

EIGRP

Metric Formula

$$256 * (K_1 * \text{bw} + \frac{K_2 * \text{bw}}{256 - \text{load}} + K_3 * \text{delay}) * \frac{K_5}{\text{rel} + K_4}$$

bw

= 10⁷ / minimum path bandwidth in kbps

delay

= interface delay in µsecs / 10

Packet Types

1 Update	K ₁ 1
3 Query	K ₂ 0
4 Reply	K ₃ 1
5 Hello	K ₄ 0
8 Acknowledge	K ₅ 0

Terminology

Reported Distance

The metric for a route advertised by a neighbor

Feasible Distance

The distance advertised by a neighbor plus the cost to get to that neighbor

Stuck In Active (SIA)

The condition when a route becomes unreachable and not all queries for it are answered; adjacencies with unresponsive neighbors are reset

Passive Interface

An interface which does not participate in EIGRP but whose network is advertised

Stub Router

A router which advertises only a subset of routes, and is omitted from the route query process

Default Timers

LAN (>T1)	WAN (<=T1)
Hello 5 sec	60 sec
Hold 15 sec	180 sec

Troubleshooting

```
show ip[v6] eigrp {interfaces | neighbors}
```

```
show ip[v6] eigrp topology
```

```
clear ip[v6] eigrp [AS-number] neighbors
```

```
debug ip[v6] eigrp [neighbor]
```

EIGRP Configuration

! Enable EIGRP for an autonomous system

ip[v6] router eigrp *AS-number*

! Specify a router ID formatted in IPv4 dotted-decimal

[eigrp] router-id *router-ID*

! Disable automatic classfull summarization (IPv4 only)

no auto-summary

! Enable EIGRP on interfaces by network (IPv4 only)

network *IPv4-address wildcard-mask*

! Modify maximum paths for equal-cost load balancing

maximum-paths *1-16*

! Configure multiplier for unequal-cost load balancing

variance *1-128*

! Configure K values to manipulate the metric formula

metric weights 0 *k1 k2 k3 k4 k5*

! Explicitly identify neighbors on NBMA links

neighbor *IP-address interface*

! Designate passive interfaces

passive-interface {*interface* | default}

! Enable stub routing

[eigrp] stub [receive-only | connected | static | summary | redistribute]

interface *type number*

! Enable EIGRP for IPv6 on the interface

ip[v6] eigrp *AS-number*

! Set the maximum bandwidth EIGRP can consume (can be >100%)

ip[v6] bandwidth-percent eigrp *AS-number 1-999999*

! Configure manual summarization of outbound routes

ip summary-address eigrp *AS-number IPv4-address subnet-mask [AD]*

ip[v6] summary-address eigrp *AS-number IPv6-prefix [AD]*

! Enable MD5 authentication

ip[v6] authentication mode eigrp *AS-number* md5

ip[v6] authentication key-chain eigrp *AS-number key-chain*

! Modify interface hello and hold timers

ip[v6] hello-interval eigrp *AS-number seconds*

ip[v6] hold-time eigrp *AS-number seconds*

! Toggle split horizon

[no] ip[v6] split-horizon eigrp *AS-number*

Global Configuration

Interface Configuration

Integrated IS-IS

NSAP Addressing

NSAP Condensed Example	Interdomain Part		Domain-Specific Part		
	AFI	IDI	HODSP	System ID	SEL
	Area				
	49	0005.80ff.f800.0000	0001	0000.0c00.1234	00

Interdomain Part (IDP)

Portion of the address used in routing between autonomous systems; assigned by ISO

Domain-Specific Part (DSP)

Portion of the address relevant only within the local AS

Authority and Format Identifier (AFI)

Identifies the authority which dictates the format of the address

Initial Domain Identifier (IDI)

An organization belonging to the AFI

High Order DSP (HODSP)

The area within the AS

System ID

Unique router identifier; 48 bits for Cisco devices (often taken from an Ethernet MAC address)

NSAP Selector (SEL)

Identifies a network layer service; always 0x00 in a NET

Network Types

	Broadcast	Point-to-Point
DIS Elected	Yes	No
Neighbor Discovery	Yes	Yes
Hello/Dead Timers	10/30	10/30

