Chapter 24

Open Systems Interconnection (OSI)

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Introduction

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.

OSI is enabled with a special feature licence that you can obtain by contacting an Allied Telesis authorised distributor or reseller.

ISO NSAP (Network Service Access Point) Addresses

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>
<thead>
<tr>
<th>NSAP Address Example</th>
<th>Interpretation</th>
</tr>
</thead>
</table>
| 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.0003.1272.3320.1111.1134.4300.2233.1177.00 | 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 Switch

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 switch.

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 switch 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:


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:


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 -IS-IS 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 protocol:
- 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.
Command Reference

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

The shortest valid command is denoted by capital letters in the Syntax section. See “Conventions” on page xlix 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 switch.

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 switch 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 [IIHPint=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]
  [ISIS={ON|OFF|YES|NO|TRue|FALse}]
  [ISConfint=1..65535]
  [PORT=port] [VLantag=1..4090]
```

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:
- 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 10-39 of Chapter 10, Interfaces.

The `iihpint` 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 switch 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 switch 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 switch 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 vlantag parameter is not specified. This port must be a member of that VLAN. There is no default.

The vlantag 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=vlantag 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]
[EXPMType={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 snpasource 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 snpasource 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 switch.

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**

```
DELeete 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**

```
DELeete 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 switch’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:

```
en 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.

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

**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] [LEVEL={L1|L2}]
   [LSPMaxgenint=1..65535] [LSPMingenint=1..65535]
   [LSPmtu=512..1492] [MAXPathsplits=1..3]
   [MINLSPtxint=1..65535] [MINBroadsptxint=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 `l1` is specified, the switch is a level 1 intermediate system. If `l2` is specified, the switch is a level 2 intermediate system. The default is `l2`.

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

The `minbroadsptxint` parameter specifies the minimum time, in milliseconds, between transmission of LSPs on broadcast circuits. The default is 33.
The **psnpinterval** 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
  [IIHpint=1..65535]  [L1DEFmetricval=0..63]
  [L1DELmetricval=0..63]  [L1EXPmetricval=0..63]
  [L1ERMetricval=0..63]  [L2DEFmetricval=1..63]
  [L2DELmetricval=0..63]  [L2EXPmetricval=0..63]
  [L2ERMetricval=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|FALsa}]
  [ESConfint=1..65535]  [RDHint=1..65535]
  [VLantag=1..4090]
```

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 `l1ermetricval` 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 `l2ermetricval` 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 switch 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 switch 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 switch to one or more End Systems. If **yes**, the interface connects the switch 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

```plaintext
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 switch 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 `snpasource` 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 switch (Figure 24-1, Table 24-2).

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

```plaintext
sh clns
```

**Related Commands**  
- `enable clns circuit`
- `purge clns`
- `reset clns`
- `set clns`
- `show clns detail`

**Table 24-2: Parameters in output of the show clns command**

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

**Figure 24-1: Example output from the show clns command**

<table>
<thead>
<tr>
<th>CLNS Virtual Routers</th>
<th>Router</th>
<th>Level</th>
<th>Area Addresses</th>
<th>System ID</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>L2</td>
<td>47.2222.3333</td>
<td>0000.cd00.a4d6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>47.5678.5678</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>L2</td>
<td>47.2345.7890</td>
<td>0100.cd00.a4d6</td>
</tr>
</tbody>
</table>
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 24-2 on page 24-29, Table 24-3 on page 24-29).

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

Figure 24-2: Example output from the `show clns adjacency` command

<table>
<thead>
<tr>
<th>ES Adjacencies</th>
<th>Circ</th>
<th>SysID</th>
<th>Type</th>
<th>SNPA</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2345.6782.ad12</td>
<td>Manual</td>
<td>00-00-cd-00-0d-01</td>
<td>UP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IS Adjacencies</th>
<th>Circ</th>
<th>SysID</th>
<th>Type</th>
<th>SNPA</th>
<th>Usage</th>
<th>HTime</th>
<th>Priority</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>0000.cd00.a0db</td>
<td>L1IS</td>
<td>00-00-cd-00-a0-db</td>
<td>L1L2</td>
<td>66080</td>
<td>1854</td>
<td>UP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area Adjacencies</th>
<th>Circ</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>47.1234.1234</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>47.1234.2222</td>
</tr>
</tbody>
</table>

