

Configuring ISG IPv6 Support

Intelligent Services Gateway (ISG) is a Cisco IOS XE software feature set that provides a structured framework in which edge devices can deliver flexible and scalable services to subscribers. This module describes the IPv6 support available for ISG IP subscriber sessions including information about the Time-Based Billing feature.

- Restrictions for ISG IPv6 Support, on page 1
- Information About ISG IPv6 Support, on page 1
- How to Configure ISG IPv6 Support, on page 4
- Configuration Examples for ISG IPv6 Support, on page 7
- Additional References, on page 10
- Feature Information for ISG IPv6 Support, on page 11

Restrictions for ISG IPv6 Support

- Out-of-band IPv6 sessions are not supported, which means DHCP initiated or RADIUS proxy initiated sessions are not supported for IPv6 sessions.
- Time-based billing is not supported on PPP sessions directly; it is supported through services and flows installed on the PPP session

Information About ISG IPv6 Support

ISG IPv6 Session Support

ISG creates an IPv6 subscriber session based on the first IPv6 packet received from an unclassified IPv6 address or IPv6 prefix, similar to the way subscriber sessions are created for IPv4 packets. The subscriber session is identified by the IPv6 address. Native IP sessions have either an IPv4 or IPv6 address, but not both. A native IPv6 session has an IPv6 address only and all traffic generated from the subscriber uses IPv6.

IPv6 single-stack sessions are supported for ISG subscriber sessions. If a native IP subscriber's host sends traffic for both an IPv4 and IPv6 address, ISG creates a separate IP session for each of these IP addresses. This subscriber will have an IPv4 session and an IPv6 session with no interaction between them. A dual-stack session is a single subscriber session with two distinct IP addresses, one for IPv4 and one for IPv6. Dual-stack native IP sessions are not supported.

Layer 3 unclassified IPv6 sessions for routed subscribers are supported. These sessions are identified by their unique IPv6 IP address or an IPv6 subnet session (IPv6 address and prefix). IPv6 is not supported for Layer 2 connected and DHCP-initiated subscriber sessions.

Session Coexistence on ISG Interfaces

The following session combinations can exist on the same ISG interface in Cisco IOS XE Release 3.5S and later releases:

- Native IPv6 and native IPv4 sessions
- Native IPv6 and PPP IPv4 sessions
- Native IPv6 and PPP IPv6 sessions
- Native IPv6 and PPP dual-stack sessions

ISG Dual-Stack Features

Dual-stack features are protocol independent and work at the session level. These features cannot be configured based on the stack. A single generic configuration is applied to the session regardless of whether it is a single-stack or dual-stack session. The configuration of these features is the same for IPv4 and IPv6.

Because these features are applied at the session level, the same instance of the feature handles both the IPv4 and IPv6 stacks for a dual-stack session, and the behavior is aggregated. For example, the same instance of the accounting feature counts both IPv4 and IPv6 packets. Similarly, the same instance of the idle timeout feature monitors both IPv4 and IPv6 traffic and considers a session to be idle when there is neither type of traffic.

The following features are examples of dual-stack features:

- Absolute Timeout (Session Timer)
- Idle Timeout (Connection Timer)
- ISG Accounting
- ISG Policer (Dynamic Rate Limiting)
- Quality of Service

ISG Protocol-Dependent Features

Protocol-dependent features rely on the underlying protocol. An instance of the feature works only for one of the protocols, either IPv6 or IPv4. For example, the Layer 4 Redirect feature has translation rules that are protocol dependent. An IPv6 packet can be redirected only to an IPv6 destination; an IPv4 packet can be redirected only to an IPv4 destination.

The configuration of protocol-dependent features applies only to the corresponding stack of the session. If a feature must run on both protocols for a dual-stack session, separate configurations must be created and applied on both stacks respectively. These features cannot be configured for an entire session unless it is a single-stack session.

