ISIS Configuration

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Chapter 1 ISIS Configuration

1.1 Overview

ISIS is a routing protocol presented by ISO. It is a link state protocol. In this protocol, IS (router) is in charge of switching the link-cost-based routing information and decides the network topology. ISIS is similar to the OSPF protocol in the TCP/IP network.

The ISO network includes the terminal system, interim system, area and domain. The terminal system means user's devices and the interim system means the routers. The local router group is called as the area and many areas are called as a domain. ISIS is designed to provides routes for an area or a domain. ISIS works together with CLNP, ESIS and IDRP to provide comprehensive routing choice for all the network.

ISIS routing uses the two-layer routing system. The level-1 routers only know their topology the local area, including all routers and hosts, but don't know routers outside of the local area and outside destinations. The level-1 routers forward all flows, which run to other areas, to a L2 router in the local area, which only knows the level-2 topology but not the level-1 topology.

ISIS that is suitable for transmitting the IP network's information is called as the integrated ISIS. The most important character of Integrated IS-IS is that it supports VLSM and fast convergence. Another character of Integrated ISIS is its flexibility and it can support the large networks.

The ISIS routing protocol of our company has the following characters:

- Authentication password

- Multiple instances and many processes

- Related parameter configuration on a routing interface

- Route forwarding--- Forwards the routing information of other routing protocols to the ISIS database.

- Graceful restart

- Routing summary

1.2 ISIS Configuration Task List

The following tasks must be done before you finish ISIS configuration. Among these tasks, the task to activate the ISIS protocol is basic and the most important, while other tasks can be done according to your requirements.

- Activating ISIS

- Setting the level of the ISIS router

- Setting the network type of the ISIS interface

- Setting related parameters on the ISIS interface

- Setting ISIS routing convergence

- Setting ISIS to release the default route

- Setting LSP parameter

- Setting SPF calculation interval

- Setting the LSDB overload label

- Setting ISIS route forwarding

- Setting neighborhood authentication

- Setting area authentication

- Setting domain authentication

- Setting graceful ISIS restart

1.3 ISIS Configuration Tasks

1.3.1 Activating ISIS

To activate ISIS, run the following command in global mode:

Command	Purpose
router isis *<1-65535>*	Activates the ISIS protocol and enter the router configuration mode.
net *XX. .. .XXXX.YYYY.YYYY.YYYY.00*	Sets the title of the ISIS network.
exit	Goes back to the global configuration mode.
interface *interface-name*	Enters the interface configuration mode.
ip router isis *<1-65535>*	Relates the ISIS process on the interface.

1.3.2 Setting the Level of the ISIS Router

ISIS can be used to set the level of a router in routing configuration mode and the level of an interface in interface configuration mode, both of which affects the establishment of ISIS neighbors and the content of the ISIS database.

In general, if there is only one area, it is recommended to set all routers to level-1 or level-2 because it is unnecessary to enable all routers to maintain two completely same LSDBs simultaneously. In the IP network, all routers are recommended to set to level-2, which is good for the following expansion.

When all routers are level-1 or level-2, the links of the interfaces are level-1 or level-2. When all routers are level-1-2, the links of the interfaces are level-1-2. When a router only needs to establish a level-1 or level-2 neighborhood with its peer, the link of an interface should be set to level-1 or level-2 to limit the to-be-established neighborhood on an interface.

Run the following commands to set the level of the routers and interfaces:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
is-type [level-1|level-1-2|level-2-only]	Sets the router type, whose default type is level-1-2.
exit	Returns to the global configuration mode
interface *interface-name*	Enters the interface configuration mode.
isis circuit-type **level-1|level-1-2| level-2-only**	Sets the ISIS interface's type, whose default type is level-1-2.