Troubleshooting

show [clns isis] neighbors	show isis [database spf-log]
show clns interface	debug [clns isis] [...]
show isis [ipv6] topology	

ISO Routing Levels

Level 0

Used to locate end systems

Level 1

Routing within an area (IS-IS)

Level 2

Routing between areas (IS-IS)

Level 3

Inter-AS routing

Terminology

Type-Length-Value (TLV)

Variable-length modular datasets carried by PDUs

IS-IS Hello (IIH)

Establish and maintain neighbor adjacencies

Link State PDU (LSP)

Carry TLVs encompassing link state information

Sequence Number Packet (SNP)

Used to request and advertise LSPs; can be complete (CSNP) or partial (PSNP)

Network Entity Title (NET)

Unique router ID; includes area ID

Designated Intermediate System (DIS)

A pseudonode responsible for emulating point-to-point links across a multi-access segment

Adjacency Requirements

• Interface MTUs must match

• Levels must match

• Areas must match (if level 1)

• System IDs must be unique

• Authentication must succeed

DIS Election

• Highest-priority interface elected

• Highest SNPA (e.g. MAC or DLCI) breaks tie

• Highest system ID breaks SNPA tie

• Default interface priority is 64

• Current DIS may be preempted, unlike OSPF

	<div> <div>OSPF Configuration</div> <pre> ! Create an OSPF process [ipv6] router ospf process-ID ! Specify a router ID formatted as IPv4 dotted-decimal router-id router-ID ! Modify the default reference bandwidth auto-cost reference-bandwidth speed-in-mbps ! Assign interfaces to areas by network (OSPFv2) network IPv4-address wildcard-mask area area ! Identify neighbors for NBMA links (OSPFv2) neighbor IPv4-address [cost 1-65535] ! Configure summaries on area border routers area area range { IPv4-address subnet-mask IPv6-prefix } ! Summarize external routes (ASBRs only) summary-address IPv4-address subnet-mask [not-advertise] summary-prefix IPv6-prefix [not-advertise] ! Originate a default route default-information originate [always] ! Designate stub, totally stubby, or not-so-stubby areas area area { stub nssa } [no-summary] ! Create a virtual link area area virtual-link router-ID </pre> </div>
<div>Interface Configuration</div>	<div> <div>interface type number</div> <pre> ! Enable OSPF on the interface ip[v6] ospf process-ID area area ! Identify neighbors for NBMA links (OSPFv3) ip[v6] ospf neighbor IPv6-address ! Set interface cost manually ip[v6] ospf cost 1-65535 ! Configure DR election priority ip[v6] ospf priority 0-255 ! Specify network type (broadcast, point-to-point, etc.) ip[v6] ospf network type ! Modify interface hello and dead intervals ip[v6] ospf hello-interval seconds ip[v6] ospf dead-interval seconds ! Enable MD5 authentication (OSPFv2) ip ospf authentication message-digest ip ospf message-digest-key key-id md5 key-string ! Enable IPsec authentication (OSPFv3) ip[v6] ospf auth ipsec spi spi-number { md5 sha1 } string </pre> </div>
	<div> <div>IS-IS Configuration</div> <pre> ! Enable IS-IS routing router isis ! Specify one or more NET addresses net NET ! Set global routing level (default level-1-2) is-type { level-1 level-1-2 level-2-only } ! Configure IPv4 route summaries summary-address IP-address subnet-mask [level] ! Configure IPv6 route summaries address-family ipv6 summary-prefix IPv6-prefix [level] ! Originate a default route default-information originate </pre> </div>
<div>Interface Configuration</div>	<div> <div>interface type number</div> <pre> ! Enable IS-IS on an interface ip[v6] router isis ! Specify interface routing level isis circuit-type { level-1 level-1-2 level-2-only } ! Set interface metric isis [ipv6] metric { 1-16777214 maximum } ! Designate the network as point-to-point isis network point-to-point ! Configure DIS election priority isis priority 0-127 [level-1 level-2] ! Modify interface hello and dead intervals isis hello-interval seconds [level-1 level-2] isis hello-multiplier 3-1000 [level-1 level-2] ! Enable MD5 authentication isis authentication mode md5 isis authentication key-chain key-chain </pre> </div>