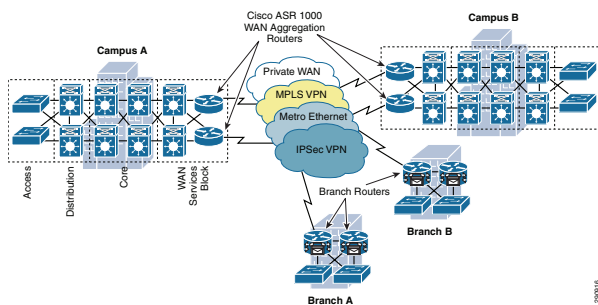


Role in Medianet WAN Network

The Cisco ASR 1000 routers are well suited to the role of WAN aggregation routers in medianet WAN and VPN networks. As such, these routers may connect campus or large branch networks to private WANs, MPLS VPNs, Metro Ethernet circuits, and/or IPSec-based VPNs, as shown in Figure 1.

Figure 1 Cisco ASR 1000 Routers in Medianet WAN/VPN Networks



QoS Design Steps

There are two main steps to configure QoS on Cisco ASR 1000 series routers:

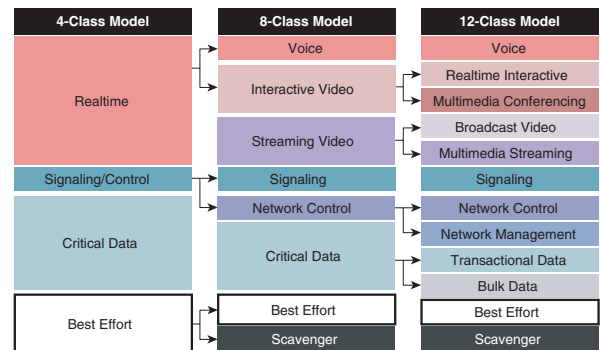
1. Configure WAN/VPN edge QoS Model(s):
 - 4-Class Model
 - 8-Class Model
 - 12-Class Model
2. Configure Internal Scheduling (if required)
 - SPA-based Internal Scheduling
 - SIP-based Internal Scheduling

Step 1: Configure WAN/VPN Edge QoS Model(s)

The number of classes of service provisioned on the WAN/VPN edge is a function of the business priorities of the enterprise. Each class of business-critical applications that has unique service-level requirements needs a dedicated class of service.

While RFC 4594 outlines a 12-class model, Cisco recognizes that not all enterprises are ready to implement such a complex QoS design. Therefore, Cisco recommends a phased approach to media application class expansion, as illustrated in Figure 2.

Figure 2 Medianet Application Class Expansion

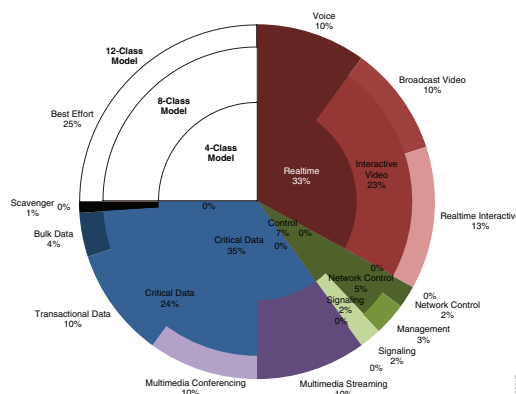


Administrators can incrementally implement QoS policies across their medianet WAN/VPN networks in a progressive manner, utilizing such a phased approach to application class expansion to keep in step with their evolving business needs.

DSCP Marking codepoints should remain as consistent as possible as the number of application classes expand. Multiple application classes can be matched on a single codepoint or as a group of several codepoints, with the latter being the preferred option as it facilitates easier expansion.

Not only should marking values remain consistent as the number of classes of service expand, but also relative bandwidth allocations, as shown in Figure 3.

Figure 3 Example Medianet Bandwidth Allocation Models



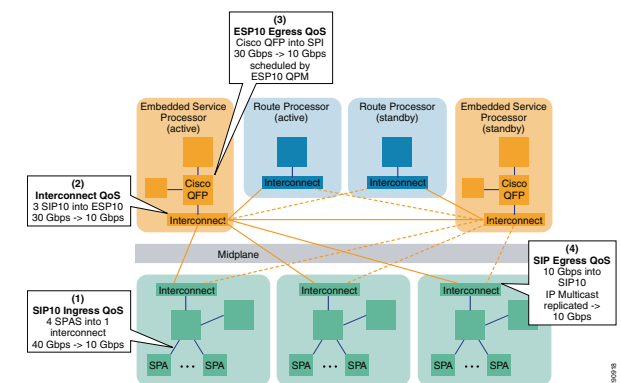
Additional WAN Edge QoS design recommendations include:

- Limit LLQ(s) to 33%
- Provision at least 25% for the Best Effort Queue
- Limit the Scavenger Queue to 1%
- Enable Fair-Queuing Pre-Sorters on all classes except control and scavenger classes
- Expand queue limits as required
- Enable DSCP-based WRED on all AF classes
- Optional: Tune DSCP-based WRED:
 - Set min-thresholds to 60% for AFx3
 - Set min-thresholds to 70% for AFx2
 - Set min-thresholds to 80% for AFx1
 - Set all max-thresholds to 100%

Step 2: Configure Internal Scheduling

Due to the hardware architecture of the Cisco ASR 1000, there may be certain circumstances where this platform becomes internally oversubscribed, as shown in Figure 4. However, the Cisco ASR 1000 supports internal scheduling mechanisms to address potential internal oversubscription scenarios.

