DECnet Commands

Digital Equipment Corporation (Digital) developed the DECnet protocol to provide a way for its computers to communicate with one another. DECnet is currently in its fifth major product release called Phase V. DECnet Phase V is a superset of the OSI protocol suite, supports all OSI protocols, and is compatible with the previous release, Phase IV. DECnet Phase IV Prime supports inherent MAC addresses, which allow DECnet nodes to coexist with systems running other protocols that have MAC address restrictions. DECnet support on our routers includes local-area and wide-area DECnet Phase IV routing over Ethernet, Token Ring, FDDI, and serial lines (X.25, Frame Relay, SMDS).

Use the commands in this chapter to configure and monitor DECnet networks. For DECnet protocol configuration information and examples, refer to the "Configuring DECnet" chapter of the *Router Products Configuration Guide*.

access-list (extended)

To create an extended access list, use the **access-list** global configuration command. Use the **no** form of this command to delete the entire access list.

> **access-list** *access-list-number* {**permit** | **deny**} *source source-mask* [*destination destination-mask*]
> **no access-list**

Syntax Description

access-list-number	Integer you choose between 300 and 399 that uniquely identifies the access list.
permit	Permits access when there is an address match.
deny	Denies access when there is an address match.
source	Source address. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All addresses are in decimal.
source-mask	Mask to be applied to the address of the source node. All masks are in decimal.
destination	(Optional) Destination node's DECnet address in decimal format. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50.
destination-mask	(Optional) Destination mask. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All masks are in decimal.

Default

No access list is defined.

Command Mode

Global configuration

Example

In the following example, access list 301 is configured to allow traffic from any host in networks 1 and 3. It implies no other traffic will be permitted. (The end of a list contains an implicit "deny all else" statement.)

```
access-list 301 permit 1.0 0.1023 0.0 63.1023
access-list 301 permit 3.0 0.1023 0.0 63.1023
```

Related Commands

access-list (filter connect initiate packets)
access-list (standard)
decnet access-group
decnet in-routing-filter
decnet out-routing-filter
show decnet interface

access-list (filter connect initiate packets)

To create an access list that filters *connect initiate* packets, use the **access-list** global configuration command. Use the **no** form of this command to disable the access list.

> **access-list** *access-list-number* {**permit** | **deny**} *source source-mask*
> [*destination destination-mask* {**eq** | **neq**} [[*source-object*] [*destination-object*]
> [*identification*]] **any**]

> **no access-list**

The optional argument *source-object* consists of the following string:

> **src** [{**eq** | **neq** | **gt** | **lt**} *object-number*] [**exp** *regular-expression*] [**uic** [*group, user*]]

The optional argument *destination-object* consists of the following string:

> **dst** [{**eq** | **neq** | **gt** | **lt**} *object-number*] [**exp** *regular-expression*] [**uic** [*group, user*]]

The optional argument *identification* consists of the following string:

> [**id** *regular-expression*] [**password** *regular-expression*] [**account** *regular-expression*]

Syntax Description

access-list-number	Integer you choose between 300 and 399 that uniquely identifies the access list.
permit	Permits access when there is an address match.
deny	Denies access when there is an address match.
source	Source address. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All addresses are in decimal.
source-mask	Mask to be applied to the address of the source node. All masks are in decimal.
destination	(Optional) Destination node's DECnet address in decimal format. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All addresses are in decimal.
destination-mask	(Optional) Destination mask. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All masks are in decimal.
eq	**neq**	Use either of these keywords: **eq**—item matches the packet if *all* the specified parts of *source-object*, *destination-object*, and *identification* match data in the packet. **neq**—item matches the packet if *any* of the specified parts do *not* match the corresponding entry in the packet.

source-object	(Optional) Contains the mandatory keyword **src** and one of the following optional keywords:
	eq | **neq** | **lt** | **gt**—equal to, not equal to, less than, or greater than. These keywords must be followed by the argument *object-number*, a numeric DECnet object number.
	exp—stands for expression; followed by a regular expression that matches a string.
	uic—stands for user identification code; followed by a numeric user ID (UID*)* expression.The argument [*group, user*] is a numeric UID expression. In this case, the bracket symbols are literal; they must be entered. The group and user parts can either be specified in decimal, in octal by prefixing the number with a 0, or in hex by prefixing the number with 0x. The uic expression is displayed in show displays as an octal number.
destination-object	(Optional) Contains the mandatory keyword **dst** and one of the following optional keywords:
	eq | **neq** | **lt** | **gt**—equal to, not equal to, less than, or greater than. These keywords must be followed by the argument *object-number*, a numeric DECnet object number.
	exp—stands for expression; followed by a regular expression that matches a string.
	uic—stands for user identification code; followed by a numeric user ID (UID*)* expression. In this case, the bracket symbols are literal; they must be entered. The group and user parts can either be specified in decimal, in octal by prefixing the number with a 0, or in hex by prefixing the number with 0x. The uic expression is displayed in show displays as an octal number.
identification	(Optional) Uses any of the following three keywords:
	id—regular expression; refers to user ID.
	password—regular expression; the password to the account.
	account—regular expression; the account string.
any	Item matches if *any* of the specified parts *do* match the corresponding entries for *source-object*, *destination-object*, or *identification*.

See the "Regular Expressions" appendix for a description of regular expressions.

Default

No access list is defined.

Command Mode

Global configuration

Usage Guidelines

Depending upon the arguments you use, you can define access lists in three ways:

- Restrict access based on source addresses

  Use the *source* and *source-mask* arguments only.

- Restrict access based on destination addresses

  Use the *source*, *source-mask, destination*, and *destination-mask* arguments.

- Add filters to further narrow access

  Use the *source*, *source-mask, destination*, and *destination-mask* arguments, the **eq** | **neq** or **any** keywords and any or all of the following arguments: *source-object, destination-object*, and *identification*.

Table 17-1 lists the DECnet object numbers.

Table 17-1   **Common DECnet Object Numbers**

Name	Number	Description
FAL	17	File Access Listener
HLD	18	Host Loader
NML	19	Network Monitor Link/NICE
MIRROR	25	Loopback mirror
EVL	26	Event logger
MAIL	27	Mail
PHONE	29	Phone
NOTES	33	VAX Notes
CTERM	42	Terminal sessions
DTR	63	DECnet Test Sender/Receiver

Examples

The following example illustrates an access list for matching all connect packets for object number 27:

```
access-list 300 permit 0.0 63.1023 eq dst eq 27
```

The following example illustrates an access list for matching all connect packets *except* for the object number 17:

```
access-list 300 permit 0.0 63.1023 neq dst eq 17
```

The following example illustrates an access list for matching all connect packets where the access identification was *SYSTEM*:

```
access-list 300 permit 0.0 63.1023 eq id ^SYSTEM$
```

The following example illustrates an access list for matching all connect packets from area 1 to object number 27 (27 = VAX/VMS Personal Utility or MAIL) where *SYSTEM* is the originating user:

```
access-list 300 permit 1.0 0.1023 eq src exp ^SYSTEM$ dst eq 27
```

The following example illustrates an access list for matching any connect packet and can be used at the end of a list to permit any packets not already matched:

```
access-list 300 permit 0.0 63.1023 eq any
```

Related Commands

access-list (extended)
access-list (standard)
decnet access-group
decnet in-routing-filter
decnet out-routing-filter
show decnet interface

access-list (standard)

To create a standard access list, use the **access-list** global configuration command. Use the **no** form of this command to delete the entire access list.

access-list *access-list-number* {**permit** | **deny**} *source source-mask*
no access-list

Syntax Description

access-list-number	Integer you choose between 300 and 399 that uniquely identifies the access list.
permit	Permits access when there is an address match.
deny	Denies access when there is an address match.
source	Source address. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All addresses are in decimal.
source-mask	Mask to be applied to the address of the source node. Bits are set wherever the corresponding bits in the address should be ignored. All masks are in decimal.

Default

No access list is defined.

Command Mode

Global configuration

Usage Guidelines

In contrast with IP masks, a DECnet mask specification of "all ones" is entered as the decimal value 1023. In IP, the equivalent is 255.

Example

The following example sets up access list 300 to deny packets coming from node 4.51 and permit packets coming from 2.31:

```
access-list 300 deny 4.51 0.0
access-list 300 permit 2.31 0.0
```

Related Commands

access-list (extended)
access-list (filter connect initiate packets)
decnet access-group
decnet in-routing-filter
decnet out-routing-filter
show decnet interface

clear decnet counters

To clear DECnet counters that are shown in the output of the **show decnet traffic** EXEC command, use the **clear decnet counters** EXEC command.

