the interface that provides the circuit.
SNPA	Sub-network point of attachment. If the interface is Ethernet, the MAC address is shown. If the circuit is point to point, no value is shown.
State	Operational state of the circuit. (UP/DOWN).
Virtual Interface Rx Queue Length	Number of packets in the receive queue of the virtual interface between CLNS virtual routers.

**Examples** To display information about the circuit with the ID of 1 attached to CLNS virtual router 0, use the command:

```
sh clns circ=1
```

To display information about all circuits on all virtual routers use, the command

```
sh clns circ
```

**Related Commands**

- [add clns circuit](#)
- [delete clns circuit](#)
- [disable clns circuit](#)
- [enable clns circuit](#)
- [set clns circuit](#)
- [show clns counters](#)

## show clns circuit counters

**Syntax** `SHoW CLNS[=virtual-router-id] CIRCUit=circ-id COUnTers`

where:

- *virtual-router-id* is an integer from 0 to 2.
- *circ-id* is an integer from 1 to 255.

**Description** This command displays the circuit counter of a circuit attached to the specified CLNS virtual router (Figure 34-8 on page 34-37, Table 34-7 on page 34-37).

The **clns** parameter specifies to which virtual router the circuit is attached. The default is **0**.

The **circuit** parameter specifies which circuit's counters is displayed.

Figure 34-8: Example output from the **show clns circuit counters** command

Counters	
Adjacency State Changes	0
Initialisation Failures	0
Rejected Adjacencies	0
Control PDUs Tx	3168
Control PDUs Rx	0
ID Field Length Mismatches	0
L1 Designated IS Changes	2
L2 Designated IS Changes	2
IS ES Reachability Changes	0
Invalid ES-IS PDUs Rx	0
CLNS PDUs Rx	0
CLNS PDUs Tx	0
Bad DSAP PDUs Rx	0
Control Packets Rx	0
Data Packets Rx	0
Packets Tx	3562

Table 34-7: Parameters in output of the **show clns circuit counters** command

Parameter	Meaning
Adjacency State Changes	Number of times an adjacency state change has occurred on this circuit.
Initialisation Failures	Number of times initialisation of this circuit has failed.
Rejected Adjacencies	Number of times an adjacency has been rejected on this circuit.
Control PDUs Tx	Number of IS-IS control PDUs sent on this circuit.
Control PDUs Rx	Number of IS-IS control PDUs received on this circuit.
ID Field Length MisMatches	Number of times an IS-IS control PDU with an ID field length different to that for this system has been received.
L1 Designated IS Changes	Number of times the LAN Level 1 Designated Intermediate System has changed.
L2 Designated IS Changes	Number of times the LAN Level 2 Designated Intermediate System has changed.

Table 34-7: Parameters in output of the **show clns circuit counters** command (Continued)

Parameter	Meaning
IS ES Reachability Changes	Number of changes in reachability of End Systems from this circuit.
Invalid ES-IS PDUs Rx	Number of ISO 9452 PDUs received that were discarded as a result of the PDU Header Error Detection or Protocol Error Processing Functions specified in ISO 9542.
CLNS PDUs Rx	Number of CLNS PDUs received on this circuit.
CLNS PDUs Tx	Number of CLNS PDUs transmitted on this circuit.
Bad DSAP PDUs Rx	Number CLNS PDUs received with a bad DSAP.
Control Packets Rx	Number of control packets received on this circuit.
Data Packets Rx	Number of data packets received on this circuit.
Packets Tx	Number of packets transmitted over this circuit.

**Examples** To display circuit counters for circuit 2, which is attached to CLNS virtual router 0, use the command:

```
sh clns circ=2 cou
```

**Related Commands**

- [add clns circuit](#)
- [delete clns circuit](#)
- [disable clns circuit](#)
- [enable clns circuit](#)
- [set clns circuit](#)
- [show clns ra](#)
- [show clns counters](#)

## show clns counters

**Syntax** SHow CLNS COUnters

**Description** This command displays counters relating to sent and received packets for all CLNS virtual routers (Figure 34-9 on page 34-39, Table 34-8 on page 34-39).

