Chapter 13
Intermediate System to Intermediate System (IS-IS)

13.1 Overview

IS-IS is a link state interior gateway protocol (IGP), or Intra-Domain Routing Protocol, originally developed for routing International Organization for Standardization/Connectionless Network Protocol (ISO/CLNP) packets. The version distributed with GateD routes IP packets.

In ISO terminology, a router is referred to as an "intermediate system" (IS). IS-IS intra-domain routing is organized hierarchically so that a large domain can be administratively divided into smaller areas. These areas route using Level 1 intermediate systems within areas and Level 2 intermediate systems between areas. Routing between administrative domains is handled by Border Intermediate Systems (BISs) using IDRP, the Inter-Domain Routing Protocol. Level 1 systems route directly to systems within their own area. Level 1 systems route toward a Level 2 intermediate system when the destination system is in a different area. Level 2 intermediate systems route between areas and keep track of the paths to destination areas. Systems in the Level 2 subdomain route toward a destination area or another routing domain.

As with any Internet routing protocol, IS-IS support for large routing domains can also include support for many types of individual subnetworks. These subnetworks can include point-to-point links, multipoint links, and dynamically established data links as in X.25 subnetworks and broadcast subnetworks like ISO 8802 LANs. In IS-IS, all subnetwork types are treated by the subnetwork independent functions as though they were connectionless subnetworks using subnetwork convergence functions where necessary.

Like OSPF, IS-IS uses a "shortest-path first" algorithm to determine routes. A congestion control component monitors and prevents buffer deadlock at each intermediate system. GateD configuration syntax allows as much autoconfiguration as possible, thus reducing the probability of error. GateD configuration syntax also allows a policy to be specified for exchanging routing information with other protocols running in GateD, such as BGP and RIP. The IS-IS protocol supports multipath (load-split) forwarding. IS-IS also supports full injection of exterior network prefixes and attribute information, thus eliminating the need for any internal BGP or similar protocols. IS-IS supports static routing domain information at Level 2 intermediate systems.

The reachable address prefix indicates that any Network Service Access Points (NSAPs) that match the prefix can be reachable via the Subnet Point of Attachment (SNPA) with which the prefix is associated. Where the subnetwork to which this SNPA is connected is a general topology subnetwork supporting dynamically established data links, the prefix also has associated with it the required subnetwork addressing information, or an indication that it can be derived from the destination NSAP address. The address prefixes are handled by the

Level 2 routing algorithm in the same way that information about Level 1 is handled within the domain.

An API for the origination of Traffic Engineering (TE) information is available in this release. For more information on this API (and TE support in GateD), see the IS-IS TE API document. The extended metrics (larger than 63) are originated using the **extended-metrics** keyword, which defaults to off.

The ISIS implementation in GateD requires either access to the physical layer (e.g. Ethernet) or an ISO stack in order to send and receive packets. PDU (Protocol Data Units) in ISIS are sent directly over the physical layer using 802.2 LLC encapsulation. The supported operating systems with ISIS in this release are NetBSD, BSD/OS, and Linux 2.4. These systems allow either access to an AF_ISO socket or direct access to the physical layer through a PF_PACKET socket.