Table 24-3: Parameters in output of the `show clns adjacency` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES Adjacencies</td>
<td>Summary of end systems that are adjacent to the virtual router.</td>
</tr>
<tr>
<td>Circ (ES Adjacencies)</td>
<td>Circuit index of the circuit via which the end system is adjacent to the switch.</td>
</tr>
<tr>
<td>SysID (ES Adjacencies)</td>
<td>The system ID of the adjacent system.</td>
</tr>
<tr>
<td>Type (ES Adjacencies)</td>
<td>“Manual” if the adjacency was added by the user, or “Auto” if the adjacency was added by the CLNS engine.</td>
</tr>
<tr>
<td>SNPA (ES Adjacencies)</td>
<td>Sub-network point of attachment of the end system.</td>
</tr>
<tr>
<td>State (ES Adjacencies)</td>
<td>The state of the adjacency (UP/DOWN). Adjacencies created manually always have this value set to UP.</td>
</tr>
<tr>
<td>IS Adjacencies</td>
<td>Summary of intermediate systems that are adjacent to the virtual router.</td>
</tr>
<tr>
<td>Circ (IS Adjacencies)</td>
<td>Circuit index of the circuit via which the intermediate system is adjacent to the switch.</td>
</tr>
<tr>
<td>SysID (IS Adjacencies)</td>
<td>The system ID of the adjacent system.</td>
</tr>
<tr>
<td>Type (IS Adjacencies)</td>
<td>The type of the neighbouring system. Intermediate System (IS), Level 1 IS (L1IS), or Level 2 IS (L2IS).</td>
</tr>
<tr>
<td>SNPA (IS Adjacencies)</td>
<td>Sub-network point of attachment of the intermediate system.</td>
</tr>
<tr>
<td>Circ (Area Adjacencies)</td>
<td>Circuit index of the circuit via which the area is adjacent to the switch.</td>
</tr>
</tbody>
</table>
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 24-3 on page 24-31, Table 24-4 on page 24-31).

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

Figure 24-3: 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 24-4: Parameters in output of the `show clns area` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Area Addresses</td>
<td>Set of manual area addresses configured on this intermediate system.</td>
</tr>
<tr>
<td>Union of Area Addresses</td>
<td>Union of the sets of area addresses reported in all Level 1 LSPs received by this instance of the protocol.</td>
</tr>
</tbody>
</table>

Examples

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

```
sh clns area
```

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 24-4 on page 24-32, Table 24-5 on page 24-33).

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 24-5 on page 24-34, Table 24-7 on page 24-35).