Figure 34-9: Example output from the **show clns counters** command.

	Done	No Circuit	
pktOut	4676	0	(DBdeleted 4676)
fragOut	0	0	
discard	0		
errorReport	0		
redirect	0		
routingFrame	0		
forward	0	0	
forwardLocal	0		
forwardFrag	0		
rxEth		0	
rxPPP		0	
rxVirt		0	
rxVlan		0	

Table 34-8: Parameters in output of the **show clns counters** command

Parameter	Meaning
Done	The number of times the indicated event was done successfully.
No Circuit	The number of times the indicated event failed because the specified circuit did not exist.
pktOut	Transmission of an OSI routing process PDU.
DBdeleted	Deletion of the buffer containing an OSI routing process PDU as requested by the OSI routing process.
fragOut	Transmission of a PDU fragment.
discard	Number of discarded PDUs.
errorReport	Generation of a CLNS error report PDU.
redirect	Received a PDU and sent an ES-IS redirect PDU toward the PDU's origin.
routingFrame	Sent an ES-IS or IS-IS frame to the routing process.
forward	Forwarded a CLNS PDU to another system.
forwardLocal	Forwarded a CLNS PDU to the local system.
forwardFrag	Fragmented and then forwarded a CLNS PDU to another system.
rxEth	Received a packet from Ethernet.
rxPPP	Received a packet from PPP.
rxVirt	Received a packet from a virtual interface.
rxVlan	Received a packet from a VLAN interface.

**Examples** To display counters relating to sent and received packets for all CLNS virtual routers, use the command:

```
sh clns cou
```

**Related Commands** [enable clns](#)  
[reset clns](#)  
[purge clns](#)  
[set clns](#)  
[show clns circuit counters](#)

## show clns detail

---

**Syntax** SHow CLNS[=*virtual-router-id*] DETail

where *virtual-router-id* is an integer from 0 to 2

**Description** This command displays detailed information about a CLNS virtual router (Figure 34-10 on page 34-41, Table 34-9 on page 34-42).

The **clns** parameter specifies which CLNS virtual router's configuration is displayed. The default is **0**.

Figure 34-10: Example output from the **show clns detail** command

```

clns 0
  State                               ENABLED
  Level                               L2
  System ID                           0000.cd00.a4d6
  Area Addresses                       47.2222.3333
                                       47.5678.5678

  Maximum Path Splits                 2
  Minimum LSP Transmit Int (seconds)  5
  Minimum Broadcast LSP Int (seconds) 33
  Maximum LSP Generation Int (seconds) 900
  Minimum LSP Generation Int (seconds) 10
  CSNP Interval (seconds)             10
  PSNP Interval (seconds)             2
  L1 LSP MTU (bytes)                  1492
  Maximum Number of Area Addresses     3
  ES Hello Interval (seconds)         10
  IS-IS Hello Interval (seconds)      10
  Wait Time                           60
  L1 Database State                   UP
  Corrupted LSPs Detected             0
  L1 Database Overloads               0
  Manual Area Address Drops           0
  Attempts To Exceed Max Sequence Num. 0
  Sequence Number Skips               0
  Own LSP Purges                      0
  System ID Length Mismatches         0
  Maximum Area Addresses Mismatch     0
  L2 LSP MTU (bytes)                  1492
  L2 Database State                   UP
  L2 Database Overloads               0
  Maximum Area Address Checking       ON

