



QoS Service Model Overview

A QoS policy is a set of parameters that control and condition the traffic flowing through a service provider network.

The Cisco IP Solution Center (ISC) configures QoS at the access circuit, which involves the PEs in the service provider network and the CPEs in the customer network. A QoS policy is applied to the selected set of access circuits using a QoS service request. The ISC provisioning engine generates the QoS configuration from the service request and downloads the configuration to the specified CPE and PE devices.

A QoS service request can be integrated with VPN provisioning accomplished through ISC or deployed on its own if VPN services are not provisioned through ISC.

In ISC, the IP QoS service model is comprised of:

- IP QoS Link—contains device (CPE and PE) interface information.
- IP QoS Policy—ISC offers two different levels of policies. Most networks have a combination of both policy types.
 - Service level QoS policy—the part of the QoS policy where you define service classes for the different service level agreements (SLA) purchased by customers.
 - Link level QoS policy—The part of the QoS policy that specifies QoS parameters that are specific to the CPE-PE link.
- IP QoS Service Request—a container for the link objects and QoS policies to be applied to the device.



Note

To set up QoS provisioning for VPN services, see [Chapter 7, “Applying QoS Policies to VPN Services”](#).

This chapter provides an overview of the IP QoS service model in ISC.

The chapter contains the following sections:

- [QoS Link, page 3-2](#)
- [Service Level IP QoS Policy, page 3-2](#)
- [Link Level QoS Policy, page 3-4](#)
- [IP QoS Service Requests, page 3-6](#)

QoS Link

A QoS Link can contain two interfaces (for both the CPE and PE) or one interface (CPE only or PE only). For QoS provisioning, you can select both interfaces in the CPE-PE link. A typical device interface selection is as follows:

- For the CPE device:
 - The provider-facing device interface is selected as the link endpoint.
 - The customer-facing LAN interface is selected for marking and rate limiting.



Note Marking and rate limiting on the customer-facing LAN interface is optional and is done using a CPE device editor as part of defining QoS link candidates.

- For the PE device:
 - The customer-facing interface is marked as a link endpoint.

The interfaces selected as link endpoints can be provisioned with QoS parameters such as policing, traffic shaping, congestion management, congestion avoidance, link efficiency, and CAR. You apply these parameters later in the provisioning process.

See [Defining QoS Link Candidates, page 5-5](#) for information on defining QoS link candidate interfaces in the ISC user interface.

Service Level IP QoS Policy

The service level portion of the QoS policy corresponds to service classes. A QoS service class provides a method for classifying traffic flows into classes so that you can apply the appropriate QoS parameters to a class of traffic instead of applying them to all traffic. For example, all TCP traffic might be grouped into a single class so that bandwidth is allocated for the class and not for individual traffic flows.

A QoS service class can include:

- Methods for classifying traffic (protocol, DSCP value, IP precedence value, source address)
- Methods for marking traffic (DSCP or IP precedence values)
- Traffic shaping parameters (average/peak, rate)
- Rate limiting parameters (mean/peak rate, burst size, conform/exceed/violate actions)
- Congestion management parameters (bandwidth and queue limit)
- Congestion avoidance parameters (drop, exponential weighing constant)

A typical service provider network might create different QoS policies, and each QoS policy might contain three to five service classes. For example, a service provider might have a gold, silver, and bronze QoS policies, each specifying different service level agreements (SLA), and each of those QoS policies might contain one or more service classes. Most networks require at least a voice, a management, and a data service class.

ISC provides five default or template service classes for you to modify and use for a service level QoS policy:

- VoIP—voice service class
- Routing Protocol—routing protocol service class

- Management—management service class
- Business-Data-1—data service class
- Best Effort—data service class

See [Creating the Service Level IP QoS Policy, page 5-10](#) for information on defining the service level QoS policy in the ISC user interface.

The following section describes the five service classes provided with ISC.

QoS Service Classes

A QoS service class defines how each QoS parameter is applied.

Network traffic can be categorized into voice traffic, data traffic, and control traffic. Voice and data traffic are common in enterprise networks. Control traffic refers to routing protocol traffic and management traffic, which are commonly used in the service provider portion of the network.

The five default service classes provided with ISC cover most networks, which require at least one for interactive voice traffic, one for management traffic, and at least one service class for data traffic.

You can either remove or add more service classes if required. ISC supports the number of service classes defined by the Cisco differentiated services (DiffServ) architecture; up to 64 classes for DSCP traffic, and up to 8 service classes for IP Precedence traffic.

See [Adding a Data Service Class, page 6-21](#) for more information.

VoIP Service Class

Interactive voice traffic in ISC refers to any voice traffic (telephone calls, faxes) that is IP-encapsulated and sent over the network, such as Voice-over-IP (VoIP).

Mandatory QoS components for this service class:

- Traffic classification
- Marking
- Congestion management
- Rate-limiting (optional)

Routing Protocol Service Class

Routing protocol traffic refers to traffic control messages, such as route update messages, hellos, database descriptors, keepalives, and database refresh messages. We recommend the minimum bandwidth, one percent, for your routing protocol service class.

Mandatory QoS components for this service class:

- Traffic classification
- Congestion management

Management Service Class

Management traffic refers to the traffic between the management station at the provider core and the access routers. We recommended the minimum bandwidth, one percent, for your management service class.