1.3.3   Setting the Network Type of the ISIS Interface

ISIS only supports two types of networks, which can be categorized according to different physical links:

Broadcast links such as Ethernet and Token ring

Point-to-point links such as PPP and HDLC

As to the Non-Broadcast Multi-Access (NBMA) networks such as ATM, their sub-interfaces need be set and their interface type need be set to point-to-point or broadcast. ISIS cannot be running on the P2MP link.

No matter what physical media type the network is, you can configure your network to be a broadcast network, a non-broadcast network or a multi-access network. So you can set your network flexibly and your network can be set to be a non-broadcast and multi-access one, or a broadcast network such as the X.25, Frame Relay or SMDS network.

If the network type is different, the working mechanism is also different. For example, when a network is a broadcast one, DIS selection is needed and LSDB synchronization is realized through CSNP flooding; when a network is a P2P one, DIS selection is not required and LSDB synchronization is also different.

When two routers are accessing to the same broadcast network, you can set the interface's network type to P2P and ISIS will run according to the P2P network's working mechanism not the working mechanism of the broadcast network, avoiding the DIS selection and CSNP flooding.

In the interface configuration mode, run the following command to set the network type of ISIS.

Command	Purpose
isis network [broadcast|point-to-point]	Sets the network type of the ISIS interface.

1.3.4　Setting Related Parameters on the ISIS Interface

● Setting the metric of the ISIS link

When ISIS uses the SPF algorithm, the metric of the ISIS interface will be used. You can set the metric of the ISIS interface in interface configuration mode by running the following command :

Command	Purpose
isis metric *<1-63>* [level-1|level-2]	Sets the metric of an interface in level-1 or level-2, which is valid to level-1 and level-2. The metric in level-1 or level-2 is 10.

● Setting the transmission interval of the ISIS hello packet

Run the following command to set the hello interval in interface configuration mode. The neighboring routers should have identical parameters. It is to be noted that the interval for DIS to transmitting the Hello packet is just one third of the time that is set by the **isis timer hello** command.

Command	Purpose
isis hello-interval *INTERVAL* [level-1| level-2]	Sets the hello interval in level-1 or level-2, which is valid to level-1 and level-2. The metric in level-1 or level-2 is 10 seconds.

● Setting the multiplier of ISIS hello

When a router has not received the Hello packet from its neighbor in the limitation time, it claims the neighbor is invalid.

Run the following command in interface configuration mode to set the hello multiplier.

Command	Purpose
isis hello-multiplier <3-1000> [level-1| level-2]	Sets the hello multiplier in level-1 or level-2, which is valid to level-1 and level-2. The metric in level-1 or level-2 is 3.

● Setting the transmission interval and retransmission interval of ISIS LSP

When LSDB's content changes, ISIS will send the changed LSP out. Users can adjust the minimum LSP transmission interval.

Run the following commands in interface configuration mode to set the LSP transmission interval and the LSP retransmission interval:

Command	Purpose
isis lsp-interval *<1-4294967295>*	Sets the LSP transmission interval, whose default value is 33 mili-seconds.
isis retransmit-interval *<0-65535>*	Sets the LSP retransmission interval, whose default value is 5 seconds.

● Setting the priority of DIS selection

In the broadcast network, ISIS has to select a router from all routers as DIS. DIS in level-1 and DIS in level-2 are selected respectively. You can set different priorities for different levels of DIS selection. The high the priority is, the more possibly DIS will be selected.

Run the following command in interface configuration mode to set the priority of DIS selection.

Command	Purpose
isis priority *<0-127>* **[level-1|level-2]**	Sets the priority of DIS selection in level-1 or level-2, which is valid to level-1 and level-2. The priority in level-1 or level-2 is 64.

1.3.5 Setting ISIS Routing Convergence

Routing convergence can reduce the scale of the routing table, the size of the LSP packet that is generated by the local router and the scale of LSDB. The converged router can be the route that is discovered by ISIS and also a route that is introduced from the outside.

After routing convergence, the route cost is the minimum cost in all converged route costs. The router only converges the routes that are generated by LSP.