```

Table 34-9: Parameters in output of the **show clns detail** command

Parameter	Meaning
State	Whether the CLNS virtual router is ENABLED or DISABLED.
Level	Type of the virtual router: level 1 (L1) or level 2 (L2).
System ID	6-byte number (in dotted hexadecimal form) that is used as the system ID part of the virtual router's NSAP address.
Area Addresses	List of the virtual router's area addresses.
Maximum Path Splits	Maximum numbers of equal cost paths that router traffic may be split between.
Minimum LSP Transmit Int	Minimum number of seconds between transmission of link state PDUs.
Minimum Broadcast LSP Int	Minimum number of seconds between transmission of link state PDUs over broadcast circuits.
Maximum LSP Generation Int	Maximum number of seconds between generation of link state PDUs.
Minimum LSP Generation Int	Minimum number of seconds between generation of link state PDUs.
CSNP Interval	Number of seconds between transmission of complete sequence number PDUs.
PSNP Interval	Number of seconds between transmission of partial sequence number PDUs.
L1 LSP MTU	Maximum allowable size of L1 link state PDUs.
Maximum Number of Area Addresses	Maximum number of area addresses the virtual router may have at one time.
ES Hello Interval	Number of seconds between transmission of ES hello packets.
IS-IS Hello Interval	Number of seconds between transmission of IS-IS hello packets
Wait Time	Number of seconds to delay in Waiting State before entering On State.
L1 Database State	Whether the L1 database is up.
Corrupted LSPs Detected	Number of corrupted LSPs detected.
L1 Data base Overloads	Number of times the LSP L1 database has become overloaded.
Manual Area Address Drops	Number of times a manual address has been dropped from the area.
Attempts To Exceed Max Sequence Num	Number of times the IS has attempted to exceed the maximum sequence number.
Sequence Number Skips	Number of times a sequence number skip has occurred.
Own LSP Purges	Number of times a zero-aged copy of the system's own LSP is received from some other node.
System ID Length Mismatches	Number of times a PDU is received with a different value for ID field length than the field length for the receiving system.
Maximum Area Address Mismatches	Number of times a PDU is received with a different value for Maximum Area Addresses than the Maximum Area Addresses for the receiving system.
L2 LSP MTU	Maximum allowable size of L2 link state PDUs.

Table 34-9: Parameters in output of the **show clns detail** command (Continued)

Parameter	Meaning
L2 Database State	Whether the L2 database is up.
L2 Database Overloads	Number of times the Level 2 LSP database has become overloaded.
Maximum Area Address Checking	Whether maximum area addresses per IS version of ISO10589 are checked.

**Examples** To display detailed information about CLNS virtual router 0, use the command:

```
sh clns det
```

**Related Commands**

- [enable clns](#)
- [reset clns](#)
- [purge clns](#)
- [set clns](#)
- [show clns](#)

## show clns ra

**Syntax** SHow CLNS[=*virtual-router-id*] RA

where *virtual-router-id* is an integer from 0 to 2

**Description** This command displays information from the reachable address database of a CLNS virtual router (Figure 34-11 on page 34-44, Table 34-10 on page 34-44).

The **clns** parameter specifies the database of a specific virtual router to display. The default is 0.

Figure 34-11: Example output from the **show clns ra** command.

Reachable Addresses									
-----									
Destination									
Circ	Type	MapType	Metrics:	Def	Del	Exp	Err	State	NextHop
-----									
22.2222.2222						00-00-cd-0d-00-01			
5	Manual	Explicit		20	20	20	20	UP	
11.1111.1111.1111.1111.1111.11						00-00-cd-00-0d-01			
5	Manual	Explicit		20	20	20	20	UP	
47.2222.2222						00-00-cd-11-00-0d			
5	Manual	Explicit		20	20	20	20	UP	

Table 34-10: Parameters in output of the **show clns ra** command

Parameter	Meaning
Destination	Destination of this Reachable Address. This is an Address Prefix.
Next Hop	SNPA Address to which a PDU may be forwarded in order to reach a destination that matches the address prefix of the Reachable Address.
Circ	ID of the circuit to use for this reachable address
Type	How the RA was obtained. "Manual" indicates the RA was added by system management. "Automatic" indicates the RA was added by the routing engine.
Map Type	How the next hop SNPA Address is obtained. "None" indicates that no address is required because the circuit is point to point. "Explicit" indicates that the address is an Ethernet address that has been specified either by system management or the routing engine.
Metrics	Values for the four metric types (default, delay, expense, error) for the RA.
State	Operation state of the RA.