> **clear decnet counters**

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Example

The following example zeros all DECnet counters:

```
router# clear decnet counters
```

Related Command

show decnet traffic

decnet access-group

To create a DECnet access group, use the **decnet access-group** interface configuration command.

> **decnet access-group** *access-list-number*

Syntax Description

access-list-number	Either a standard or extended DECnet access list. A standard DECnet access list applies to source addresses. The value (or values in the case of extended lists) can be in the range 300 through 399.

Default

No access group is defined.

Command Mode

Interface configuration

Example

The following example applies access list 389 to Ethernet interface 1:

```
interface ethernet 1
decnet access-group 389
```

Related Commands

access-list (standard)
show decnet interface

decnet advertise

To configure border routers to propagate Phase IV areas through an OSI backbone, use the **decnet advertise** global configuration command. To disable this feature, use the **no** form of this command.

> **decnet advertise** *decnet-area hops cost*
> **no decnet advertise** [*decnet-area*]

Syntax Description

decnet-area	Phase IV area that you want propagated.
hops	Hop count to be associated with the route being advertised. Default is 0.
cost	Cost to be associated with the route being advertised. Default is 0.

Default

Disabled

Command Mode

Global configuration

Usage Guidelines

The output from the **show decnet route** EXEC command shows the cost and hop count for routes.

The **decnet advertise** command is used by border routers for propagating Phase IV areas through an OSI backbone.

The **decnet advertise** command and the **clns route** *nsap-prefix* **discard** command work together. When a router has DECnet Phase IV/V conversion enabled, any packet with the specified CLNS NSAP prefix causes CLNS to behave as if no route was found. That router then looks up the route to the border router that is advertising the Phase IV route. In turn, the router that is advertising the DECnet Phase IV route converts the packet to Phase V and sends it through the OSI cloud to the border router that is advertising the CLNS discard static route. Once it gets there, the packet is converted back to Phase IV.

The CLNS discard routes are created dynamically when the advertised adjacencies are propagated through the CLNS cloud. When a DECnet interface is disabled, the adjacencies are lost and the CLNS discard route is deleted. The DECnet area routing states are displayed in the output from the **show decnet route** EXEC command.

Example

The following example shows a partial use of the **decnet advertise** command:

```
decnet conversion 49
decnet advertise 4
clns route 49.0001 discard
```

Related Commands

A dagger (†) indicates that the command is documented in another chapter.

clns route discard †
show decnet route

decnet area-max-cost

To set the maximum cost specification value for *interarea* routing, use the **decnet area-max-cost** global configuration command.

> **decnet** [*network-number*] **area-max-cost** *value*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
value	Maximum cost for a route to a distant area that the router may consider usable; the router treats as unreachable any route with a cost greater than the value you specify. A valid range for cost is from 1 through 1022. This parameter is only valid for area routers. The default is 1022.

Defaults

*network-numbe*r: 0
value: 1022

Command Mode

Global configuration

Usage Guidelines

Make sure you have used the **decnet node-type area** global configuration command before using this command.

Example

In the following example, the node type is specified as area and the maximum cost is set to 500. Any route with a cost exceeding 500 will be considered unreachable by this router.

```
decnet node-type area
decnet area-max-cost 500
```

Related Commands

decnet area-max-hops
decnet node-type
show decnet interface

decnet area-max-hops

To set the maximum hop count value for *interarea* routing, use the **decnet area-max-hops** global configuration command.

> **decnet** [*network-number*] **area-max-hops** *value*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
value	Maximum number of hops for a usable route to a distant area. The router treats as unreachable any route with a count greater than the value you specify. A valid range for the hop count is from 1 through 30. The default is 30 hops.

Default

30 hops

Command Mode

Global configuration

Usage Guidelines

This command is only valid for area routers. Make sure you have issued the **decnet node-type area** global configuration command before using this command.

Example

The following example sets the router to be a Level 2 router, then sets a maximum hop count of 21:

```
decnet node-type area
decnet area-max-hops 21
```

Related Commands

decnet area-max-cost
decnet node-type
show decnet interface

decnet congestion-threshold

Use the **decnet congestion-threshold** interface configuration command to set the congestion-experienced bit if the output queue has more than the specified number of packets in it. Use the **no decnet congestion-threshold** command to remove the parameter setting and set it to 0.

decnet congestion-threshold *number*
no decnet congestion-threshold

Syntax Description

number	Number of packets that are allowed in the output queue before the system will set the congestion experience bit. This value is an integer between 0 and 0x7fff. The value zero prevents this bit from being set. Only relatively small integers are reasonable. The default is 1 packet.

Default

1 packet

Command Mode

Interface configuration

Usage Guidelines

If a router configured for DECnet experiences congestion, it sets the congestion-experienced bit. A *number* value of zero or the **no** form of the command prevents this bit from being set.

Example

The following example sets the congestion threshold to 10:

```
interface ethernet 0
decnet congestion-threshold 10
```

decnet conversion

To allow Phase IV routers (running Software Release 9.1 or higher) to run in a Phase V network and vice versa, enable conversion with the **decnet conversion** global configuration command. To disable conversion, use the **no** form of this command.

> **decnet conversion** *nsap-prefix*
> **no decnet conversion** *nsap-prefix*

Syntax Description

nsap-prefix	Value used for the IDP field when constructing NSAPs from a Phase IV address.

Default
Disabled

Command Mode
Global configuration

Usage Guidelines

To enable DECnet conversion, you must configure both DECnet and ISO CLNS on your router.

DECnet Phase V is OSI-compatible and conforms to the ISO 8473 (CLNP/CLNS) and ISO 9542 (ES-IS) standards. Digital has defined algorithms for mapping a subset of the Phase V address space onto the Phase IV address space and for converting Phase IV and Phase V packets back and forth. This allows a network administrator to support both Phase IV hosts in Phase V networks and Phase V hosts in Phase IV networks.

Our implementation differs from Digital's in how reachability information is advertised. Our implementation allows you to add Phase V support without modifying your existing Phase IV support. It also delays converting packets from Phase IV to Phase V, while Digital's implementation converts as soon as possible.

It is essential that the area you specify in the **decnet routing** global configuration command is the same as the local area you specified with the **net** router configuration command for the CLNS network.

Make sure that the area you specify in the **decnet conversion** command is the same as the area you specified for the CLNS network. Also note that the DECnet area is specified in decimal, and the CLNS area is specified in hexadecimal.

The **decnet routing** command is specified with a decimal address, while the **net** command address is specified in hexadecimal. In addition, the *nsap-prefix* specified on the **decnet conversion** command must match one of the NETs for this router.

The following guidelines apply:

- Host connectivity across multiple areas is only possible if a Level 2 path exists for which every Level 2 router in the path supports a common protocol: Phase IV or Phase V. If not all routers support both protocols, those routers that do *must* have conversion enabled.

- Host connectivity across a single area is only possible if a Level 1 path exists for which every Level 1 router in the path supports a common protocol: Phase IV or Phase V. If not all routers support both protocols, those routers that do *must* have conversion enabled.

- The Level 2 backbone *must* have conversion enabled in all Level 2 routers that support an area that needs conversion.

Example

The following example enables DECnet conversion on a router with the area tag xy and Phase IV address 20.401 using an ISO IGRP router:

```
clns routing
decnet routing 20.401
decnet max-address 600
!
router iso-igrp xy
net 47.0004.004d.0014.aa00.0400.9151.00
!
decnet conversion 47.0004.004d
!
interface ethernet 0
decnet cost 4
clns router iso-igrp xy
```

Related Commands

A dagger (†) indicates that the command is documented in another chapter.

net †
show decnet interface
show decnet route

decnet cost

To set a cost value for an interface, use the **decnet cost** interface configuration command. Use the **no** form of this command to disable DECnet routing for an interface.

> **decnet cost** *cost-value*
> **no decnet cost**

Syntax Description

cost-value	Integer from 1 through 63. There is no default cost for an interface, although a suggested cost for FDDI is 1, for Ethernet is 4, and for serial links is greater than 10.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

After DECnet routing has been enabled, you must assign a cost to each interface over which you want DECnet to run. Assigning a cost in effect enables DECnet routing for an interface. Most DECnet installations have an individualized routing strategy for using costs. Therefore, check the routing strategy used at your installation to ensure that costs you specify are consistent with those set for other hosts on the network.

