Cisco Router and Security Device Manager

Quality of Service

Introduction

This document explains how to configure and monitor Quality of Service (QoS).

Quality of Service

A communications network forms the backbone of any successful organization. These networks transport a multitude of applications and data, including high-quality video and delay-sensitive data such as real-time voice. The bandwidth-intensive applications stretch network capabilities and resources and complement, add value, and enhance every business process. Networks must provide secure, predictable, measurable, and sometimes guaranteed services. Achieving the required quality of service (QoS) by managing delay, delay variation (jitter), bandwidth, and packet loss parameters on a network is the answer to a successful end-to-end business solution. QoS is the technique to manage network resources.

QoS for VPNs

When packets are encapsulated by tunnel or encryption headers, QoS features are unable to examine the original packet headers and correctly classify the packets. Several packets traveling across the same tunnel have the same tunnel headers, and the packets are treated identically if the physical tunnel interface is congested.

The QoS for VPNs feature is designed for tunnel interfaces. When the new feature is enabled, the QoS features on the output interface classify packets before encryption, adjusting traffic flows in congested environments. The end result is more effective packet tunneling. QoS for VPNs is supported for IP Security (IPSec).

QoS Supported by Cisco Router and Security Device Manager

Cisco® Router and Security Device Manager (SDM) prioritizes traffic and allocates bandwidth. It creates three traffic categories: Real-Time, Business-Critical, and Trivial, which includes Best-Effort traffic to help users configure QoS policies for outgoing traffic on WAN interfaces and IPSec Tunnels.

SDM considers Voice over IP (VoIP) and signaling packets as Real-Time traffic, and considers Transactional, Management and Routing traffic as Business-Critical traffic that is important for a typical corporate environment. The Transactional traffic handles packets meant for enterprise resource planning (ERP)/Database, interactive sessions, and enterprise applications; the Management traffic handles packets meant for network management; and the Routing traffic handles packets meant for routing and signaling. The traffic that does not belong to Real-Time and Business-Critical traffic is in the Trivial traffic category.

SDM QoS wizard creates and tailors QoS policies with default values based on interface types and functions to facilitate QoS deployment; users can edit the policies to customize the default values.
Deployment Scenario
This document demonstrates how to configure QoS for data, voice, and video on a Frame-Relay WAN link with IPSec Tunnel (Figure 1).

Figure 1. Network Diagram

Sample Configuration

Prerequisites
The site-to-site IPSec Tunnel over Frame Relay link has been established between two sites.

QoS on Frame Relay Link with IPSec Tunnel
The sample configuration includes the configuration to apply QoS policy to the serial0/0.1 interface of Cisco IOS® Router in Site A; the prerequisite configurations are not covered in this sample configuration.

Cisco Security Device Manager QoS Management
Cisco Router and SDM facilitates QoS deployment by creating QoS policies with tailored default values and modifying interfaces and router configuration, if necessary, to support QoS. The following steps are used to configure the deployment scenario using Cisco SDM.

Configuring QoS on a Frame Relay WAN Link with IPSec Tunnel
At Configure Mode, select the Quality of Service, click Create QoS Policy tab (Figure 2), and click Launch QoS Wizard to launch the wizard.

Figure 2. Create QoS Policy
Click Next to go to Interface Selection screen.
• For interface, in this scenario, use **Serial0/0.1** (Figure 3)

• (Optional) Click **Details** to see the current configuration of an interface (Figure 4)

• Click **Next**

Figure 3. Interface Selection

Figure 4. Interface Details of Serial0/0.1

Interface Serial0/0.1 is a Frame-Relay link with DLCI = 16 and IPSec Policy configured.
To configure the Bandwidth Allocation (Figure 5), take the following steps:

- Real Time (Voice, Video): **65 percent**
- Business-Critical: **5 percent**

Note: The Total Bandwidth is always 100 percent because SDM automatically recalculates the bandwidth percentage of the Best-Effort category.

- (Optional) Click **View Details** to see the protocols supported classified into Real-Time category and Business-Critical category (Figure 6)
- Click Next

**Figure 5. Bandwidth Allocation**

![Quality of Service](image)

**QoS Policy Generation**

SDM will create a QoS policy to provide quality of service to 2 types of traffic:

1. **Real-Time Traffic**: SDM will create 2 QoS classes to handle VoIP and voice signaling packets.

2. **Business-Critical Traffic**: SDM will create 3 QoS classes to handle packets which are important for a typical corporate environment. Some of the protocols included in this traffic category are citrix, sqlnet, notes, ldap, and secure ldap. Routing protocols in this category include bgp, egp, eigrp and rip.

<table>
<thead>
<tr>
<th>Type of Traffic</th>
<th>Bandwidth in %</th>
<th>kbps value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time (Voice, Video)</td>
<td>65</td>
<td>1004</td>
</tr>
<tr>
<td>Business-Critical</td>
<td>5</td>
<td>77</td>
</tr>
<tr>
<td>Best-Effort</td>
<td>30</td>
<td>453</td>
</tr>
<tr>
<td>Total Bandwidth</td>
<td>100</td>
<td>1544</td>
</tr>
</tbody>
</table>

**Figure 6. Protocols Classification**
• If you are prompted to enable Network-Based Application Recognition (NBAR) Protocol discovery for this interface, click Yes.