The behavior of protocol-dependent features is limited to a single stack. An instance of the feature runs only on a particular stack and has no functional impact on the other stack, if applicable. If the feature is applied on

both stacks of a dual-stack session, two separate instances are created and run independently. There is no aggregated behavior for these features.

The following features are examples of ISG protocol-dependent features:

- Access Control Lists (ACLs)
- Layer 4 Redirect
- Port-Bundle Host Key
- Traffic Classes

IPv6 Support for ISG Features

The following ISG features are supported for native IPv6 sessions and PPP dual-stack sessions:

Feature	Description	Session Support
Absolute Timeout (Session Timer)	IPv6 functionality and configuration are the same as for IPv4 subscriber sessions. For configuration information, see the "Configuring ISG Policies for Session Maintenance" module in this guide.	• Native IPv4/IPv6 • PPP dual stack
Idle Timeout (Connection Timer)	IPv6 functionality and configuration are the same as for IPv4 subscriber sessions. For configuration information, see the "Configuring ISG Policies for Session Maintenance" module in this guide.	• Native IPv4/IPv6 • PPP dual stack
ISG Accounting	Per-session and per-service accounting can be configured on either an IPv4-only or IPv6-only IP session. Per-flow accounting can be configured on either an IPv4 or IPv6 traffic class. For configuration information, see the "Configuring ISG Accounting" module in this guide.	• Native IPv4/IPv6 • PPP dual stack
ISG Policer (Dynamic Rate Limiting)	IPv6 functionality and configuration are the same as for IPv4 subscriber sessions. For information, see the "Configuring MQC Support for IP Sessions" module in this guide.	• Native IPv4/IPv6 • PPP dual stack
Layer 4 Redirect	IPv6 packets can be redirected only to an IPv6 destination; IPv4 packets can be redirected only to an IPv4 destination. For configuration information, see the "Redirecting Subscriber Traffic Using ISG Layer 4 Redirect" module in this guide.	• Native IPv4/IPv6 • PPP dual stack • Protocol dependent

Feature	Description	Session Support
Modular QoS CLI (MQC)	The following operations are supported for an MQC policy applied to PPP IPv6 sessions and PPP dual-stack sessions: • Add or remove a class • Add, remove, or modify an action under a class • Modify an ACL For configuration information, see the "Configuring MQC Support for IP Sessions" module in this guide.	• Native IPv4 • PPP IPv6 • PPP dual stack
Traffic Classes	The protocol version of a traffic class is determined by the protocol version of the access control list (ACL) that was used to configure the traffic class. IPv6 traffic classes are supported using named IPv6 ACLs. Traffic classes are also supported on PPP sessions. For configuration information, see the "Configuring ISG Subscriber Services" module in this guide.	• Native IPv4/IPv6 • PPP dual stack • Protocol dependent

Time-Based Billing Service

The Time-Based Billing feature calculates the 24-hour volume usage for all subscriber sessions that are active on an L2TP network server (LNS) at a specified time each day. It reports the volume used by a session since the last specified time, in 24-hour intervals. You can configure the router to collect the volume statistics of all active sessions at the same time every day, for example, everyday at midnight. The system would report the volume usage of a session from midnight of the previous day to midnight of the current day.

Time-based billing will also report input and output traffic statistics for IPv6 and IPv4 traffic separately and as an aggregate using new AAA attributes in AAA accounting records.

Changes in local time based on Day Light Savings Time (DST), Network Time Protocol (NTP), or clock changes configured on the router are taken into account when reporting volume statistics at the specified time.

Time-based billing is supported for IPv4, IPv6, and PPP sessions.

How to Configure ISG IPv6 Support

For information on creating IPv6 subscriber sessions for routed ISG subscribers, see the module "Configuring ISG Access for IP Subscriber Sessions."



Note IPv6 sessions for Layer 2 connected subscribers are not supported.

Defining an IPv6 Prefix for ISG Subscriber Sessions

To enable ISG to create an IPv6 subscriber session after receiving the first packet with a particular IPv6 prefix, you define the IPv6 prefix in an IP subscriber list.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip subscriber list** *list-name*
4. **ipv6 prefix default** *length*
5. **exit**
6. **interface** *type number*
7. **ip subscriber routed**
8. **initiator unclassified ip-address** [**ipv6**] [**list** *list-name*]
9. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip subscriber list** *list-name* **Example:** `Router(config)# ip subscriber list mylist`	Specifies the IP subscriber list name and enters server list configuration mode.
Step 4	**ipv6 prefix default** *length* **Example:** `Router(config-server-list)# ipv6 prefix default 64`	Defines the IPv6 prefix for which ISG initiates IPv6 subscriber sessions.
Step 5	**exit** **Example:** `Router(config-server-list)# exit`	Returns to global configuration mode.
Step 6	**interface** *type number* **Example:** `Router(config)# interface GigabitEthernet 2/0/0`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 7	**ip subscriber routed** **Example:** `Router(config-if)# ip subscriber routed`	Specifies that routed IP subscribers are to be hosted on the interface and enters ISG IP subscriber configuration mode.
Step 8	**initiator unclassified ip-address** [**ipv6**] [**list** *list-name*] **Example:** `Router(config-subscriber)# initiator unclassified ip-address ipv6 list mylist`	Enables ISG to create an IPv6 subscriber session after receiving a packet with the IPv6 prefix.
Step 9	**end** **Example:** `Router(config-subscriber)# end`	Returns to privileged EXEC mode.

Configuring Time-Based Billing Service

ISG time-based billing is configured in the service profile on a AAA server. If you include a traffic class in the service profile, time-based billing will apply to the specified flow. If you do not configure a traffic class, time-based billing will apply to the session.

Before you begin

ISG per-session or per-flow accounting must be configured.

SUMMARY STEPS

1. Cisco-AVpair = “PPW*hh*:*mm*:*ss*:*d*”
2. Cisco-AVpair = “ip:traffic-class={in | out} access-group [*acl-number* | name *acl-name*] [priority *n*]”
3. **show subscriber session feature time-based-billing detailed**

DETAILED STEPS

Procedure

Step 1 Cisco-AVpair = “PPW*hh*:*mm*:*ss*:*d*”

Add the Post Paid VSA to the service profile. This attribute specifies the weekly tariff-billing points as follows:

hh:*mm*:*ss*:*d*—Weekly billing time.

- hh = hour of day <0–23>
- mm = minutes <0–59>
- ss = seconds <0–59>
- d = bitmap format for the days of week. Each weekday is represented by one bit, as follows:
  - 00000001 = Monday

- 00000010 = Tuesday
- 00000100 = Wednesday
- 00001000 = Thursday
- 00010000 = Friday
- 00100000 = Saturday
- 01000000 = Sunday

Step 2 Cisco-AVpair = "ip:traffic-class={in | out} access-group [*acl-number* | name *acl-name*] [priority *n*]"

Add the ISG traffic class attribute to the service profile. This attribute specifies the input and output traffic to which the service will apply. Both an input and output traffic classifier can be added to a service profile.

Step 3 **show subscriber session feature time-based-billing detailed**

Enter this command on the ISG router to display information about time-based billing. The following example shows output from this command:

```
Router# show subscriber session feature time-based-billing detailed

-------------------------------------------------
Type: IP, UID: 7, State: authen, Identity: aabb.cc00.6400
Session Up-time: 00:00:08, Last Changed: 00:00:08
Switch-ID: 4102

Time-based-billing:
Class-id   Dir  Last-Tariff  Packets-v4    Bytes-v4    Packets-v6 Bytes-v6  Source
0          In   1291415061   4             400         2          200       Peruser
1          Out  1291415061   3             200         1          100       Peruser
```