Example

The following example establishes a DECnet routing process for the router and sets the router's DECnet address to 21.456, then sets a cost of 4 for the Ethernet interface 0:

```
decnet routing 21.456
interface ethernet 0
decnet cost 4
```

Related Commands

decnet encapsulation
decnet node-type
decnet routing
show decnet interface
show decnet route

decnet encapsulation

To provide DECnet encapsulation over Token Ring, use the **decnet encapsulation** interface configuration command.

> **decnet encapsulation** {**pre-dec** | **dec**}

Syntax Description

pre-dec	Configures routers for operation on the same Token Ring with routers running software versions prior to 9.1. In this mode, Cisco routers cannot communicate with non-Cisco equipment. Referred to as Cisco-style encapsulation.
dec	Provides encapsulation that is compatible with other Digital equipment. All Cisco routers must be running Software Release 9.1 or later.

Default

Encapsulation is compatible with other Digital equipment.

Command Mode

Interface configuration

Usage Guidelines

If you have both Software Release 9.0 and 9.1 routers in the same network, you must use the **pre-dec** encapsulation type on the 9.1 routers.

Note   You must first enable DECnet routing on the selected Token Ring interface before you can configure the DECnet encapsulation mode.

Example

The following example sets Cisco-style encapsulation for DECnet routing, which means that Cisco and Digital equipment will not interoperate over Token Ring:

```
interface tokenring 0
decnet encapsulation pre-dec
decnet cost 4
```

Related Commands

decnet cost
show decnet interface

decnet hello-timer

To change the interval for sending broadcast hello messages, use the **decnet hello-timer** interface configuration command. To restore the default value, use the **no** form of this command.

> **decnet hello-timer** *seconds*
> **no decnet hello-timer**

Syntax Description

seconds	Interval at which the router sends hello messages. It can be a decimal number in the range 1 through 8191 seconds; the default is 15 seconds.

Default
15 seconds

Command Mode
Interface configuration

Usage Guidelines
The router broadcasts hello messages on all interfaces with DECnet enabled. Other hosts on the network use the hello messages to identify the hosts with which they can communicate directly. On extremely slow serial lines, you may want to increase the default value to reduce overhead on the line.

Example
The following example increases the hello interval to 2 minutes (120 seconds) on serial interface 1:

```
interface serial 1
decnet hello-timer 120
```

Related Command
show decnet interface

decnet host

Use the **decnet host** global configuration command to associate a name-to-DECnet address mapping, which will show up in the output of various commands. To disable name mapping, use the **no** form of this command.

> **decnet host** *name decnet-address*
> **no decnet host** *name*

Syntax Description

name	A name you choose that uniquely identifies this DECnet address.
decnet-address	Source address. DECnet addresses are written in the form *area.node*. For example, 50.4 is node 4 in area 50. All addresses are in decimal.

Default

No name is defined.

Command Mode

Global configuration

Usage Guidelines

The assigned name is displayed, where applicable, in **show decnet route** and **show hosts** EXEC command output.

The name can also be used with the **ping decnet** command.

Example

The following example defines name-to-DECnet address mapping:

```
decnet host cisco1 3.33
```

Related Commands

ping decnet
show decnet route
show hosts

decnet in-routing-filter

To provide access control to hello messages or routing information received on an interface, use the **decnet in-routing-filter** interface configuration command. Use the **no** form of this command to remove access control.

decnet in-routing-filter *access-list-number*
no decnet in-routing-filter

Syntax Description

access-list-number	Standard DECnet access list. This list applies to source addresses. The value can be in the range 300 through 399.

Default

No access control is defined.

Command Mode

Interface configuration

Example

In the following example, Ethernet interface 0 is set up with a DECnet in-routing filter of 321, which means that any hello messages sent from addresses that are denied in list 321 will be ignored. Additionally, all node addresses listed in received routing messages on this interface will be checked against the access list, and only routes passing the filter will be considered usable.

```
interface ethernet 0
decnet in-routing-filter 321
```

Related Commands

access-list (standard)
decnet out-routing-filter
show decnet interface

decnet map

To establish an address translation for selected nodes, use the **decnet map** global configuration command.

decnet *first-network* **map** *virtual-address second-network real-address*

Syntax Description

first-network	DECnet network numbers in the range 0 through 3.
virtual-address	Numeric DECnet address (10.5, for example).
second-network	DECnet network number you map to; DECnet numbers range from 0 through 3.
real-address	Numeric DECnet address (10.5, for example).

Default

No address translation is defined.

Command Mode

Global configuration

Usage Guidelines

Keep the following limitations in mind when configuring the Address Translation Gateway (ATG):

- Both nodes that want to communicate across the ATG must exist in the translation map. Other nodes outside of the map will see route advertisements for the mapped address but will be unable to communicate with them. An unmapped node trying to communicate with a mapped node will always get the message "Node unreachable." This can be confusing if another nearby node can communicate with mapped nodes because it is also a mapped node.

- Third-party DECnet applications could fail if they pass node number information in a data stream (most likely a sign of a poorly designed application).

- Routing information for mapped addresses is static and does not reflect the reachability of the actual node in the destination network.

As an additional feature and security caution, DECnet "Poor Man's Routing" can be used between nodes outside of the translation map as long as those nodes have access to nodes that are in the map, so that a user on node B could issue the following VMS command:

```
$ dir A::D::E::
```

When a Poor Man's Routing connection is made between two networks, only the two adjacent nodes between the networks will have any direct knowledge about the other network. Application-level network access may then be specified to route through the connection.

Note   We do not support Poor Man's Routing directly; the intermediate nodes must be VMS systems with Poor Man's Routing enabled in file access language (FAL).

Example

In the following example, packets in Network 0 sent to address 19.5 will be routed to Network 1, and the destination address will be translated to 50.1. Packets sent to address 47.1 in Network 1 will be routed to Network 0 as 19.1.

```
decnet 0 map 19.5 1 50.1
decnet 1 map 47.1 0 19.1
```

Related Command

show decnet map

decnet max-address

To configure the router with a maximum number of node addresses, use the **decnet max-address** global configuration command.

> **decnet** [*network-number*] **max-address** *value*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
value	A number less than or equal to 1023 that represents the maximum address possible on the network. In general, all routers on the network should use the same value for this argument. The default is 1023.

Default

1023 node addresses

Command Mode

Global configuration

Usage Guidelines

DECnet routers do not have the concept of aging out a route. Therefore, all possible areas or nodes must be advertised as unreachable if they cannot be reached. Since it is best to keep routing updates small, you need to indicate the default maximum possible node and area numbers that can exist in the network.

Example

The following example configures a small network to a maximum address value of 300:

```
decnet max-address 300
```

Related Command

decnet max-area

decnet max-area

To set the largest number of areas that the router can handle in its routing table, use the **decnet max-area** global configuration command.

decnet [*network-number*] **max-area** *area-number*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
area-number	Area number from 1 through 63. Like the **decnet max-address** global configuration command value, this argument controls the sizes of internal routing tables and of messages sent to other nodes. All routers on the network should use the same maximum address value. The default is 63.

Default

63 areas

Command Mode

Global configuration

Example

In the following example, the largest area to be stored in the routing table is 45:

```
decnet max-area 45
```

Related Commands

decnet max-address
show decnet interface

decnet max-cost

To set the maximum cost specification for *intra-area* routing, use the **decnet max-cost** global configuration command.

> **decnet** [*network-number*] **max-cost** *cost*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
cost	Cost from 1 through 1022. The default is 1022.

Default

1022

Command Mode

Global configuration

Usage Guidelines

The router ignores routes within its local area that have a cost greater than the value you specify.

Example

In the following example, the node type is specified as a Level 1 router and the maximum cost is set to 335. Any route whose cost exceeds 335 will be considered unreachable by this router.

```
decnet node-type routing-iv
decnet max-cost 335
```

Related Commands

decnet max-hops
decnet max-paths
decnet node-type routing-iv
decnet path-split-mode
show decnet interface

decnet max-hops

To set the maximum hop count specification value for *intra-area* routing, use the **decnet max-hops** global configuration command.

> **decnet** [*network-number*] **max-hops** *hop-count*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
hop-count	Hop count from 1 through 30. The router ignores routes that have a hop count greater than the corresponding value of this parameter. The default is 30 hops.