Figure 4 Cisco ASR 1000 Potential Internal Oversubscription Points



Cisco Validated Design (CVD)

Cisco Validated Designs for Cisco ASR 1000 series routers in the role of a WAN aggregator in a medianet WAN network are presented on the reverse.

4-Class WAN-Edge Model

```
class-map match-any REALTIME
  match dscp ef
  match dscp cs5
  match dscp cs4
class-map match-any CONTROL
  match dscp cs6
  match dscp cs3
  match dscp cs2
class-map match-any CRITICAL-DATA
  match dscp af41 af42 af43
  match dscp af31 af32 af33
  match dscp af21 af22 af23
  match dscp af11 af12 af13
```

```
policy-map WAN-EDGE-4-CLASS
class REALTIME
  priority percent 33
class CONTROL
  bandwidth percent 7
class CRITICAL-DATA
  bandwidth percent 35
  fair-queue
  random-detect dscp-based
class class-default
  bandwidth percent 25
  fair-queue
  random-detect dscp-based
```

```
service-policy output WAN-EDGE-4-CLASS
```

ASR 1000 Internal Scheduling:**SPA-Based Internal Scheduling**

```
plim qos input map ip dscp-based
plim qos input map ip dscp cs4 cs5 ef
queue strict-priority
```

SIP-Based Internal Scheduling

```
ingress-class-map 1
map ip dscp-based
map ip dscp cs4 cs5 ef
queue strict-priority
```

```
plim qos input class-map 1
```

8-Class WAN-Edge Model

```
class-map match-all VOICE
  match dscp ef
class-map match-any INTERACTIVE-VIDEO
  match dscp cs5
  match dscp cs4
class-map match-any NETWORK-CONTROL
  match dscp cs6
  match dscp cs2
class-map match-all SIGNALING
  match dscp cs3
class-map match-all MULTIMEDIA-STREAMING
  match dscp af31 af32 af33
class-map match-any CRITICAL-DATA
  match dscp af41 af42 af43
  match dscp af21 af22 af23
  match dscp af11 af12 af13
class-map match-all SCAVENGER
  match dscp cs1
```

```
policy-map WAN-EDGE-8-CLASS
class VOICE
  priority percent 10
class INTERACTIVE-VIDEO
  priority percent 23
class NETWORK-CONTROL
  bandwidth percent 5
class SIGNALING
  bandwidth percent 2
class MULTIMEDIA-STREAMING
  bandwidth percent 10
  fair-queue
  random-detect dscp-based
class CRITICAL-DATA
  bandwidth percent 24
  fair-queue
  random-detect dscp-based
class SCAVENGER
  bandwidth percent 1
class class-default
  bandwidth percent 25
  fair-queue
  random-detect dscp-based
```

```
service-policy output WAN-EDGE-8-CLASS
```

12-Class WAN-Edge Model

```
class-map match-all VOICE
  match dscp ef
class-map match-all BROADCAST-VIDEO
  match dscp cs5
class-map match-all REALTIME-INTERACTIVE
  match dscp cs4
class-map match-all NETWORK-CONTROL
  match dscp cs6
class-map match-all SIGNALING
  match dscp cs3
class-map match-all NETWORK-MANAGEMENT
  match dscp cs2
class-map match-any MULTIMEDIA-CONFERENCING
  match dscp af41 af42 af43
class-map match-any MULTIMEDIA-STREAMING
  match dscp af31 af32 af33
class-map match-any TRANSACTIONAL-DATA
  match dscp af21 af22 af23
class-map match-any BULK-DATA
  match dscp af11 af12 af13
class-map match-all SCAVENGER
  match dscp cs1
```

```
policy-map WAN-EDGE-12-CLASS
class VOICE
  priority percent 10
class BROADCAST-VIDEO
  priority percent 10
class REALTIME-INTERACTIVE
  priority percent 13
class NETWORK-CONTROL
  bandwidth percent 2
class SIGNALING
  bandwidth percent 2
class NETWORK-MANAGEMENT
  bandwidth percent 3
class MULTIMEDIA-CONFERENCING
  bandwidth percent 10
  fair-queue
  random-detect dscp-based
class MULTIMEDIA-STREAMING
  bandwidth percent 10
  fair-queue
  random-detect dscp-based
class TRANSACTIONAL-DATA
  bandwidth percent 10
  fair-queue
  random-detect dscp-based
class BULK-DATA
  bandwidth percent 4
  fair-queue
  random-detect dscp-based
class SCAVENGER
  bandwidth percent 1
class class-default
  bandwidth percent 25
  fair-queue
  random-detect dscp-based
```

```
service-policy output WAN-EDGE-12-CLASS
```

290919

Note: Highlighted commands are interface specific; otherwise these are global.

For more details, see Medianet WAN Aggregation QoS Design 4.0: http://www.cisco.com/en/US/docs/solutions/Enterprise/WAN_and_MAN/QoS_SRND_40/QoS_WAN_40.html.