Run the following commands to set ISIS routing convergence:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
summary-address *address* *mask* **[level-1|level-1-2|level-2]**	Converges the routes in the corresponding IP network field.

1.3.6 Setting ISIS to Release the Default Route

As to a router on which ISIS is running, you can set a default route and the router will release the information about the path whose destination is 0.0.0.0/0 through LSP; other routers of the same level will add a new default route in their routing tables.

Run the following commands to set ISIS to release the default route:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
default-information originate	Sets ISIS to release the default route.

1.3.7 Setting LSP Parameters

- Setting the maximum LSP lifetime

Each LSP contains a maximum lifetime. When LSP is in LSDB, each LSP's maximum lifetime will decrease gradually to zero as time goes on. When the maximum LSP lifetime is 0, ISIS will delete this overdue LSP. Users can adjust the maximum LSP lifetime according to the scale of the network.

Run the following commands to set the maximum lifetime of ISIS LSP:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
max-lsp-lifetime *<1-65535>*	Sets the maximum lifetime of ISIS LSP.

● Setting the LSP generation interval and the LSP refreshing interval

Each LSP has its maximum lifetime and will age as time goes by, so each router must refresh its own LSPs regularly to prevent the maximum LSP lifetime from decreasing to 0. Additionally, through regular LSP refreshment LSPs in a whole area will keep synchronized. Users can set the LSP refreshment interval and the high LSP refreshment frequency will fasten the speed of network convergence.

Run the following commands to set the LSP generation interval and the LSP refreshing interval respectively.

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
lsp-refresh-interval *<1-65535>*	Sets the ISIS LSP refreshment interval, whose default value is 900 seconds.
lsp-gen-interval [level-1|level-2] *<1-120>*	Sets the LSP generation interval in level-1 or level-2, which is valid to level-1 and level-2. The default LSP generation interval in level-1 or level-2 is 30 seconds.

● Setting to omit the LSP check-code error

By default, the router will authenticate the received LSP check code; if error happens, the corresponding LSP will be discarded.

Run the following commands to set to omit the LSP check-code errors:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
ignore-lsp-errors	Omits the LSP check-code error.

1.3.8   Setting SPF Calculation Interval

In the ISIS protocol, route calculation need be conducted when LSDB changes. Frequent route calculation will occupy a lot of systematic resources and the systematic performance is hence impaired, while regular SPF calculation helps to improve efficiency. The SPF calculation interval can be set according to users' requirements.

Run the following commands to set the SPF calculation interval:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
spf-interval (level-1|level-2) *<1-120>*	Sets the minimum SPF calculation interval.

1.3.9 Setting ISIS Route Forwarding

ISIS can import routes from other routing protocols and at the same time filter these routes through the routing map.

Run the following commands in routing configuration mode to set route forwarding:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
redistribute *protocol* *[process-id]* *[***route-map** *map-name]* *[* **level-1| level-2** *]*	Forwards related routes from other routing protocols.

1.3.10 Setting Neighborhood Authentication

Run the following command in interface configuration mode to set the neighborhood authentication.

Command	Purpose
isis password *WORD* **[level-1|level-2]**	Sets the password of neighborhood authentication for level-1 and level-2 respectively. The default password is valid to both level-1 and level-2.

1.3.11 Setting Area Authentication

Users can set the area authentication to prevent the routing information, which is learned from the distrustful router, from being added to the local level-1 LSDB. After area authentication, the authentication password will be encapsulated into the level-1 packets such as LSP, CSNP and PSNP according to the designated mode, and the authentication password of the received level-1 packets will be checked.

The routers in the same area must be set to have the same authentication mode and the same authentication password.

Run the following commands to set the area authentication:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
area-password *WORD* **[authenticate snp send-only|validate]**	Sets the level-1 area authentication password.