Default

30 hops

Command Mode

Global configuration

Example

The following example sets the router to be a Level 1 router, then sets a maximum hop count of 2:

```
decnet node-type routing-iv
decnet max-hops 2
```

Related Commands

decnet max-cost
decnet max-paths
decnet multicast-map
decnet node-type routing-iv

decnet max-paths

To define the maximum number of equal-cost paths to a destination that the router will keep in its routing table, use the **decnet max-paths** global configuration command.

decnet [*network-number*] **max-paths** *value*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
value	Decimal number equal to the maximum number of equal-cost paths the router will save. The valid range is from 1 through 31. The default is 1.

Default

1 equal-cost path

Command Mode

Global configuration

Usage Guidelines

Limiting the number of equal-cost paths can save memory on routers with limited memory or very large configurations. Additionally, in networks with a large number of multiple paths and end-systems with limited ability to cache out-of-sequence packets, performance may suffer when traffic is split between many paths.

Limiting the size of the routing table will not affect your router's ability to recover from network failures transparently, provided that you do not make the maximum number of paths too small. If more than the specified number of equal-cost paths exist, and one of those paths suddenly becomes unusable, the router will discover an additional path from the paths it has been ignoring.

Example

In the following example, the router will save no more than three equal-cost paths:

```
decnet max-paths 3
```

Related Commands

decnet max-cost
decnet max-hops
decnet path-split-mode
show decnet interface
show decnet route

decnet max-visits

To set the limit on the number of times a packet can pass through a router, use the **decnet max-visits** global configuration command.

> **decnet** [*network-number*] **max-visits** *value*

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
value	Number of times a packet can pass through a router. It can be a decimal number in the range 1 through 63. If a packet exceeds *value*, the router discards the packet. Digital recommends that the value of the **max-visits** parameter be at least twice that of the **max-hops** parameter, to allow packets to still reach their destinations when routes are changing. The default is 63 times.

Default

63 times

Command Mode

Global configuration

Example

The following example of intra-area routing configuration specifies Level 1 routing, a maximum hop count of 28, and maximum number of visits of 62 (which is more than twice 28).

```
decnet node-type routing-iv
decnet max-hops 28
decnet max-visits 62
```

Related Commands

decnet max-hops
show decnet interface
show decnet traffic

decnet multicast-map

Use the **decnet multicast-map** interface configuration command to specify a mapping between DECnet multicast addresses and Token Ring functional addresses, other than the default mapping. The **no** form of this command deletes the specified information.

> **decnet multicast-map** *multicast-address-type functional-address*
> **no decnet multicast-map** *multicast-address-type functional-address*

Syntax Description

multicast-address-type	Type of multicast address that is used. The following are valid values for the argument:
	iv-all-routers (All Phase-IV routers)
	iv-all-endnodes (All Phase-IV end nodes)
	iv-prime-all-routers (All Phase IV Prime routers)
functional-address	Functional MAC address that this multicast ID will map to. In the form of "c000.xxxx.yyyy."

Default

Enabled, with the default mapping listed in Table 17-2.

Command Mode

Interface configuration

Usage Guidelines

This command is valid for Token Ring interfaces only. The command will reject a functional address that does not start with "C000" or "c000."

Routing multicasts and end node multicasts must be on different functional addresses.

Table 17-2   Default Mapping of DECnet Multicast Address Types and Token Ring Functional Addresses

DECnet Multicast Address Type	Token Ring Functional Address
L1 router L2 router	C000.1000.0000
End node	C000.0800.0000
DECnet Phase IV-Prime router	C000.1000.0000

Example

In the following example, Token Ring interface 1 is configured for multicasts of all Phase IV end nodes and the multicast ID is configured to map to MAC address c000.2222.3333.

```
interface tokenring 1
decnet multicast-map iv-all-endnodes c000.2222.3333
```

decnet node-type

To specify the node type, use the **decnet node-type** global configuration command.

> **decnet** [*network-number*] **node-type** {**area** | **routing-iv**}

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
area	Router participates in the DECnet routing protocol with other area routers, as described in the Digital documentation, and routes packets from and to routers in other areas. This is sometimes referred to as Level 2, or interarea, routing. An area router does not just handle interarea routing; it also acts as an intra-area or Level 1 router in its own area.
routing-iv	Router acts as an intra-area (standard DECnet Phase IV, Level 1 router) and ignores Level 2 routing packets. In this mode, it routes packets destined for other areas to a designated interarea router, exchanging packets with other end nodes and routers in the same area.

Default

No node type is specified.

Command Mode

Global configuration

Example

In the following example, the router node type is specified as *area*, or Level 2:

```
decnet node-type area
```

Related Commands

decnet cost
decnet routing
show decnet interface

decnet out-routing-filter

To provide access control to routing information being sent out on an interface, use the **decnet out-routing-filter** interface configuration command. Use the **no** form of this command to remove access control.

decnet out-routing-filter *access-list-number*
no decnet out-routing-filter

Syntax Description

access-list-number	Standard DECnet access list applying to source addresses. The value can be in the range 300 through 399.

Default

No access control to routing information is defined.

Command Mode

Interface configuration

Usage Guidelines

Addresses that fail this test are shown in the update message as unreachable.

Example

In the following example, Ethernet interface 1 is set up with a DECnet out-routing filter of 351. This filter is applied to addresses in the transmitted routing updates. Transmitted hello messages are not filtered.

```
interface ethernet 1
decnet out-routing-filter 351
```

Related Commands

access-list (standard)
decnet in-routing-filter
show decnet interface

decnet path-split-mode

To specify how the router will split the routable packets between equal-cost paths, use the **decnet path-split-mode** global configuration command with the appropriate keyword.

decnet path-split-mode {**normal** | **interim**}

Syntax Description

normal	Normal mode, where equal-cost paths are selected on a round-robin basis. This is the default.
interim	Traffic for any particular (higher-layer) session is always routed over same path. This mode supports older implementations of DECnet (VMS Versions 4.5 and earlier) that do not support out-of-order packet caching. Other sessions may take another path, thus using equal-cost paths that a router may have for a particular destination.

Default
Normal mode

Command Mode
Global configuration

Example
In the following example, the router will split routable packets between equal-cost paths using the round-robin (or first-come, first-served) basis:

```
decnet path-split-mode normal
```

Related Commands
decnet max-cost
decnet max-paths

decnet propagate static

Use this form of the **decnet propagate static** global configuration command to enable static route propagation. The **no** form of this command disables propagation.

> **decnet route propagate static**
> **no decnet route propagate static**

Syntax Description

This command has no arguments or keywords.

Default

No default routes are propagated.

Command Mode

Global configuration

Usage Guidelines

By default, DECnet static routes will not be propagated to other routers. Use the **decnet propagate static** command to enable static route propagation. A default route will be used only after DECnet conversion is checked.

Example

The following example shows how to enable static route propagation for the specified static and default routes:

```
decnet propagate static
!
decnet route 3.0 ethernet 0 aa00.0400.0404
decnet route 5.0 serial 0
decnet route 5.100 serial 2
decnet route default 2.100
decnet route 6.0 2.3 4 5
```

Related Commands

decnet route (interface static route)
decnet route (to enter a static route)
show decnet
show decnet static

decnet route-cache

To enable fast-switching, use the **decnet route-cache** interface configuration command. To disable fast switching, use the **no** form of this command.

> **decnet route-cache**
> **no decnet route-cache**

Syntax Description

This command has no arguments or keywords.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

By default, our DECnet routing software implements fast switching of DECnet datagrams. There are times when it makes sense to disable fast switching. This is especially important when using rates slower than T1.

Fast switching uses memory space on interface cards. In situations where a high-bandwidth interface is writing large amounts of information to a low-bandwidth interface, additional memory could help avoid congestion on the slow interface.

Example

In the following example, fast switching is disabled on Ethernet interface 0:

```
interface ethernet 0
no decnet route-cache
```

decnet router-priority

To elect a designated router to which packets will be sent when no destination is specified, use the **decnet router-priority** interface configuration command.

    decnet router-priority *value*

Syntax Description

value	Priority of the router. This can be a number in the range 0 through 127. The larger the number the higher the priority. The default priority is 64.

Default

64

Command Mode

Interface configuration

Usage Guidelines

The *designated* router is the router to which all end nodes on an Ethernet communicate if they do not know where else to send a packet. The designated router is chosen through an election process in which the router with the highest priority gets the job. When two or more routers on a single Ethernet in a single area share the same highest priority, the unit with the highest node number is elected. You can reset a router's priority to help ensure that it is elected designated router in its area.

On a LAN with both DECnet IV and DECnet IV Prime hosts, make sure that a bilingual router always becomes the designated router.

DECnet end systems use the designated router only when they have no other information about how to reach a particular system. The end systems maintain a cache of how to reach other systems on the network. The cache contains the following information:

```
<remote system DECnet address>  <next hop DECnet address>
```

When an end system receives a packet, it examines three pieces of information: the intra-LAN bit, the source address, and the previous hop. If the intra-LAN bit is set, indicating that the packet has never left this wire (and thus the remote system is reachable without a router), a cache entry is created as follows:

```
<remote system DECnet address> = <source address>
<next hop DECnet address> = <source address>
```

If the intra-LAN bit is not set, indicating that the packet has come from another network, the cache entry is created as follows:

```
<remote system DECnet address> = <source address>
<next hop DECnet address> = <previous hop>
```

If there is no cache entry, then the designated router is used. This means that when starting a session, the designated router is used, but the reverse traffic will populate a cache entry so that the router can later communicate directly.

A DECnet IV Prime end node sends a packet to the Unknown Destination multicast if it has no cache entry for the destination and has no designated router.

Example

In the following example, DECnet priority for this router is set to 110 on Ethernet interface 1:

```
interface ethernet 1
decnet router-priority 110
```

decnet route (interface static route)

Use this form of the **decnet route** global configuration command to create an interface static route. The **no** form of this command removes this route.

decnet route *decnet-address next-hop-type number* [*snpa-address*] [*hops* [*cost*]]
no decnet route *decnet-address next-hop-type number*

Syntax Description

decnet-address	DECnet address. This value is entered into a static routing table and used to match a destination DECnet address. Use a node address value of 0 to specify an area static route.
next-hop-type	Interface type.
number	Interface unit number.
snpa-address	(Optional) Optional for serial links; required for multiaccess networks.
hops	(Optional) Hop count to be associated with the route being advertised. Default is 0.
cost	(Optional) Cost to be associated with the route being advertised. Default is 0.

Default

No interface static routes are created.

Command Mode

Global configuration

Usage Guidelines

If you do not specify an SNPA address when you have a multiaccess network, you will receive an error message indicating a bad SNPA. By default, DECnet static routes will not be propagated to other routers. Use the **decnet propagate static** command to enable propagation.

Examples

The following example shows how to create a static route for a serial interface. No SNPA need be specified for point-to-point interfaces.

```
decnet route 3.1 serial 1
```

The following example shows how to create a static route for an Ethernet interface. The SNPA must be specified for an interface that is not point-to-point.

```
decnet route 3.2 ethernet 1 aa00.0400.0104
```

Related Commands

decnet propagate static
decnet route (to enter a static route)
decnet route default (interface default route)
decnet route default (to enter a default route)
show decnet static

decnet route (to enter a static route)

Use this form of the **decnet route** global configuration command to enter a specific static route. DECnet addresses that match are forwarded to the *next-hop-address*. The **no** form of this command removes this route.

>**decnet route** *decnet-address next-hop-address* [*hops* [*cost*]]
>**no decnet route** *decnet-address next-hop-address*

Syntax Description

decnet-address	DECnet address. This value is entered into a static routing table and used to match a destination DECnet address. Use a node address value of 0 to specify an area static route.
next-hop-address	This value is used to establish the next hop of the route for forwarding packets.
hops	(Optional) Hop count to be associated with the route being advertised. Default is 0.
cost	(Optional) Cost to be associated with the route being advertised. Default is 0.

Default

No interface static routes are created.

Command Mode

Global configuration

Usage Guidelines

Area static routes can be configured by specifying a DECnet node address of 0. By default, DECnet static routes will not be propagated to other routers. Use the **decnet propagate static** command to enable propagation.

Examples

The following example shows how to create a static route for 1.1 that points to 1.9 and uses default values of 0 for the *hops* and *cost*:

```
decnet route 1.1 1.9
```

The following example shows how to create a static route for 3.100 that points to 3.4 and specifies values for the *hops* and *cost*:

```
decnet route 3.100 3.4 9 8
```

The following example shows how to create a static route for area 1 that points to 2.999:

```
decnet route 1.0 2.999
```

Related Commands

decnet propagate static
decnet route (interface static route)
decnet route default (interface default route)
decnet route default (to enter a default route)
show decnet static

decnet route default (interface default route)

Use this form of the **decnet route default** global configuration command to create an interface default route. The **no** form of this command removes this route.

> **decnet route default** *next-hop-type number* [*snpa-address*] [[*hops* [*cost*]]
> **no decnet route default** *next-hop-type number*

Syntax Description

next-hop-type	Interface type.
number	Interface unit number.
snpa-address	(Optional) Optional for serial links; required for multiaccess networks.
hops	(Optional) Hop count to be associated with the route being advertised. Default is 0.
cost	(Optional) Cost to be associated with the route being advertised. Default is 0.

Default

No interface default routes are created.

Command Mode

Global configuration

Usage Guidelines

If you do not specify an SNPA address when you have a multiaccess network, you will receive an error message indicating a bad SNPA.

A default route will be used only after DECnet conversion is checked. DECnet default routes will not be propagated to other routers.

Examples

The following example shows how to create a default route for a serial interface. No SNPA need be specified for point-to-point interfaces.

```
decnet route default serial 1
```

The following example shows how to create a default route for an Ethernet interface. The SNPA must be specified for an interface that is not point-to-point.

```
decnet route default ethernet 1 aa00.0400.0104
```

Related Commands

decnet propagate static
decnet route (interface static route)
decnet route default (interface default route)
decnet route default (to enter a default route)
show decnet static

decnet route default (to enter a default route)

Use this form of the **decnet route default** global configuration command to enter a specific default route. The **no** form of this command removes this route.

> **decnet route default** *next-hop-address* [*hops* [*cost*]]
> **no decnet route default** *next-hop-address*

Syntax Description

next-hop-address	This value is used to establish the next hop of the route for forwarding packets.
hops	(Optional) Hop count to be associated with the route being advertised. Default is 0.
cost	(Optional) Cost to be associated with the route being advertised. Default is 0.

Default

No interface default routes are created.

Command Mode

Global configuration

Usage Guidelines

A default route will be used only after DECnet conversion is checked. By default, DECnet static routes will not be propagated to other routers. Use the **decnet propagate static** command to enable propagation.

DECnet packets not for the current area are forwarded to the *next-hop-address*.

Examples

The following example shows how to create a default route for 1.3 which uses default values of 0 for hops and cost:

```
decnet route default 1.3
```

Related Commands

decnet propagate static
decnet route (interface static route)
decnet route (to enter a static route)
decnet route default (interface default route)
show decnet static

decnet routing

To enable DECnet routing, use the **decnet routing** global configuration command. To disable DECnet routing, use the **no** form of this command.

> **decnet** [*network-number*] **routing** [**iv-prime**] *decnet-address*
> **no decnet routing**

Syntax Description

network-number	(Optional) Network number in the range 0 through 3. Specified when using Address Translation Gateway (ATG). If not specified, the default is network 0.
iv-prime	(Optional) Enables DECnet Phase IV Prime routing.
decnet-address	Address in DECnet format X.Y, where X is the area number and Y is the node number.

Default
Disabled

Command Mode
Global configuration

Usage Guidelines
Enabling DECnet changes the MAC addresses of the router's interfaces. This is not a problem on routers equipped with nonvolatile memory. On systems that attempt to get their IP network addresses from network servers rather than from nonvolatile memory, there may be a problem as with the hardware addresses changing and confusing other IP-speaking hosts. This potential problem can be avoided by configuring and enabling DECnet before enabling other protocols.

Note   You can configure up to four DECnet networks (numbered 0 through 3). To set up multiple DECnet networks, use the **decnet** global configuration commands with the appropriate network number and keywords. If the network number is omitted from the commands, network 0 will be configured for DECnet routing.

DECnet Phase IV Prime eliminates the DEC addressing restrictions so that DECnet nodes can coexist with systems running other protocols that have other MAC address restrictions. If **iv-prime** is not specified, only Phase IV will be enabled; configuring the MAC address will then make DECnet inoperable. The standard "AA-00-04-00" form will be set as the address of the interface on which DECnet is enabled. If Phase IV Prime was already running and this command is reissued without the **iv-prime** keyword (that is, going from Phase IV Prime to Phase IV), the command will return an error if any of the interfaces that have DECnet enabled have MAC addresses that are not compliant with DECnet Phase IV, requiring the user to evaluate conflicting interface commands.

The **no** form of this command will disable Phase IV and Phase IV Prime routing.

