



End-to-End QoS Network Design

Quality of Service for
Rich-Media & Cloud Networks

Second Edition

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- Transactional data (marked AF2) is assigned to dedicated nonpriority queue with a 24 percent bandwidth allocation with DBL enabled.
- Scavenger traffic (marked CS1) is constrained within a dedicated nonpriority queue with a 1 percent bandwidth allocation.
- Best-effort traffic (marked DF) is assigned to a default queue with 25 percent bandwidth allocation with DBL enabled.

Note As before, DBL is not enabled on the real-time or control traffic classes (because real-time traffic and control traffic should never be early dropped); nor would DBL be required on the scavenger class, because traffic in this class has no “good-faith” guarantee of service to begin with. Enabling DBL on the Interactive Video and Streaming Video classes assumes that the video codecs used for these flows are adaptive/elastic and therefore will adjust transmission rates in the event of congestion.

Figure 15-4 illustrates the resulting eight-class (1P7Q1T+DBL) egress queuing model for the Catalyst 4500.

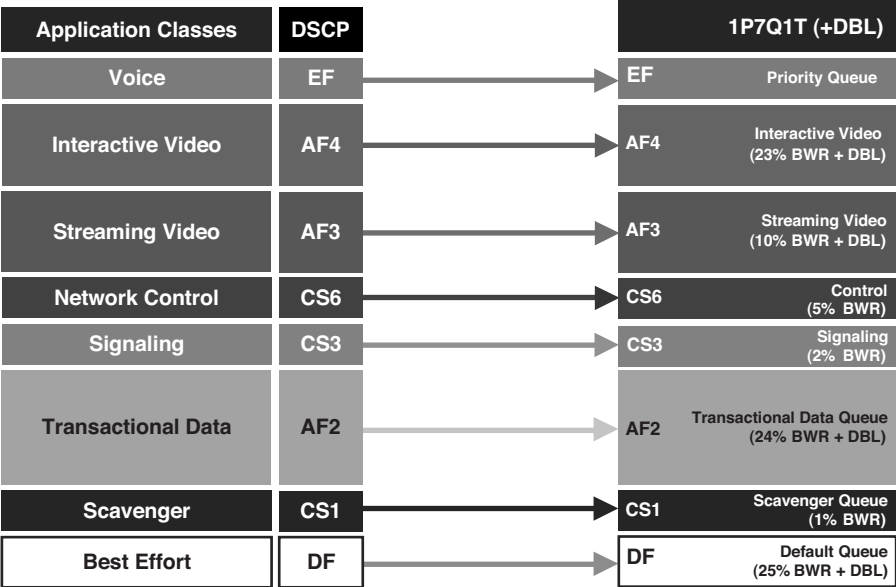


Figure 15-4 Catalyst 4500 Eight-Class (1P7Q1T+DBL) Egress Queuing Model

Example 15-2 shows the corresponding configuration for eight-class (1P7Q1T+DBL) egress queuing on the Catalyst 4500.

Example 15-2 *Eight-Class (1P7Q1T+DBL) Egress Queuing Configuration Example on a Catalyst 4500*

```

! This section configures the class maps for the egress queuing policy
C4500(config)# class-map match-all PRIORITY-QUEUE
C4500(config-cmap)# match dscp ef
! VoIP (EF) is mapped to the PQ
C4500(config)# class-map match-all INTERACTIVE-VIDEO-QUEUE
C4500(config-cmap)# match dscp af41 af42 af43
! Interactive-Video (AF4) is assigned a dedicated queue
C4500(config)# class-map match-all STREAMING-VIDEO-QUEUE
C4500(config-cmap)# match dscp af31 af32 af33
! Streaming-Video (AF3) is assigned a dedicated queue
C4500(config)# class-map match-all CONTROL-QUEUE
C4500(config-cmap)# match dscp cs6
! Network Control (CS6) is mapped to a dedicated queue
C4500(config)# class-map match-all SIGNALING-QUEUE
C4500(config-cmap)# match dscp cs3
! Signaling (CS3) is mapped to a dedicated queue
C4500(config)# class-map match-all TRANSACTIONAL-DATA-QUEUE
C4500(config-cmap)# match dscp af21 af22 af23
! Transactional Data (AF2) is assigned a dedicated queue
C4500(config)# class-map match-all SCAVENGER-QUEUE
C4500(config-cmap)# match dscp cs1
! Scavenger (CS1) is assigned a dedicated queue

! This section configures the 1P7Q1T+DBL egress queuing policy map
C4500(config)# policy-map 1P7Q1T
C4500(config-pmap-c)# class PRIORITY-QUEUE
C4500(config-pmap-c)# priority
! Defines a priority queue
C4500(config-pmap-c)# class INTERACTIVE-VIDEO-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 23
C4500(config-pmap-c)# dbl
! Defines a interactive-video queue with 23% BW remaining + DBL
C4500(config-pmap-c)# class STREAMING-VIDEO-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 10
C4500(config-pmap-c)# dbl
! Defines a streaming-video queue with 10% BW remaining + DBL
C4500(config-pmap-c)# class CONTROL-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 5
! Defines a control/management queue with 5% BW remaining
C4500(config-pmap-c)# class SIGNALING-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 2
! Defines a signaling queue with 2% BW remaining