**Examples** To display information from the reachable address database of CLNS virtual router 0, use the command:

```
sh clns ra
```

**Related Commands**

- [add clns ra](#)
- [delete clns ra](#)
- [set clns ra](#)
- [show clns route](#)

## show clns route

**Syntax** SHow CLNS[=*virtual-router-id*] ROUte[=ALL]

where *virtual-router-id* is an integer from 0 to 2

**Description** This command displays information from the CLNS routing database (Figure 34-12 on page 34-45, Table 34-11 on page 34-45).

The **clns** parameter specifies the virtual router's routing database information to display. The default is 0.

If no value is specified for the **route** parameter, routes using the default metric are displayed. If **all** is specified, all routes are displayed.

Figure 34-12: Example output from the **show clns route=all** command

```

CLNS 0 Routes - all metrics
-----
Destination          Circ:NextHop          Source |Metric  :ext  :value
-----|-----
L1 Routes:
0000.cd00.a4d6       4   :0000.cd00.a4d6     ISIS-L1 Default No   20
0000.cd00.a4d6       4   :0000.cd00.a4d6     ISIS-L1 Delete No   20
0000.cd00.a4d6       4   :0000.cd00.a4d6     ISIS-L1 Expense No   20
0000.cd00.a4d6       4   :0000.cd00.a4d6     ISIS-L1 Error  No   20

L2 Routes:
40.1234.1234         4   :0000.cd00.a4d6     ISIS-L2 Default No   40
47.5678.5678        100 :0100.cd00.a0db     ISIS-L2 Default No   20
40.1234.1234         4   :0000.cd00.a4d6     ISIS-L2 Delete No   40
47.5678.5678        100 :0100.cd00.a0db     ISIS-L2 Delete No   20
40.1234.1234         4   :0000.cd00.a4d6     ISIS-L2 Expense No   40
47.5678.5678        100 :0100.cd00.a0db     ISIS-L2 Expense No   20
40.1234.1234         4   :0000.cd00.a4d6     ISIS-L2 Error  No   40
47.5678.5678        100 :0100.cd00.a0db     ISIS-L2 Error  No   20

Learned Manual Routes:
48                   100 :0100.cd00.a0db     ISIS      Default No   40

Manual Routes:
34                   4   :00-00-00-00-00-01 Manual   Default No   20
-----

```

Table 34-11: Parameters in output of the **show clns route=all** command

Parameter	Meaning
Destination	Destination end system ID or address prefix.
Circ	Circuit that the route is over.
Next Hop	System ID of the next hop to reach destination.
Source	Source of the route:
	Manual manually configured information on the system
	ISIS-L1 ISIS Level 1 LSPs
	ISIS-L2 ISIS Level 2 LSPs
	ISIS ISIS LSPs of unknown

Table 34-11: Parameters in output of the **show clns route=all** command (Continued)

Parameter	Meaning
	Esis      ES Hellos
Metric	The metric used by this route (default, delay, expense, error).
ext	Whether the metric has an external component or is just internal. "Yes" if there is an external component.
value	Path metric value for this route.
L1 Routes	Level 1 routing information.
L2 Routes	Level 2 routing information.
Learned Manual Routes	Manual routing information learned from other Intermediate systems.
Manual Routes	Manually added routing information.

**Examples** To display information from the routing database of CLNS virtual router 0 about routes using the default metric, use the command:

```
sh clns rou
```

**Related Commands**

- [add clns ra](#)
- [delete clns ra](#)
- [set clns ra](#)
- [show clns ra](#)