Example

In the following example, DECnet routing is enabled for the router in area 21 with node number 456:

```
decnet routing 21.456
```

Related Commands

decnet cost
decnet node-type

decnet routing-timer

To specify how often the router sends routing updates that list the hosts that the router can reach, use the **decnet routing-timer** interface configuration command. Use the **no** form of this command to disable the routing update timer.

> **decnet routing-timer** *seconds*
> **no decnet routing-timer**

Syntax Description

seconds	Time, in seconds, from 1 through 65535. The default is 40 seconds.

Default

40 seconds

Command Mode

Interface configuration

Usage Guidelines

Other routers use this information to construct local routing tables. In a network where changes occur infrequently or do not need to be responded to immediately (it is small and uncomplicated, applications are not particularly sensitive to delays or occasional packet loss, slow serial links, and so on), increasing the time between routing updates reduces the amount of unnecessary network traffic. Digital calls this argument the *broadcast routing timer* because they use a different timer for serial lines; our DECnet implementation does not make this distinction.

Example

In the following example, a serial interface is set to broadcast routing updates every 2 minutes (120 seconds):

```
interface serial 0
decnet routing-timer 120
```

lat host-delay

To set the delayed acknowledgment for incoming LAT slave connections, use the **lat host-delay** global configuration command. To restore the default, use the **no** form of this command.

    lat host-delay *number*
    no host-delay

Syntax Description

number	Delay in milliseconds.

Default

Disabled

Command Mode

Global configuration

Example

The following example sets the acknowledgment for incoming LAT slave connections to 100 milliseconds:

```
lat host-delay 100
```

lat service autocommand

To associate a command with a service, use the **lat service autocommand** global configuration command. To remove the specified autocommand, use the **no** form of this command.

lat service *service-name* **autocommand** *command*
no lat service *service-name* **autocommand** *command*

Syntax Description

service-name	Name of the service.
command	Command to be associated with the service.

Default

No commands are automatically associated with a service.

Command Mode

Global configuration

Usage Guidelines

When an inbound connection is received for the specified service, the command associated with the service is automatically executed instead of the user receiving a virtual terminal session.

Authentication is bypassed for these services; only the LAT password is checked.

Note Do not use this option with the **rotary** keyword.

Example

The following example associates the command **telnet readings** to the service *readings*:

```
lat service readings autocommand telnet readings
```

ping (privileged)

Use the DECnet **ping** privileged EXEC command to send DECnet echo packets to test the reachability of a remote host over a DECnet network.

ping

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Usage Guidelines

To abort a ping session, type the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key).

Table 17-3 describes the test characters that the ping facility sends.

Table 17-3   Ping Test Characters

Character	Description
!	Each exclamation point indicates receipt of a reply.
.	Each period indicates the network server timed out while waiting for a reply.
U	A destination unreachable error PDU was received.
C	A congestion-experienced packet was received.
I	User interrupted test.
?	Unknown packet type.
&	Packet lifetime exceeded.

Sample DECnet Display Using a DECnet Address

The following display shows a sample DECnet **ping** session that uses a DECnet address to specify the source:

```
router# ping
Protocol [ip]: decnet
Target DECnet address: 2.16
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Type escape sequence to abort.
Sending 5, 100-byte DECnet Echos to 2.16,
timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/4/8 ms
```

Table 17-4 describes the fields shown in the display.

Table 17-4   Ping Field Descriptions

Field	Description
Protocol [ip]:	Default is IP.
Target DECnet address:	Prompts for the DECnet address of the destination node you plan to ping.
Repeat count [5]:	Number of ping packets that will be sent to the destination address. Default: 5.
Datagram size [100]:	Size of the ping packet (in bytes). Default: 100 bytes.
Timeout in seconds [2]:	Timeout interval (in seconds). Default: 2 seconds.

Related Command

ping (user)

ping (user)

Use the DECnet **ping** user EXEC command to send DECnet echo packets to test the reachability of a remote host over a DECnet network.

ping decnet {*host* | *address*}

Syntax Description

decnet	DECnet protocol keyword.
host	DECnet host of system to ping.
address	DECnet address of system to ping.

Command Mode
EXEC

Usage Guidelines

The **ping** Exec command provides a basic user ping facility for DECnet users who do not have system privileges. This feature allows the router to perform the simple default ping functionality for the DECnet protocol. Only the nonverbose form of the **ping** command is supported for user-level pings.

To abort a ping session, type the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key).

Table 17-5 describes the test characters that the ping facility sends.

Table 17-5   Ping Test Characters

Character	Description
!	Each exclamation point indicates receipt of a reply.
.	Each period indicates the network server timed out while waiting for a reply.
U	A destination unreachable error PDU was received.
C	A congestion-experienced packet was received.
I	User interrupted test.
?	Unknown packet type.
&	Packet lifetime exceeded.

Sample DECnet Display Using a DECnet Address

The following display shows sample ping output when you ping the DECnet address of 2.16:

```
router> ping decnet 2.16
Sending 5, 100-byte DECnet Echos to 2.16,
timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/4/8 ms
```

Related Command
ping (privileged)

show decnet

Use the **show decnet** privileged EXEC command to display the global DECnet parameters.

> **show decnet**

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Sample Display

The following is sample output from the **show decnet** command:

```
router# show decnet

Global DECnet parameters for network 0:
    Local address is 19.15, node type is area (Phase-IV Prime)
    Level-2 'Attached' flag is FALSE,  nearest level-2 router is 19.5
    Maximum node is 350, maximum area is 63, maximum visits is 63
    Maximum paths is 1, path split mode is normal
    Local maximum cost is 1022, maximum hops is 30
    Area maximum cost is 1022, maximum hops is 30
    Static routes *NOT* being sent in routing updates
    Default route configured; next hop address of 2.100
```

Table 17-6 describes significant fields shown in the display.

Table 17-6   Show DECnet Field Descriptions

Field	Description
Global DECnet parameters for network 0:	Indicates the DECnet network number of the network being described.
Local address is 19.15	DECnet address of the router.
node type is area	Indicates the DECnet node type with which the interface has been configured. Possible values include area (area router) or routing-iv (intra-area router).
Level-2 'Attached' flag is FALSE	(DECnet Level-2 routers only) Indicates that this Level-2 router is not "attached" (does not have reachability to other DECnet Phase IV areas). If the 'Attached' flag is TRUE, the router has reachability to other areas.
	If the 'Attached' flag is FALSE, other displays on this line are the following:
	• Nearest Level-2 router is NONE—(DECnet Level-1 routers only) Indicates that this Level-1 router has not heard from any eligible Level-2 router (to send out-of-area packets to)
	• Nearest Level-2 router is 1.200—(DECnet Level-1 routers only) Indicates that this router's nearest Level-2 router is 1.200. Any packets received by this router destined for other areas will be sent to 1.200.

Field	Description
(Phase-IV Prime)	Indicates that the router is running DECnet Phase IV Prime routing.
Maximum node is 350	Highest node number that the router will recognize.
maximum area is 63	Indicates the maximum DECnet area number, which is used to control the size of internal routing tables and messages sent to other routers. Range: 1 through 63. Default: 63.
maximum visits is 63	Indicates the maximum number of times (visits) a packet can pass through a router. Range: 1 through 63. Default: 63.
Maximum paths is 1	Indicates the maximum number of equal-cost paths the router will save. Range: 1 through 31. Default: 1.
path split mode is normal	Indicates how the router will split the routable packets among equal-cost paths. Possible values: normal (default) or interim.
Local maximum cost is 1022	For intra-area routes. Router ignores routes in its area that have a cost greater than this value.
maximum hops is 30	Indicates the maximum number of hops for a usable route within the local area. The router ignores routes within the local area that use more than this number of hops.
Area maximum cost is 1022	Indicates the maximum cost specification for interarea routing. The router ignores routes to other areas that have a cost greater than this value. Range: 1 through 1022: Default: 1022.
maximum hops is 30	Indicates the maximum number of hops for a usable route to other areas. The router ignores routes to other areas that use more than this number of hops.
Static routes *NOT* being sent in routing updates	Indicates static routes are not included in routing updates.
Default route configured; next hop address of 2.100	Indicates a default route is configured on this router and shows the next hop address.

show decnet interface

Use the **show decnet interface** EXEC command to display the global DECnet status and configuration for all interfaces, or the status and configuration for a specified interface.

> **show decnet interface** [*type number*]

Syntax Description

type	(Optional) Interface type.
number	(Optional) Interface number.