1.3.12   Setting Domain Authentication

Users can set the domain authentication to prevent the incredible routing information from being added to the current routing domain. After domain authentication, the authentication password will be encapsulated into the level-2 packets such as LSP, CSNP and PSNP according to the designated mode, and the authentication password of the received level-2 packets will be checked.

The routers in the same domain must be set to have the same authentication mode and the same authentication password.

Run the following commands to set the domain authentication:

Command	Purpose
router isis *<1-65535>*	Enters the ISIS routing configuration mode from the global configuration mode.
domain-password *WORD* **[authenticate snp send-only|validate]**	Sets the level-2 domain authentication password.

1.3.13   Monitoring and Maintaining ISIS

The network statistics information which can be displayed includes the content of the IP routing table, caching and database. This kind of information can help users to judge the usage of network resources and solve network problems.

You can run the following commands to display all kinds of routing statistics information:

Command	Purpose
show isis database [detail]	Displays the information about the ISIS link state database.
show isis interface [*IFNAME* **]**	Displays the information about the ISIS interface.
show isis neighbor	Displays the ISIS neighbors and the neighborhood.
show isis route	Displays the ISIS routing table of IPv4.
debug isis ifsm|nsm|events|pdu|lsp|spf	Opens the corresponding ISIS debug switch.

1.4   ISIS Configuration Example

1.4.1   Example of Basic ISIS Configuration

As shown in the following figure, R152 and R154 are two directly-connected routers.
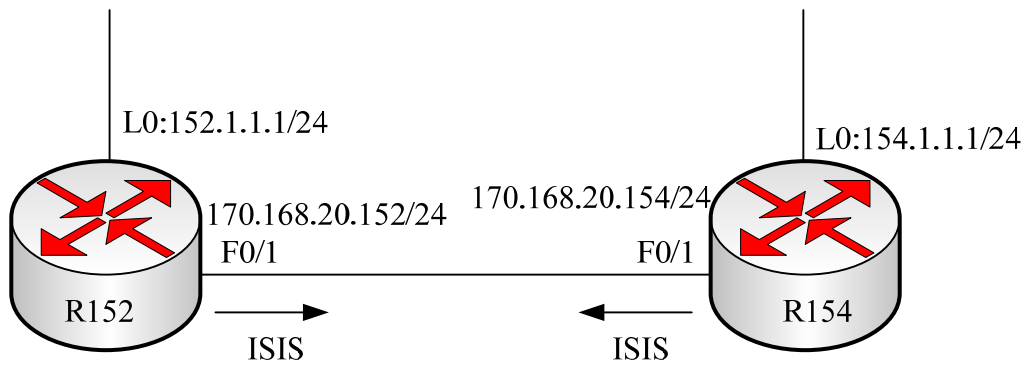
The two routers are taken as a level-1-2 router, and then a basic ISIS configuration is shown below:

R152 configuration:

Hostname R152

!

interface Loopback0

  ip address 152.1.1.1 255.255.255.0

  no ip directed-broadcast

  ip router isis 1

!

interface FastEthernet0/1

  ip address 170.168.20.152 255.255.255.0

  ip router isis 1

  no ip directed-broadcast

  duplex half

!

router isis 1

  net 51.0001.0000.0000.000a.00

R154 configuration:

hostname R154

!

interface Loopback0

  ip address 154.1.1.1 255.255.255.0

  ip router isis 1

   no ip directed-broadcast

!

interface FastEthernet0/1

  ip address 170.168.20.154 255.255.255.0

  ip router isis 1

  no ip directed-broadcast

  duplex half

!

router isis 1

  net 51.0001.0000.0000.000b.00

After configuration users can run the following commands to check the ISIS configuration results.

show isis database [detail]	Displays the information about the ISIS link state database.
show isis interface [*IFNAME* **]**	Displays the information about the ISIS interface.
show isis neighbor	Displays the ISIS neighbors and the neighborhood.
show isis route	Displays the ISIS routing table of IPv4.