Configuration Examples for ISG IPv6 Support

Example: IPv6 Prefix for ISG Subscriber Sessions

The following example shows an IPv6 prefix defined in the IP subscriber list named mylist, which has been assigned to Gigabit Ethernet port 0/0/0. ISG will create an IPv6 subscriber session when it receives the first packet with the default IPv6 prefix.

```
ip subscriber list mylist
  ipv6 prefix default 64

interface GigabitEthernet0/0/0
 ip vrf forwarding vrf-1
 ip address 10.1.1.1 255.255.255.0
 ip access-group 101 out
 ip virtual-reassembly
 zone-member security private
 media-type sfp
 negotiation auto
 ipv6 address 2001:DB8:1:1::26/64
 ip subscriber routed
  initiator unclassified ip-address ipv6 list mylist
```

Example: Time-Based Billing Service

The following example shows an IPv6 session configured for doing billing daily at midnight:

```
PPW00:00:00:127
```

Day 1—A native IPv6 session starts at 10 a.m.

Day 1 at tariff-switch point (12 a.m.)—A snapshot of the current volume used from 10 a.m. is recorded, for example:

```
IPv6-input-bytes = 10000
IPv6-input-packets = 100
IPv6-output-bytes = 20000
IPv6-output-packets= 200
```

Day 2 say at 12:10 a.m.—Interim record is sent. The Interim record will carry the following values in the VSAs:

```
Tariff-Input-Packets = 100          Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 10000         Aggregate Input IPv4 and IPv6 Bytes
Tariff-Input-Packets-IPv6 = 100
Tariff-Input-Octets-IPv6 = 10000
Tariff-Output-Packets = 200         Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 20000        Aggregate Output IPv4 and IPv6 Bytes
Tariff-Output-Packets-IPv6 = 200
Tariff-Output-Octets-IPv6 = 200
```

Day 2—All Interim records sent thereafter until the next tariff-switch point will carry the above values.

Day 2 at tariff-switch point (12 a.m.)—A snapshot of the volume used from Day 1 at 12 a.m. to Day 2 at 12 a.m. is recorded, for example:

```
IPv6-input-bytes = 600000
IPv6-input-packets = 6000
IPv6-output-bytes = 20000
IPv6-output-packets= 200
```

Day 3 say at 12:20 a.m.—Interim record is sent. The Interim record will carry the following values in the VSAs:

```
Tariff-Input-Packets = 6000         Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 600000        Aggregate Input IPv4 and IPv6 Bytes
Tariff-Input-Packets-IPv6 = 6000
Tariff-Input-Octets-IPv6 = 600000
Tariff-Output-Packets = 200         Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 20000        Aggregate Output IPv4 and IPv6 Bytes
Tariff-Output-Packets-IPv6 = 200
Tariff-Output-Octets-IPv6 = 200
```

Day 3—All Interim records sent thereafter until the next tariff-switch point will carry the above same values.

Day 4—The session is disconnected at 8 a.m. A snapshot of the volume used from last tariff to the session disconnect time is taken, for example:

```
IPv6-input-bytes = 500
IPv6-input-packets = 1
IPv6-output-bytes = 400
IPv6-output-packets= 1
```

A stop record is sent with the following values in the VSAs:

```
Tariff-Input-Packets = 1            Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 500           Aggregate Input IPv4 and IPv6 Bytes
Tariff-Input-Packets-IPv6 = 1
Tariff-Input-Octets-IPv6 = 500
Tariff-Output-Packets = 1           Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 400          Aggregate Output IPv4 and IPv6 Bytes
Tariff-Output-Packets-IPv6 = 1
Tariff-Output-Octets-IPv6 = 400
```

The following example shows an IPv4 session configured for doing billing daily at midnight:

```
PPW00:00:00:127
```

Day 1—A native IPv4 session starts at 10 a.m.

Day 1 at tariff-switch point (12 a.m.)—A snapshot of the current volume used from 10 a.m. is recorded, for example:

```
IPv4-input-bytes = 10000
IPv4-input-packets = 100
IPv4-output-bytes = 20000
IPv4-output-packets= 200
```

Day 2 say at 12:10 a.m.—Interim record is sent. The Interim record will carry the following values in the VSAs:

```
Tariff-Input-Packets = 100          Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 10000         Aggregate Input IPv4 and IPv6 Bytes
Tariff-Output-Packets = 200         Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 20000        Aggregate Output IPv4 and IPv6 Bytes
```

Day 2—All Interim records sent thereafter until the next tariff-switch point will carry the same above values.

Day 2 at tariff-switch point (12 a.m.)—A snapshot of the volume used from Day 1 at 12 a.m. to Day 2 at 12 a.m. is recorded, for example:

```
IPv4-input-bytes = 600000
IPv4-input-packets = 6000
IPv4-output-bytes = 20000
IPv4-output-packets= 200
```

Day 3 say at 12:20 a.m.—Interim record is sent. The Interim record will carry the following values in the VSAs:

```
Tariff-Input-Packets = 6000         Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 600000        Aggregate Input IPv4 and IPv6 Bytes
Tariff-Output-Packets = 200         Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 20000        Aggregate Output IPv4 and IPv6 Bytes
```

Day 3—All Interim records sent thereafter until the next tariff-switch point will carry the same above values.

Day 4—The session is disconnected at 8 a.m. A snapshot of the volume used from the last tariff-switch point to session disconnect time is taken, for example:

```
IPv4-input-bytes = 500
IPv4-input-packets = 1
IPv4-output-bytes = 400
IPv4-output-packets= 1
```

A stop record is sent with the following values in the VSAs:

```
Tariff-Input-Packets = 1            Aggregate Input IPv4 and IPv6 Packets
Tariff-Input-Octets = 500           Aggregate Input IPv4 and IPv6 Bytes
Tariff-Output-Packets = 1           Aggregate Output IPv4 and IPv6 Packets
Tariff-Output-Octets = 400          Aggregate Output IPv4 and IPv6 Bytes
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ISG commands	Cisco IOS Intelligent Services Gateway Command Reference
IPv6 Configuration	IPv6 Configuration Guide, Cisco IOS XE Release 3S
Configuring ISG accounting	"Configuring ISG Accounting" module in this guide
Configuring ISG timers	"Configuring ISG Policies for Session Maintenance" module in this guide
Configuring Layer 4 redirect	"Redirecting Subscriber Traffic Using ISG Layer 4 Redirect" module in this guide
Configuring traffic classes	"Configuring ISG Subscriber Services" module in this guide

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ISG IPv6 Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for ISG IPv6 Support

Feature Name	Releases	Feature Information
ISG IPv6 Support	Cisco IOS XE Release 3.4S	Adds IPv6 support for routed IP subscriber sessions and for the following ISG features: • Absolute Timeout • Idle Timeout • ISG Accounting • Traffic Classes Adds the Time-Based Billing feature and traffic class support for services and flows on PPP sessions. **Note** Only single-stack sessions are supported for ISG subscriber sessions; dual-stack sessions are not supported. The following commands were introduced or modified: **initiator**, **ipv6 prefix**, **show ip subscriber**, **show subscriber session**.

Feature Name	Releases	Feature Information
ISG: IPv6 Support phase II	Cisco IOS XE Release 3.5S	Adds support for IPv6 PPP sessions and PPP dual-stack sessions for the following features: • HA-supported ISG features • ISG Policer • Layer 4 Redirect • MQC Adds support for PPP dual-stack sessions for the following features: • Absolute Timeout • Idle Timeout • ISG Accounting • Traffic Classes The following commands were introduced or modified: **redirect session-limit**, **redirect to**, **show redirect group**, **show redirect translations**, **server ip**.