Command Mode

EXEC

Sample Display

The following is sample output from the **show decnet interface** command:

```
router# show decnet interface

Global DECnet parameters for network 0:
  Local address is 19.15, node type is area
  Maximum node is 350, maximum area is 63, maximum visits is 63
  Maximum paths is 1, path split mode is normal
  Local maximum cost is 1022, maximum hops is 30
  Area maximum cost is 1022, maximum hops is 30
Ethernet 1 is up, line protocol is up, encapsulation is ARPA
  Interface cost is 4, priority is 64, DECnet network: 0
  The designated router is 1.9
  Sending HELLOs every 15 seconds, routing updates 40 seconds
  Smallest router blocksize seen is 1498 bytes
  Routing input list is not set, output list is not set
  Access list is not set
  DECnet fast switching is enabled
  Number of L1 router adjacencies is : 3
  Number of non-PhaseIV+ router adjacencies is : 3
  Number of PhaseIV+ router adjacencies is : 0
  Router is bilingual
```

Table 17-7 describes significant fields shown in the display.

Table 17-7   Show DECnet Interface Field Descriptions when an Interface Is Not Specified

Field	Description
Global DECnet parameters for network 0:	Indicates the DECnet network number of the network being described.
Local address is 19.15	DECnet address of the router.
node type is area	Indicates the DECnet node type with which the interface has been configured. Possible values include area (area router) or routing-iv (intra-area router).
Maximum node is 350	Highest node number that the router will recognize.

Field	Description
maximum area is 63	Indicates the maximum DECnet area number, which is used to control the size of internal routing tables and messages sent to other routers. Range: 1 through 63. Default: 63.
maximum visits is 63	Indicates the maximum number of times (visits) a packet can pass through a router. Range: 1 through 63. Default: 63.
Maximum paths is 1	Indicates the maximum number of equal-cost paths the router will save. Range: 1 through 31. Default: 1.
path split mode is normal	Indicates how the router will split the routable packets among equal-cost paths. Possible values: normal (default) or interim.
Local maximum cost is 1022	For intra-area routes. Router ignores routes in its area that have a cost greater than this value.
maximum hops is 30	Indicates the maximum number of hops for a usable route within the local area. The router ignores routes within the local area that use more than this number of hops.
Area maximum cost is 1022	Indicates the maximum cost specification for interarea routing. The router ignores routes to other areas that have a cost greater than this value. Range: 1 through 1022: Default: 1022.
maximum hops is 30	Indicates the maximum number of hops for a usable route to other areas. The router ignores routes to other areas that use more than this number of hops.
Ethernet 0 is up	Indicates whether the interface hardware is currently active and if it has been taken down by an administrator.
line protocol is up	Indicates whether the software processes that handle the line protocol believe the interface is usable (that is, whether keepalives are successful).
encapsulation is ARPA	Indicates the encapsulation type.
Interface cost is 4	Indicates the cost that has been assigned to this interface using the **decnet cost** interface configuration command. If there are multiple paths to a destination, the one with the lowest cost is selected.
priority is 64	Indicates the priority that has been assigned to this router on this interface. End systems will select the router with the highest priority as their designated router.
DECnet network: 0	Indicates that this interface is on DECnet network 0. This fact is significant only if Address Translation Gateway (ATG) is turned on.
The designated router is 1.3	Indicates the designated router on this particular LAN.
Sending HELLOs every 15 seconds	Indicates the frequency of hello packets.
routing updates 40 seconds	Indicates the frequency of routing updates.
Smallest router blocksize seen is 1498 bytes	Indicates the largest size of packets being sent on all routers on the LAN.
Routing input list is not set, output list is not set	Indicates that no access restrictions on incoming (or outgoing) router update or hello messages have been set for this interface.
Access list is not set	Indicates that no access lists have been configured for the interface.
DECnet fast switching is enabled	Indicates that fast switching is enabled.
Number of L1 router adjacencies is : 1	Indicates how many Level 1 adjacencies the router has on this interface.

Field	Description
Number of non-PhaseIV+ router adjacencies is : 3	Number of L1 and L2 routers on this interface that are not running Phase IV+.
Number of PhaseIV+ router adjacencies is : 0	Number of L2 routers on this interface that are running Phase IV+.
Router is bilingual	The router's MAC address on this interface is Phase IV-compatible (that is, it takes the form AA-00-04-00-xx-yy or 55-00-20-00-aa-bb on interfaces where the address is bit swapped). This means that the router will behave as both a Phase IV and a Phase IV Prime router.

Sample Display

The following is sample output from the **show decnet interface** command when you specify an interface:

```
router# show decnet interface ethernet 0

Ethernet0 is up, line protocol is up, encapsulation is ARPA
  Interface cost is 4, priority is 64, DECnet network: 0
  The designated router is 1.3
  Sending HELLOs every 15 seconds, routing updates 40 seconds
  Smallest router blocksize seen is 1498 bytes
  Routing input list is not set, output list is not set
  Access list is not set
  DECnet fast switching is enabled
  Number of L1 router adjacencies is : 1
  Number of non-PhaseIV+ router adjacencies is : 3
  Number of PhaseIV+ router adjacencies is : 0
  Router is bilingual
```

Table 17-8 describes significant fields shown in the display.

Table 17-8   Show DECnet Interface Field Descriptions when an Interface Is Specified

Field	Description
Ethernet 0 is up	Indicates whether the interface hardware is currently active and if it has been taken down by an administrator.
line protocol is up	Indicates whether the software processes that handle the line protocol believe the interface is usable (that is, whether keepalives are successful).
encapsulation is ARPA	Indicates the encapsulation type.
Interface cost is 4	Indicates the cost that has been assigned to this interface using the **decnet cost** interface configuration command. If there are multiple paths to a destination, the one with the lowest cost is selected.
priority is 64	Indicates the priority that has been assigned to this router on this interface. End systems will select the router with the highest priority as their designated router.
DECnet network: 0	Indicates that this interface is on DECnet network 0. This fact is significant only if Address Translation Gateway (ATG) is turned on.
The designated router is 1.3	Indicates the designated router on this particular LAN.
Sending HELLOs every 15 seconds	Indicates the frequency of hello packets.
routing updates 40 seconds	Indicates the frequency of routing updates.

Field	Description
Smallest router blocksize seen is 1498 bytes	Indicates the largest size of packets being sent on all routers on the LAN.
Routing input list is not set, output list is not set	Indicates that no access restrictions on incoming (or outgoing) router update or hello messages have been set for this interface.
Access list is not set	Indicates that no access lists have been configured for the interface.
DECnet fast switching is enabled	Indicates that fast switching is enabled.
Number of L1 router adjacencies is : 1	Indicates how many Level 1 adjacencies the router has on this interface.
Number of non-PhaseIV+ router adjacencies is : 3	Number of L1 and L2 routers on this interface that are not running Phase IV+.
Number of PhaseIV+ router adjacencies is : 0	Number of L2 routers on this interface that are running Phase IV+.
Router is bilingual	The router's MAC address on this interface is Phase IV-compatible (that is, it takes the form AA-00-04-00-xx-yy or 55-00-20-00-aa-bb on interfaces where the address is bit swapped). This means that the router will behave as both a Phase IV and a Phase IV Prime router.

show decnet map

Use the **show decnet map** EXEC command to display the address mapping information used by the DECnet Address Translation Gateway.

> **show decnet map**

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show decnet map** command:

```
router# show decnet map

Net Node   -> Net Node   Uses    Cost Hops
   0 1.100      1 2.100   0
```

Table 17-9 describes significant fields shown in the display.

Table 17-9   Show DECnet Map Field Descriptions

Field	Description
Net Node - Net Node	Network number and node address.
Uses	Number of times this map was used.
Cost	Cost associated with the route.
Hop	Number of hops to destination mode.

show decnet neighbors

Use the **show decnet neighbors** privileged EXEC command to display all Phase IV and Phase IV Prime adjacencies and the MAC address associated with each neighbor.

show decnet neighbors

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Sample Display

The following is sample output from the **show decnet neighbors** command:

```
router# show decnet neighbors

Net Node     Interface    MAC address      Flags
0   3.11     Ethernet0    aa00.0400.0b0c   A
0   1.1      Ethernet0    aa00.0400.0104   V
0   1.3      Ethernet1    aa00.0400.0304   V
0   1.6      Ethernet1    aa00.0400.0604   V
0   2.2      TokenRing    5500.2000.4020   V IV-PRIME
```

Table 17-10 describes the fields shown in the display.