Figure 24-4: Example output from the show clns circuit command

<table>
<thead>
<tr>
<th>Interface</th>
<th>vlan1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit State</td>
<td>Enabled</td>
</tr>
<tr>
<td>Type</td>
<td>broadcast</td>
</tr>
<tr>
<td>Hello Interval</td>
<td>3</td>
</tr>
<tr>
<td>L1 Metrics:</td>
<td></td>
</tr>
<tr>
<td>Default</td>
<td>20</td>
</tr>
<tr>
<td>Delay</td>
<td>20</td>
</tr>
<tr>
<td>Expense</td>
<td>20</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
</tr>
<tr>
<td>L2 Metrics:</td>
<td></td>
</tr>
<tr>
<td>Default</td>
<td>20</td>
</tr>
<tr>
<td>Delay</td>
<td>20</td>
</tr>
<tr>
<td>Expense</td>
<td>20</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
</tr>
<tr>
<td>IS-IS State</td>
<td>Enabled</td>
</tr>
<tr>
<td>L2 Only</td>
<td>No</td>
</tr>
<tr>
<td>L1 IS Priority</td>
<td>64</td>
</tr>
<tr>
<td>L2 IS Priority</td>
<td>64</td>
</tr>
<tr>
<td>L1 Allocated Circuit ID</td>
<td>0000.cd00.a4d6.05</td>
</tr>
<tr>
<td>L1 Designated IS</td>
<td>0000.cd00.a4d6</td>
</tr>
<tr>
<td>L2 Allocated Circuit ID</td>
<td>0000.cd00.a4d6.05</td>
</tr>
<tr>
<td>L2 Designated IS</td>
<td>0000.cd00.a4d6</td>
</tr>
<tr>
<td>Pt To Pt Circuit ID</td>
<td>0000.cd00.a4d6.05</td>
</tr>
<tr>
<td>Multicast Address Type</td>
<td>Group</td>
</tr>
<tr>
<td>ES-IS Configuration:</td>
<td></td>
</tr>
<tr>
<td>ES-IS State</td>
<td>Enabled</td>
</tr>
<tr>
<td>IS Configuration Interval</td>
<td>10</td>
</tr>
<tr>
<td>Suggested ES Configuration Interval</td>
<td>600</td>
</tr>
<tr>
<td>Redirect PDU Hold Time</td>
<td>600</td>
</tr>
</tbody>
</table>
Table 24-5: Parameters in output of the `show clns circuit` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>The interface over which the circuit transmits and receives packets.</td>
</tr>
<tr>
<td>Circuit State</td>
<td>The operational state of the circuit.</td>
</tr>
<tr>
<td>Type</td>
<td>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.</td>
</tr>
<tr>
<td>Hello Interval</td>
<td>The period, in seconds, between IIH PDUs.</td>
</tr>
<tr>
<td>L1 Metrics</td>
<td>Values for the L1 metrics for this circuit.</td>
</tr>
<tr>
<td>L2 Metrics</td>
<td>Values for the L2 metrics for this circuit.</td>
</tr>
<tr>
<td>IS-IS State</td>
<td>Whether the IS-IS protocol is enabled on this interface; one of “Yes” or “No”.</td>
</tr>
<tr>
<td>L2 Only</td>
<td>“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.</td>
</tr>
<tr>
<td>L1 IS Priority</td>
<td>The priority for becoming LAN Level 1 Designated Intermediate System on a broadcast circuit.</td>
</tr>
<tr>
<td>L2 IS Priority</td>
<td>The priority for becoming LAN Level 2 Designated Intermediate System on a broadcast circuit.</td>
</tr>
<tr>
<td>L1 Allocated Circuit ID</td>
<td>The LAN ID allocated by the LAN Level 1 Designated Intermediate System.</td>
</tr>
<tr>
<td>L1 Designated IS</td>
<td>The ID of the LAN Level 1 Designated Intermediate System on this circuit.</td>
</tr>
<tr>
<td>L2 Allocated Circuit ID</td>
<td>The LAN ID allocated by the LAN Level 2 Designated Intermediate System.</td>
</tr>
<tr>
<td>L2 Designated IS</td>
<td>The ID of the LAN Level 2 Designated Intermediate System on this circuit.</td>
</tr>
<tr>
<td>Pt To Pt Circuit ID</td>
<td>The point to point ID of the circuit.</td>
</tr>
<tr>
<td>Multicast Address Type</td>
<td>Type of multicast address used for sending HELLO PDUs on this circuit. “Group” is the only defined value for this parameter.</td>
</tr>
<tr>
<td>ES-IS Configuration</td>
<td>Configuration of the ES-IS protocol on this circuit.</td>
</tr>
<tr>
<td>IS Configuration Interval</td>
<td>Value in seconds of how often an IS reports configuration information to ESs.</td>
</tr>
<tr>
<td>Suggested ES Configuration Interval</td>
<td>Value in seconds to be used for the suggested ES configuration timer value, advertised in IS Hellos generated by the system on this circuit.</td>
</tr>
<tr>
<td>Redirect PDU Hold Time</td>
<td>The holding time in seconds to be specified in Redirect PDUs generated by the system on this circuit.</td>
</tr>
</tbody>
</table>
Figure 24-5: Example output from the `show clns circuit` command when no `circuit` value is specified

<table>
<thead>
<tr>
<th>Virtual Router</th>
<th>Circuit</th>
<th>Interface</th>
<th>SNPA</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>virt1</td>
<td>-</td>
<td>UP</td>
</tr>
<tr>
<td>5</td>
<td>vlan1</td>
<td>00-00-cd-00-a4-d6</td>
<td>UP</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>virt0</td>
<td>-</td>
<td>UP</td>
</tr>
<tr>
<td>2</td>
<td>ppp0</td>
<td>-</td>
<td>DOWN</td>
<td></td>
</tr>
</tbody>
</table>