Mandatory QoS components for this service class:

- Traffic classification
- Marking
- Congestion management

QoS parameters for the VoIP, Routing Protocol, and Management service classes are described in [VoIP, Routing Protocol, and Management Service Classes, page 6-2](#).

Business-Data-1 and Best Effort Service Classes

The two data service classes, Business-Data-1 and Best Effort, are nearly identical. The only difference between them is the Traffic Classification parameter. For Business-Data-1, traffic is classified by protocol. Best-Effort classifies all traffic.

The QoS requirements for data applications can vary. Each data application should be profiled before you determine the appropriate classification and scheduling treatment.

Mandatory QoS components for this service class:

- Traffic classification
- Marking
- Congestion management

Optional components:

- Traffic shaping or rate limiting
- Congestion avoidance



Note A typical network requires traffic shaping or rate limiting, but not both.

QoS parameters for the Business-Data-1 and Best-Effort service classes are described in [Business-Data-1 and Best Effort Service Classes, page 6-11](#).

Link Level QoS Policy

The link level portion of the QoS policy corresponds to QoS parameters that are sensitive to link bandwidth and the CPE-PE link's encapsulation type. A link level QoS policy, called link QoS settings in the ISC user interface, provides a method for defining policies specific to the CPE-PE link. For example, you might require different policies for Frame Relay and ATM links because of the different encapsulation involved.

Link level QoS parameters in ISC include:

- Link bandwidth (bandwidth specified in kbps)
- Aggregated traffic shaper types (Frame-Relay traffic shapers, ATM traffic shapers, and parent level traffic shapers for nested policies)

**Note**

Aggregated traffic shapers are different from class-based traffic shapers. Aggregated traffic shapers apply to traffic through a particular CPE-PE link. Class-based traffic shapers apply to all traffic specified in the service class.

- Link efficiency settings (FRF.12, LFI on MLPPP, and cRTP)
- Interface-based aggregated rate limiters (traffic classification, direction, mean rate, burst size, and conform/exceed action)

**Note**

Interface-based aggregated rate limiters are different from class-based rate limiters. Interface-based aggregated rate limiters apply to traffic through a particular CPE-PE link. Class-based rate limiters apply to all traffic specified in the service class.

Aggregated Traffic Shapers

Aggregated traffic shaping allows you to control the traffic leaving an interface. You can select an aggregated traffic shaper for each CPE-PE link.

Aggregated traffic shapers are optional. ISC supports the following aggregated traffic shapers:

- Frame Relay traffic shaper, or FRTS
- FRTS (non-MQC Based)
- Parent-level Class-based Shaper
- ATM traffic shaper (VBR-rt)
- ATM traffic shaper (VBR-nrt)
- ATM traffic shaper (CBR)
- ATM traffic shaper (ABR)

See [Aggregated Traffic Shapers, page 6-22](#) for more information on defining the aggregated traffic shapers parameters in the ISC user interface.

Link Efficiency

Link efficiency settings are based on the bandwidth of the CPE-PE link itself and are used to minimize serialization delay on the link. ISC uses methods of fragmentation and compression to minimize this delay.

ISC supports the following link efficiency settings:

- LFI on Frame Relay (FRF.12)—Supports the transport of real-time voice and data traffic on Frame Relay virtual circuits (VCs) without causing excessive delay to the real-time traffic.
- LFI on MLPPP—Multilink PPP (MLPPP) provides a method of splitting, recombining, and sequencing datagrams across multiple logical data links. MLPPP allows packets to be fragmented and the fragments to be sent at the same time over multiple point-to-point links to the same remote address.
- cRTP header compression—cRTP compresses the IP/UDP/RTP header in an RTP data packet from 40 bytes to approximately 2 to 5 bytes. Use cRTP on any WAN interface where bandwidth is at a premium and much of the traffic is RTP traffic.

See [Link Efficiency Settings, page 6-30](#) for information on defining the link efficiency parameters in the ISC user interface.

Interface-Based Aggregated Rate Limiters

Interface-based aggregated rate limiters allow you to control the maximum rate of traffic sent or received on an interface for the CPE-PE link. You can also specify traffic handling policies for when the traffic conforms or exceeds the specified rate limit.

Aggregate rate limits match all packets or a subset of packets on an interface or subinterface. To specify class-based rate limiting parameters, see [Creating the Service Level IP QoS Policy, page 5-10](#).

ISC supports the following interface-based rate limiter parameters:

- Traffic classification
- Direction
- Mean rate
- Burst sizes (conformed and extended)
- Conform and exceed actions

See [Interface-Based Aggregated Rate Limiters, page 6-31](#) for information on defining the interface-based rate limiters in the ISC user interface.

IP QoS Service Requests

An IP QoS service request contains one or more QoS links. Each link can optionally be associated with a link QoS setting. A QoS policy can be associated with a QoS service request.

An IP QoS service request should:

- Contain an IP QoS policy
- All links in the service request can be associated with a link QoS setting

To apply IP QoS policies to network devices, you must deploy the QoS service request. When you deploy a QoS service request, ISC compares the device information in the Repository (the ISC database) with the current device configuration and generates a configlet.

See [Creating the QoS Service Request, page 5-18](#) for information on creating the QoS service request using the ISC user interface.

See [Cisco IP Solution Center Infrastructure Reference, 4.0](#) for more information on the ISC Repository.