Table 17-10   Show DECnet Neighbors Field Descriptions

Field	Description
Net	Number of the DECnet network this adjacency is in.
Node	DECnet address of the adjacency.
Interface	Interface over which this adjacency was heard.
MAC address	MAC address that this adjacency is using on this interface.
Flags	A: L2 adjacency. V: L1 adjacency. IV-PRIME: DECnet Phase IV Prime adjacency.

show decnet route

Use the **show decnet route** EXEC command to display the DECnet routing table.

show decnet route [*decnet-address*]

Syntax Description

decnet-address	(Optional) DECnet address and, when specified, the first hop route to that address is displayed.

Command Mode

EXEC

Sample Display

The following is sample output from the **show decnet route** command when a DECnet address name was not specified, so the entire routing table is displayed:

```
router# show decnet route

   Area        Cost   Hops   Next Hop to Node       Expires   Prio

    1            4      1     Ethernet1 -> 1.300        26       64      A
   *1            4      1     Ethernet1 -> 1.400        37       64      A
   *2            8      2     Ethernet1 -> 1.400
   *5            0      0        (Local) -> 5.5
  *10            4      1     Ethernet2 -> 10.1         36       64      A
  *13           11      3     Ethernet1 -> 1.400
  *44           22      6     Ethernet1 -> 1.400
  *51           18      4     Ethernet1 -> 1.400
  *61            1      1         (OSI) -> 5.5
  *62            1      1         (OSI) -> 5.5
   *3            0      0     (STATIC)   Ethernet0, snpa aa00.0400.0404
   *4            0      0     (STATIC)      Serial0
   *6            5      4     (STATIC)  forwarding to 2.3

   Node        Cost   Hops   Next Hop to Node       Expires   Prio

  *(Area)       0      0        (Local) -> 5.5
  *5.5          0      0        (Local) -> 5.5            32       64      A+

  *DEFAULT* :   0      0      using next hop address of 2.100
```

As the display shows, the **show decnet route** command can display more than one route for a destination when equal-cost paths have been set with the **decnet max-paths** global configuration command, and when there is more than one equal-cost path to a destination. The display also shows that this node is an area router.

Table 17-11 describes significant fields shown in the display.

Table 17-11 Show DECnet Route Field Descriptions

Field	Description
*	Currently selected route for a particular destination. In interim mode, the selected route will never appear to change.
Node	DECnet address of this (reachable) destination.
(Area)	All Level 1 routes are displayed in this section except for this the first entry, which points to the nearest Level 2 router.
Cost	Assigned cost for the interface, based on a recommended value for the underlying media. Range: 1 through 63. No default.
Hops	Number of hops to this node from the router being monitored.
Next Hop to Node	DECnet address of the next hop a packet will take to get to the final destination as well as the interface.
(Local)	The address that the router is configured with.
(OSI)	Indicates that this entry was created by the **decnet advertise** command.
(STATIC)	Indicates that this entry was created by the **decnet route** command.
Expires	Displays how many seconds from now this entry expires.
Prio	Router priority of this node.
V	Adjacent Level 1 router.
A+	Adjacent Level 2 (area) router; A indicates that this is an adjacency created from a Phase IV hello, A+ indicates that thisis an adjacency created from a Phase IV+ hello.

show decnet static

Use the **show decnet static** privileged EXEC command to display all statically configured DECnet routes.

show decnet static

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Usage Guidelines

All static rotues are stored in a static route queue, which allows static routes to be reinstated when DECnet routing is turned off then on again.

Not all routes in the static route queue will show up in the routing table. This will happen under the following conditions:

- The router is a Level 1 router and any of the following apply. Assume the router DECnet address is 1.1:

    — A Level 2 area static route is configured.

    ```
    decnet route 2.0 1.2
    ```

    — A static route is configured not in the same area as the router.

    ```
    decnet route 3.10 1.200
    ```

    — A static route is configured for the same address as the router.

    ```
    decnet route 1.1 1.200
    ```

- The router is a Level 2 router and any of the following apply. Assume the router DECnet address is 2.1:

    — A Level 1 static router is not in the same area as the router.

    ```
    decnet route 4.1 10.200
    ```

    Note that the following route will appear because a Level 2 route is installed to area 4:

    ```
    decnet route 4.0 10.200
    ```

    — A Level 2 static route is configured for the router's own area.

    ```
    decnet route 2.0 10.200
    ```

    — A static route is configured for the same address as the router.

    ```
    decnet route 2.1 5.4 s 1
    ```

Sample Display

The following is sample output from the **show decnet static** command:

```
router# show decnet static

Address      Cost   Hops   Next hop        SNPA

3            0      0      Ethernet0  aa00.0400.0404
5            0      0        Serial0
5.100        0      0        Serial2
DEFAULT      0      0         2.100
6            5      4         2.3
```

Note that this router is a Level 2 router with DECnet address of 1.2, so a static route configured for 5.100 is not relevant here. This route appears in the **show decnet static** display, but not in the routing table.

show decnet traffic

The **show decnet traffic** EXEC command shows the DECnet traffic statistics, including datagrams sent, received, and forwarded.

> **show decnet traffic**

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show decnet traffic** command:

```
router# show decnet traffic

Total: 42 received, 0 format errors, 0 unimplemented
0 not a gateway, 0 no memory, 0 no routing vector
0 congestion encountered
Hellos: 21 received, 0 bad, 0 other area, 16 sent
Level 1 routing: 14 received, 0 bad, 0 other area, 16 sent
Level 2 routing: 7 received, 0 not primary router, 8 sent
Data: 0 received, 0 not long format, 0 too many visits
0 forwarded, 0 returned, 0 converted, 0 local destination
0 access control failed, 0 no route, 0 encapsulation failed
0 inactive network, 0 incomplete map
```

Table 17-12 describes the fields shown in the display.

Table 17-12   Show DECnet Traffic Field Descriptions

Field	Description
Total:	Displays the totals of packet types received.
received	Total of all types of DECnet packets received.
format errors	Lists the number of packets that appeared to be DECnet, but were formatted incorrectly. The number in the received field includes these packets.
0 unimplemented	Reports the number of incoming packets that are DECnet control packets, and how many specify a service that the router does not implement. This includes services implemented to forward Level 1 and Level 2 routing information, and router and end-system hello packets.
0 not a gateway	Reports the total number of packets received while not routing DECnet.
0 no memory	Records transaction attempts when the system has run out of memory.
0 no routing vector	Indicates that either a routing update came in from another router when the router did not have an adjacency for it, or it had no routing vector for the type of routing update. Use the **debug decnet-routing** EXEC command for more information.
0 congestion encountered	Number of times the underlying physical layer detected congestion.
HELLOs:	Displays the number of hello messages received and sent.

Field	Description
received	Displays the total number of hello messages received. All protocol types are included.
bad	Displays the total number of "bad" hello messages received. Invoke the EXEC command **debug decnet** to display more information about why the hello message was judged as bad.
other area	Displays the total number of hello messages received from nodes on other areas when the router is a Level 1 router only.
sent	Displays the total number of hello messages sent.
Level 1 routing:	Displays the Level 1 routing updates received and sent.
received	Displays the total number of Level 1 routing updates received.
bad	Displays the total number of Level 1 updates received that were judged to be bad.
other area	Displays the total number of Level 1 updates from nodes in other areas.
sent	Displays the total number of Level 1 updates sent.
Level 2 routing:	Displays the Level 2 routing updates received and sent.
received	Displays the total number of Level 2 updates received.
not primary router	Should always be zero.
sent	Displays the total number of Level 2 updates sent.
Data:	Displays the number of data packets received and sent.
received	Displays the total number of noncontrol (data) packets received.
not long format	Displays the number of packets received which are not in the long DECnet format. This number should always be zero. If it is not, investigate the source of the improperly formatted packets.
too many visits	Lists the number of packets received which have visited too many routers and have been flushed.
forwarded	Lists the total number of packets forwarded.
returned	Lists the total number of packets returned to the sender at the senders' request.
converted	Displays the number of Phase IV packets converted to Phase V packets.
local destination	Packets received that are destined for this router.
access control failed	Lists the packets dropped because access control required it.
no route	Lists the total packets dropped because the router did not know where to forward them.
encapsulation failed	Lists the number of packets that could not be encapsulated. This usually happens where there are entries missing in a map for a public data network, such as X.25 or Frame Relay. This can also occur if an interface is set for an encapsulation for which there is no defined DECnet encapsulation (such as PPP on serial interfaces).
inactive network	Displays the number of packets that appear to come from a known interface, or that ATG returned because they did not make sense.
incomplete map	Counts the number of packets that failed address translation. This usually means a node that is not in the ATG map is trying to access a node in another network advertised by the ATG.