Virtual Interface Rx Queue Length 0

Table 24-6: Parameters in output of the `show clns circuit` command when no `circuit` value is specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Router ID</td>
<td>ID of the virtual router to which the subsequent circuit belongs.</td>
</tr>
<tr>
<td>Circuit ID</td>
<td>ID of the circuit.</td>
</tr>
<tr>
<td>Interface Type and Instance</td>
<td>Type and instance of the interface that provides the circuit.</td>
</tr>
<tr>
<td>SNPA</td>
<td>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.</td>
</tr>
<tr>
<td>State</td>
<td>Operational state of the circuit. (UP/DOWN).</td>
</tr>
<tr>
<td>Virtual Interface Rx Queue Length</td>
<td>Number of packets in the receive queue of the virtual interface between CLNS virtual routers.</td>
</tr>
</tbody>
</table>

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 COUTners
```

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 24-6 on page 24-35, Table 24-7 on page 24-35).

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 24-6: Example output from the `show clns circuit counters` command

<table>
<thead>
<tr>
<th>Counters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjacency State Changes</td>
<td>0</td>
</tr>
<tr>
<td>Initialisation Failures</td>
<td>0</td>
</tr>
<tr>
<td>Rejected Adjacencies</td>
<td>0</td>
</tr>
<tr>
<td>Control PDUs Tx</td>
<td>3168</td>
</tr>
<tr>
<td>Control PDUs Rx</td>
<td>0</td>
</tr>
<tr>
<td>ID Field Length Mismatches</td>
<td>0</td>
</tr>
<tr>
<td>L1 Designated IS Changes</td>
<td>2</td>
</tr>
<tr>
<td>L2 Designated IS Changes</td>
<td>2</td>
</tr>
<tr>
<td>IS ES Reachability Changes</td>
<td>0</td>
</tr>
<tr>
<td>Invalid ES-IS PDUs Rx</td>
<td>0</td>
</tr>
<tr>
<td>CLNS PDUs Rx</td>
<td>0</td>
</tr>
<tr>
<td>CLNS PDUs Tx</td>
<td>0</td>
</tr>
<tr>
<td>Bad DSAP PDUs Rx</td>
<td>0</td>
</tr>
<tr>
<td>Control Packets Rx</td>
<td>0</td>
</tr>
<tr>
<td>Data Packets Rx</td>
<td>0</td>
</tr>
<tr>
<td>Packets Tx</td>
<td>3562</td>
</tr>
</tbody>
</table>

Table 24-7: Parameters in output of the `show clns circuit counters` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjacency State Changes</td>
<td>Number of times an adjacency state change has occurred on this circuit.</td>
</tr>
<tr>
<td>Initialisation Failures</td>
<td>Number of times initialisation of this circuit has failed.</td>
</tr>
<tr>
<td>Rejected Adjacencies</td>
<td>Number of times an adjacency has been rejected on this circuit.</td>
</tr>
<tr>
<td>Control PDUs Tx</td>
<td>Number of IS-IS control PDUs sent on this circuit.</td>
</tr>
<tr>
<td>Control PDUs Rx</td>
<td>Number of IS-IS control PDUs received on this circuit.</td>
</tr>
<tr>
<td>ID Field Length Mismatches</td>
<td>Number of times an IS-IS control PDU with an ID field length different to that for this system has been received.</td>
</tr>
<tr>
<td>L1 Designated IS Changes</td>
<td>Number of times the LAN Level 1 Designated Intermediate System has changed.</td>
</tr>
<tr>
<td>L2 Designated IS Changes</td>
<td>Number of times the LAN Level 2 Designated Intermediate System has changed.</td>
</tr>
</tbody>
</table>
Table 24-7: Parameters in output of the `show clns circuit counters` command (Continued)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS ES Reachability Changes</td>
<td>Number of changes in reachability of End Systems from this circuit.</td>
</tr>
<tr>
<td>Invalid ES-IS PDU Rx</td>
<td>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.</td>
</tr>
<tr>
<td>CLNS PDUs Rx</td>
<td>Number of CLNS PDUs received on this circuit.</td>
</tr>
<tr>
<td>CLNS PDUs Tx</td>
<td>Number of CLNS PDUs transmitted on this circuit.</td>
</tr>
<tr>
<td>Bad DSAP PDUs Rx</td>
<td>Number CLNS PDUs received with a bad DSAP.</td>
</tr>
<tr>
<td>Control Packets Rx</td>
<td>Number of control packets received on this circuit.</td>
</tr>
<tr>
<td>Data Packets Rx</td>
<td>Number of data packets received on this circuit.</td>
</tr>
<tr>
<td>Packets Tx</td>
<td>Number of packets transmitted over this circuit.</td>
</tr>
</tbody>
</table>

**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 24-7 on page 24-37, Table 24-8 on page 24-37).

Figure 24-7: Example output from the show clns counters command.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Done</th>
<th>No Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>pktOut</td>
<td>4676</td>
<td>0</td>
</tr>
<tr>
<td>fragOut</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>discard</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>errorReport</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>redirect</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>routingFrame</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>forward</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>forwardLocal</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>forwardFrag</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>rxEth</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>rxPPP</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>rxVirt</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>rxVlan</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(DBdeleted 4676)

Table 24-8: Parameters in output of the show clns counters command

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