13.2 IS-IS Syntax

```
isis ( on | off ) {
    [ area D.D.D.D | HH.HHHH.HHHH.HHHH.HHHH.HHHH ; ]
    area auth simple key ;
    area auth md5 key key ;
    area auth {
        [ simple key ; ]
        [ md5 key key ; ]
        [ md5 key key {
            [ start-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ start-generate YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-generate YYYY/MM/DD HH:MM [.ss] ; ]
        } ; ]
    } ;
    domain auth simple key ;
    domain auth md5 key key ;
    domain auth {
        [ simple key ; ]
        [ md5 key key ; ]
        [ md5 key key {
            [ start-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ start-generate YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-generate YYYY/MM/DD HH:MM [.ss] ; ]
        } ; ]
```

```
} ;
[ domain-wide ( on | off ) ; ]
[ export-defaults metric-type ( internal | external ); ]
[ export-defaults metric ( metricnum | inherit ); ]
[ export-defaults level ( 1 | 2 ); ]
[ extended-metrics ( on | off ) ; ]
[ rfc1195-metrics ( on | off ) ; ]
[ external preference preferencenum  ; ]
[ hostname "name" ; ]
[ inet ( on | off ) ; ]
[ inet6 ( on | off ) ; ]
[ interface interface_name [ {
    [ ( enable | disable ) ; ]
    auth simple key [ level ( 1 | 2 | 1 and 2 ) ] ;
    auth md5 key key ;
    auth {
        [ simple key ; ]
        [ md5 key key ; ]
        [ md5 key key  {
            [ start-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-accept YYYY/MM/DD HH:MM [.ss] ; ]
            [ start-generate YYYY/MM/DD HH:MM [.ss] ; ]
            [ stop-generate YYYY/MM/DD HH:MM [.ss] ; ]
        }; ]
        [ level ( 1 | 2 | 1 and 2 ) ; ]
    }
    [ csn-interval intervalnum [ level ( 1 | 2 | 1 and 2 ) ] ; ]
    [ dis-hello-interval intervalnum [ level ( 1 | 2 | 1 and 2 ) ]
       ; ]
    [ hello-interval intervalnum [ level ( 1 | 2 | 1 and 2 ) ] ; ]
    [ hello-multiplier multipliernum [ level ( 1 | 2 | 1 and 2 ) ]
       ; ]
    [ lsp-interval msintervalnum ; ]
    [ level ( 1 | 2 | 1 and 2 ) ; ]
    [ max-burst burstnum ; ]
    [ mesh-blocked ; ]
    [ mesh-group meshnum ; ]
    [ metric metricnum [ level ( 1 | 2 | 1 and 2 ) ] ; ]
```

```
            [ passive ( on | off ) ; ]
            [ periodic-csn ( on | off ) ; ]
            [ priority prioritynum [ level ( 1 | 2 | 1 and 2 ) ] ; ]
            [ retransmit-interval intervalnum ; ]
        } ] ; ]
        [ level ( 1 | 2 | 1 and 2 ) ; ]
        [ overload-bit ( on | off ) ; ]
        [ preference preferencenum ; ]
        [ psn-interval intervalnum ; ]
        [ require-snp-auth ( on | off ) ; ]
        [ ribs ( unicast | unicast multicast ) ; ]
        [ spf-interval intervalnum ; ]
        [ summary-originate [ inet ] {
            [ ipv4-network mask  ipv4-netmask metric cost-value ; ]
            [ ipv4-network masklen ipv4-masklen metric cost-value ; ]
        } ; ]
        [ summary-filter [ inet ] {
            [ ipv4-network mask ipv4-netmask ; ]
            [ ipv4-network masklen ipv4-masklen ; ]
        } ; ]
        [ summary-originate inet6 {
            [ ipv6-network mask  ipv6-netmask metric cost-value ; ]
            [ ipv6-network masklen ipv6-masklen metric cost-value ; ]
        } ; ]
        [ summary-filter inet6  {
            [ ipv6-network mask ipv6-netmask ; ]
            [ ipv6-network masklen ipv6-masklen ; ]
        } ; ]
        [ systemid (D.D.D.D | HHHH.HHHH.HHHH) ; ]
        [ traceoptions isis_traceoptions ; ]
```

OSI-specific:

```
        [ config-time seconds ; ]
        [ es-config-time seconds ; ]
        [ hold-time seconds ; ]
    } ;
```

Notes:

- The interface level is restricted by the global level.

- IPv6 related options (**inet6** for example) will fail to parse unless IPv6 is supported in the code base and underlying operating system.
- ISO is the only supported encapsulation type.
- IS-IS extended reachability TLV's may be originated using **extended-metrics on**. This option must be used if metrics larger than 63 are to be configured.

See page 151 of the *Command Reference Guide* for specific information about each command.

13.3 IS-IS Defaults

```
isis off {
    config-time 60;
    es-config-time 60;
    export-defaults metric-type internal;
    export defaults metric inherit;
    export defaults level 2;
    extended-metrics off;
    rfc1195-metrics on;
    external preference 151;
    hold-time 120;
    inet on;
    inet6 off;
    interface all {
        enable;
        csn-interval 10 level 1 and 2;
        dis-hello-interval 3 level 1 and 2;
        hello-interval 10 level 1 and 2;
        hello-multiplier 3 level 1 and 2;
        level 1 and 2;
        lsp-interval 33;
        max-burst 5;
        metric 10 level 1 and 2;
        periodic-csn off;
        priority 64 level 1 and 2;
        retransmit-interval 5;
    };
    level 1 and 2;
    overload-bit off;
    preference 11;
```

```
        psn-interval 2;
        require-snp-auth off;
        ribs unicast;
        spf-interval 2;
        traceoptions none;
    }
```

13.4 IS-IS Sample Configurations

Example 1

Export all static routes into level 2 external reachability.

```
    export proto isis metric-type external level 2 {
        proto static {
            all ;
        } ;
    } ;
```

Example 2

Export all IS-IS external routes into OSPF ASE with metric 2 type 1.

```
    export proto ospfase type 1 metric 2 {
        proto isis external {
            all ;
        } ;
    } ;
```