```

```

C4500(config-pmap-c)# class TRANSACTIONAL-DATA-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 24
C4500(config-pmap-c)# db1
! Defines a transactional data queue with 24% BW remaining + DBL
C4500(config-pmap-c)# class SCAVENGER-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 1
! Defines a (minimal) scavenger queue with 1% BW remaining/limit
C4500(config-pmap-c)# class class-default
C4500(config-pmap-c)# bandwidth remaining percent 25
C4500(config-pmap-c)# db1
! Provisions the default/Best Effort queue with 25% BW remaining + DBL

! This section attaches the egress queuing policy to the interface(s)
C4500(config)# interface range TenGigabitEthernet 1/1-2
C4500(config-if-range)# service-policy output 1P7Q1T

```

You can verify the configuration in Example 15-2 with the following commands:

- show class-map
- show policy-map
- show policy-map interface

Twelve-Class Egress Queuing Model

In the 12-class model (illustrated in Figures 11-7 and 11-8), the application class to queue mappings are as follows:

- Voice (marked EF), broadcast video (marked CS5), and real-time interactive traffic (marked CS4) is all assigned to the priority queue (which may be optionally policed to 30 percent bandwidth).
- Multimedia-conferencing traffic (marked AF4) is assigned to a dedicated nonpriority queue with a 10 percent bandwidth allocation with DBL enabled.
- Multimedia-streaming traffic (marked AF3) is assigned to a dedicated nonpriority queue with a 10 percent bandwidth allocation with DBL enabled.
- Network control traffic (marked CS6), signaling traffic (marked CS3) and network management traffic (marked CS2) is all assigned to a dedicated nonpriority queue with a 10 percent bandwidth allocation; optionally, CS7 traffic may also be mapped to this queue.
- Transactional data traffic (marked AF2) is assigned to dedicated nonpriority queue with a 10 percent bandwidth allocation with DBL enabled.

- Bulk data traffic (marked AF1) is assigned to a dedicated nonpriority queue with 4 percent bandwidth allocation with DBL enabled.
- Scavenger traffic (marked CS1) is constrained within a dedicated nonpriority queue with a 1 percent bandwidth allocation.
- Best-effort traffic (marked DF) is assigned to a default queue with 25 percent bandwidth allocation with DBL enabled.

Figure 15-5 illustrates the resulting 12-class (1P7Q1T+DBL) egress queuing model for the Catalyst 4500.

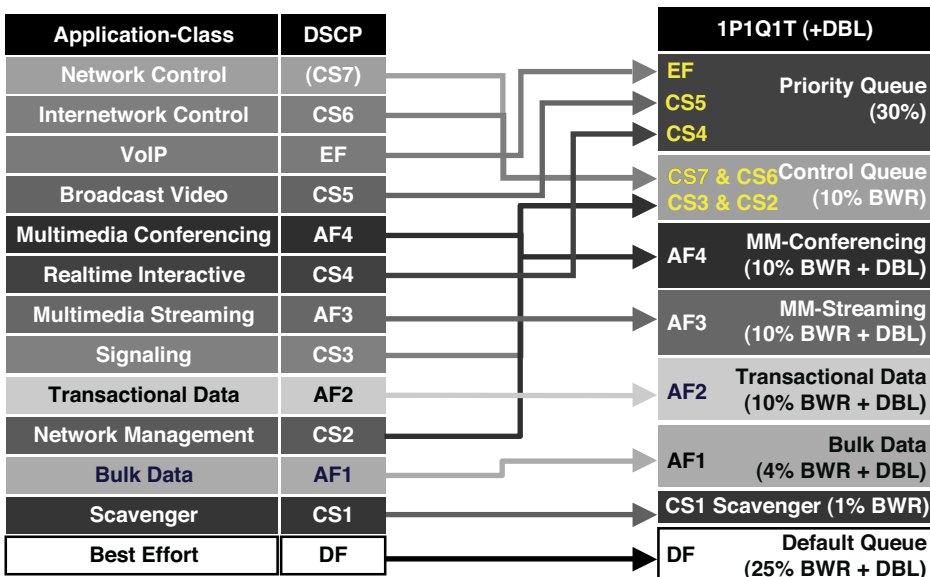


Figure 15-5 Catalyst 4500 12-Class (1P7Q1T+DBL) Egress Queuing Model

Example 15-3 shows the corresponding configuration for 12-class (1P7Q1T+DBL) egress queuing on the Catalyst 4500.

Example 15-3 Twelve-Class (1P7Q1T+DBL) Egress Queuing Configuration Example on a Catalyst 4500

```
! This section configures the class maps for the egress queuing policy
C4500(config)# class-map match-any PRIORITY-QUEUE
C4500(config-cmap)# match dscp ef
C4500(config-cmap)# match dscp cs5
C4500(config-cmap)# match dscp cs4
! VoIP (EF), Broadcast Video (CS5) and Realtime Interactive (CS4)
! are all mapped to the PQ
```

```

C4500(config)# class-map match-any CONTROL-MGMT-QUEUE
C4500(config-cmap)# match dscp cs7
C4500(config-cmap)# match dscp cs6
C4500(config-cmap)# match dscp cs3
C4500(config-cmap)# match dscp cs2
    ! Network Control (CS7), Internetwork Control (CS6),
    ! Signaling (CS3) and Management (CS2) are mapped
    ! to a Control/Management Queue
C4500(config)# class-map match-all MULTIMEDIA-CONFERENCING-QUEUE
C4500(config-cmap)# match dscp af41 af42 af43
    ! Multimedia Conferencing (AF4) is assigned a dedicated queue
C4500(config)# class-map match-all MULTIMEDIA-STREAMING-QUEUE
C4500(config-cmap)# match dscp af31 af32 af33
    ! Multimedia Streaming (AF3) is assigned a dedicated queue
C4500(config)# class-map match-all TRANSACTIONAL-DATA-QUEUE
C4500(config-cmap)# match dscp af21 af22 af23
    ! Transactional Data (AF2) is assigned a dedicated queue
C4500(config)# class-map match-all BULK-DATA-QUEUE
C4500(config-cmap)# match dscp af11 af12 af13
    ! Bulk Data (AF1) is assigned a dedicated queue
C4500(config)# class-map match-all SCAVENGER-QUEUE
C4500(config-cmap)# match dscp cs1
    ! Scavenger (CS1) is assigned a dedicated queue

    ! This section configures the 1P7Q1T+DBL egress queuing policy map
C4500(config)# policy-map 1P7Q1T
C4500(config-pmap-c)# class PRIORITY-QUEUE
C4500(config-pmap-c)# priority
    ! Defines a priority queue
C4500(config-pmap-c)# class CONTROL-MGMT-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 10
    ! Defines a control/management queue with 10% BW remaining
C4500(config-pmap-c)# class MULTIMEDIA-CONFERENCING-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 10
C4500(config-pmap-c)# db1
    ! Defines a multimedia conferencing queue with 10% BW remaining + DBL
C4500(config-pmap-c)# class MULTIMEDIA-STREAMING-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 10
C4500(config-pmap-c)# db1
    ! Defines a multimedia streaming queue with 10% BW remaining + DBL
C4500(config-pmap-c)# class TRANSACTIONAL-DATA-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 10
C4500(config-pmap-c)# db1

```

```

! Defines a transactional data queue with 10% BW remaining + DBL
C4500(config-pmap-c)# class BULK-DATA-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 4
C4500(config-pmap-c)# dbl
! Defines a bulk data queue with 10% BW remaining + DBL
C4500(config-pmap-c)# class SCAVENGER-QUEUE
C4500(config-pmap-c)# bandwidth remaining percent 1
! Defines a (minimal) scavenger queue with 1% BW remaining/limit
C4500(config-pmap-c)# class class-default
C4500(config-pmap-c)# bandwidth remaining percent 25
C4500(config-pmap-c)# dbl
! Provisions the default/Best Effort queue with 25% BW remaining + DBL

! This section attaches the egress queuing policy to the interface(s)
C4500(config)# interface range TenGigabitEthernet 1/1-2
C4500(config-if-range)# service-policy output 1P7Q1T

```

You can verify the configuration in Example 15-3 with the following commands:

- **show class-map**
- **show policy-map**
- **show policy-map interface** (as shown in Example 15-4)

Example 15-4 *Verifying Queuing Policies on a Catalyst 4500: show policy-map interface*

```

C4500# show policy-map interface TenGigabitEthernet 1/1
TenGigabitEthernet1/1
Service-policy output: 1P7Q1T
  Class-map: PRIORITY-QUEUE (match-any)
    102598 packets
    Match:  dscp ef (46)
           102598 packets
    Match:  dscp cs5 (40)
           0 packets
    Match:  dscp cs4 (32)
           0 packets
    priority queue:
      Transmit: 22782306 Bytes, Queue Full Drops: 0 Packets

  Class-map: CONTROL-MGMT-QUEUE (match-any)
    24847 packets

```