```plaintext
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 24-8 on page 24-39, Table 24-9 on page 24-40).

The `clns` parameter specifies which CLNS virtual router’s configuration is displayed. The default is 0.

Figure 24-8: Example output from the `show clns detail` command

```
cdns 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 24-9: Parameters in output of the `show clns detail` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Whether the CLNS virtual router is ENABLED or DISABLED.</td>
</tr>
<tr>
<td>Level</td>
<td>Type of the virtual router: level 1 (L1) or level 2 (L2).</td>
</tr>
<tr>
<td>System ID</td>
<td>6-byte number (in dotted hexadecimal form) that is used as the system ID part of the virtual router's NSAP address.</td>
</tr>
<tr>
<td>Area Addresses</td>
<td>List of the virtual router's area addresses.</td>
</tr>
<tr>
<td>Maximum Path Splits</td>
<td>Maximum numbers of equal cost paths that switch traffic may be split between.</td>
</tr>
<tr>
<td>Minimum LSP Transmit Int</td>
<td>Minimum number of seconds between transmission of link state PDUs.</td>
</tr>
<tr>
<td>Minimum Broadcast LSP Int</td>
<td>Minimum number of seconds between transmission of link state PDUs over broadcast circuits.</td>
</tr>
<tr>
<td>Maximum LSP Generation Int</td>
<td>Maximum number of seconds between generation of link state PDUs.</td>
</tr>
<tr>
<td>Minimum LSP Generation Int</td>
<td>Minimum number of seconds between generation of link state PDUs.</td>
</tr>
<tr>
<td>CSNP Interval</td>
<td>Number of seconds between transmission of complete sequence number PDUs.</td>
</tr>
<tr>
<td>PSNP Interval</td>
<td>Number of seconds between transmission of partial sequence number PDUs.</td>
</tr>
<tr>
<td>L1 LSP MTU</td>
<td>Maximum allowable size of L1 link state PDUs.</td>
</tr>
<tr>
<td>Maximum Number of Area Addresses</td>
<td>Maximum number of area addresses the virtual router may have at one time.</td>
</tr>
<tr>
<td>ES Hello Interval</td>
<td>Number of seconds between transmission of ES hello packets.</td>
</tr>
<tr>
<td>IS-IS Hello Interval</td>
<td>Number of seconds between transmission of IS-IS hello packets.</td>
</tr>
<tr>
<td>Wait Time</td>
<td>Number of seconds to delay in Waiting State before entering On State.</td>
</tr>
<tr>
<td>L1 Database State</td>
<td>Whether the L1 database is up.</td>
</tr>
<tr>
<td>Corrupted LSPs Detected</td>
<td>Number of corrupted LSPs detected.</td>
</tr>
<tr>
<td>L1 Database Overloads</td>
<td>Number of times the LSP L1 database has become overloaded.</td>
</tr>
<tr>
<td>Manual Area Address Drops</td>
<td>Number of times a manual address has been dropped from the area.</td>
</tr>
<tr>
<td>Attempts To Exceed Max Sequence Num</td>
<td>Number of times the IS has attempted to exceed the maximum sequence number.</td>
</tr>
<tr>
<td>Sequence Number Skips</td>
<td>Number of times a sequence number skip has occurred.</td>
</tr>
<tr>
<td>Own LSP Purges</td>
<td>Number of times a zero-aged copy of the system’s own LSP is received from some other node.</td>
</tr>
<tr>
<td>System ID Length Mismatches</td>
<td>Number of times a PDU is received with a different value for ID field length than the field length for the receiving system.</td>
</tr>
<tr>
<td>Maximum Area Address Mismatches</td>
<td>Number of times a PDU is received with a different value for Maximum Area Addresses than the Maximum Area Addresses for the receiving system.</td>
</tr>
<tr>
<td>L2 LSP MTU</td>
<td>Maximum allowable size of L2 link state PDUs.</td>
</tr>
</tbody>
</table>
Table 24-9: Parameters in output of the `show clns detail` command (Continued)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 Database State</td>
<td>Whether the L2 database is up.</td>
</tr>
<tr>
<td>L2 Database Overloads</td>
<td>Number of times the Level 2 LSP database has become overloaded.</td>
</tr>
<tr>
<td>Maximum Area Address Checking</td>
<td>Whether maximum area addresses per IS version of ISO10589 are checked.</td>
</tr>
</tbody>
</table>

**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 24-9 on page 24-42, Table 24-10 on page 24-42).

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

Figure 24-9: Example output from the `show clns ra` command.

```
<table>
<thead>
<tr>
<th>Destination</th>
<th>NextHop</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.2222.2222</td>
<td>00-00-cd-0d-00-01</td>
</tr>
<tr>
<td>11.1111.1111.1111.1111.1111.11</td>
<td>00-00-cd-0d-00-01</td>
</tr>
<tr>
<td>47.2222.2222</td>
<td>00-00-cd-11-00-0d</td>
</tr>
</tbody>
</table>
```

Table 24-10: Parameters in output of the `show clns ra` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination</td>
<td>Destination of this Reachable Address. This is an Address Prefix.</td>
</tr>
<tr>
<td>Next Hop</td>
<td>SNPA Address to which a PDU may be forwarded in order to reach a destination that matches the address prefix of the Reachable Address.</td>
</tr>
<tr>
<td>Circ</td>
<td>ID of the circuit to use for this reachable address</td>
</tr>
<tr>
<td>Type</td>
<td>How the RA was obtained. “Manual” indicates the RA was added by system management. “Automatic” indicates the RA was added by the routing engine.</td>
</tr>
<tr>
<td>Map Type</td>
<td>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.</td>
</tr>
<tr>
<td>Metrics</td>
<td>Values for the four metric types (default, delay, expense, error) for the RA.</td>
</tr>
<tr>
<td>State</td>
<td>Operation state of the RA.</td>
</tr>
</tbody>
</table>

**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 24-10 on page 24-44, Table 24-11 on page 24-44).

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 24-10:** 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 24-11:** Parameters in output of the `show clns route=all` command

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination</td>
<td>Destination end system ID or address prefix.</td>
</tr>
<tr>
<td>Circ</td>
<td>Circuit that the route is over.</td>
</tr>
<tr>
<td>Next Hop</td>
<td>System ID of the next hop to reach destination.</td>
</tr>
<tr>
<td>Source</td>
<td>Source of the route:</td>
</tr>
<tr>
<td></td>
<td>Manual manually configured information on the system</td>
</tr>
<tr>
<td></td>
<td>ISIS-L1 ISIS Level 1 LSPs</td>
</tr>
<tr>
<td></td>
<td>ISIS-L2 ISIS Level 2 LSPs</td>
</tr>
<tr>
<td></td>
<td>ISIS ISIS LSPs of unknown</td>
</tr>
</tbody>
</table>
Table 24-11: Parameters in output of the **show clns route=all** command (Continued)

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

**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`