• Summary screen displays the configuration; click Finish to deliver the configuration (Figure 7).

Figure 7. Summary

Verification
Users can go to **Configure Mode**, select **Quality of Service**, and click **Edit QoS Policy** tab to display QoS Policies. SDM creates a QoS Policy named **SDM-Pol-Serial0/0.1-FR** applied to interface Serial0/0.1 listed in the upper panel. Select the policy and the details of the policy are displayed in the lower panel.

Note: The built-in SDM intelligence automatically reconfigures IPSec Tunnel to support QoS and tailors the QoS policy to meet the Frame Relay interface prerequisites (Figure 8).

Figure 8. Display QoS Policies
Edit a QoS Policy

At Configure Mode, select the Quality of Service; and click edit QoS Policy tab to display QoS Policies. In our scenario, select SDM-Pol-Serial0/0.1-FR listed in the upper panel. SDM displays QoS Policy Details in the lower panel (shown in Figure 8).

To disable Business-Critical/SDMManage-Serial0/0.1, take the following steps:

- Select Business-Critical/SDMManage-Serial0/0.1
- Click Edit, Edit QoS Class window pops up
- Deselect Add this class to the policy (Figure 9) and click OK to go back to Edit QoS Policy screen
- Click Apply Changes/Discard Changes button on the bottom of the screen to apply or discard changes

Note: the Apply Changes and Discard Changes buttons are not available if no change is made (shown in Figure 8).

Figure 9. Edit QoS Class
Monitoring QoS Status

At **Monitor Mode**, select the **QoS Status** (Figure 10). The traffic statistics in bar charts are displayed based on the combination of View Interval (Every 1 minute, every 5 minutes, and every 1 hour) and QoS Parameters for Monitoring (input/output, bandwidth/bytes/packets dropped).

In our scenario, Serial0/0.1 with View Internal = Now, Direction = output, and Statistics = bytes are graphed on the screen.

**Figure 10. Monitoring QoS Status**
Cisco IOS Software Command-Line Interface

The QoS configuration requires the knowledge of various interfaces (ATM, Frame Relay, low-speed link, and IPSec Tunnel), the characteristics of various protocols, Cisco IOS command-line interface (CLI), and Modular QoS CLIs (MQC). The following CLIs are used to configure the same deployment scenario as above as opposed to the SDM.

```
! Enable the QoS for VPNs
crypto map SDM_CMAP_1 ipsec-isakmp
  qos pre-classify
!
! Configure Traffic Classes
class-map match-any SDMSVideo-Serial0/0.1
  match protocol cuseeme
  match protocol netshow
  match protocol rtsp
  match protocol streamwork
  match protocol vdolive
class-map match-any SDMBulk-Serial0/0.1
  match protocol exchange
  match protocol ftp
  match protocol irc
  match protocol nntp
  match protocol pop3
  match protocol printer
  match protocol secure-ftp
  match protocol secure-irc
  match protocol secure-nntp
  match protocol secure-pop3
  match protocol smtp
  match protocol tftp
class-map match-any SDMScache-Serial0/0.1
  match protocol napster
  match protocol fasttrack
  match protocol gnutella
class-map match-any SDMManage-Serial0/0.1
  match protocol dhcp
  match protocol dns
  match protocol imap
  match protocol kerberos
  match protocol ldap
  match protocol secure-imap
  match protocol secure-ldap
  match protocol snmp
  match protocol socks
  match protocol syslog
class-map match-any SDMVoice-Serial0/0.1
  match protocol rtp audio
class-map match-any SDMRout-Serial0/0.1
  match protocol bgp
  match protocol egp
  match protocol eigrp
  match protocol ospf
  match protocol rip
  match protocol rsvp
class-map match-any SDMSignal-Serial0/0.1
  match protocol h323
  match protocol rtcp
class-map match-any SDMIVideo-Serial0/0.1
  match protocol rtp video
class-map match-any SDMTrans-Serial0/0.1
  match protocol citrix
```
match protocol finger
match protocol notes
match protocol novadigm
match protocol pcanywhere
match protocol secure-telnet
match protocol sqlnet
match protocol sqlserver
match protocol ssh
match protocol telnet
match protocol xwindows
!
! Configure QoS Policy
policy-map SDM-Pol-Serial0/0.1
class SDMSignal-Serial0/0.1
  bandwidth remaining percent 28
  set dscp cs3
class SDMVoice-Serial0/0.1
  priority percent 68
  set dscp ef
class SDMRout-Serial0/0.1
  bandwidth remaining percent 6
  set dscp cs6
class SDMManage-Serial0/0.1
  bandwidth remaining percent 6
  set dscp cs2
class SDMTrans-Serial0/0.1
  bandwidth remaining percent 60
  set dscp af21
!
! For Frame-Relay links, traffic shaping is required
policy-map SDM-Pol-Serial0/0.1-FR
  class class-default
  shape average 128000
  service-policy SDM-Pol-Serial0/0.1
!
! Assign QoS Policy to an interface
interface Serial0/0.1 point-to-point
  service-policy output SDM-Pol-Serial0/0.1-FR

In summary, by using the Cisco SDM QoS Wizard, users can conduct the same QoS configuration easily and quickly with minimum knowledge of Cisco IOS CLI, Modular QoS CLIs, and QoS.
References

Quality of Service:


Quality of Service for Virtual Private Network: