

## Chapter 8

# Configuring Forwarding Classes

It is helpful to think of forwarding classes as output queues. In effect, the end result of classification is the identification of an output queue for a particular packet. For a classifier to assign an output queue to each packet, it must associate the packet with one of the following forwarding classes:

- Expedited forwarding (EF)—Provides a low loss, low latency, low jitter, assured bandwidth, end-to-end service.
- Assured forwarding (AF)—Provides a group of values you can define and includes four subclasses: AF1, AF2, AF3, and AF4, each with three drop probabilities: low, medium, and high.
- Best effort (BE)—Provides no service profile. For the BE forwarding class, loss priority is typically not carried in a class-of-service (CoS) value, and random early detection (RED) drop profiles are more aggressive.
- Network control (NC)—This class is typically high priority because it supports protocol control.

For M-series platforms (except the M320 platform), you can configure up to four forwarding classes, one of each type: EF, AF, BE, and NC.

For M320 and T-series platforms, 16 forwarding classes are supported, thus allowing you to classify packets more granularly. For example, you can configure multiple classes of EF traffic: EF, EF1, and EF2. The software supports up to eight output queues; therefore, if you configure more than eight forwarding classes, you must map multiple forwarding classes to single output queues. For more information, see “Configuring Up to 16 Forwarding Classes” on page 91.

By default, the loss priority is low. On most platforms, you can configure high or low loss priority. On the following platforms you can configure high, low, medium-high, or medium-low loss priority:

- J-series Services Routers interfaces with Frame Relay encapsulation
- T-series and M320 platforms with Enhanced II Flexible PIC Concentrators (FPCs)
- T640 platforms with Enhanced Scaling FPC4

For more information, see “Classifying Frame Relay Traffic” on page 62 and “Configuring Tricolor Marking” on page 173.

To configure CoS forwarding classes, include the following statements at the [edit class-of-service] hierarchy level of the configuration:

```

class-of-service {
  forwarding-classes {
    class class-name queue-num queue-number priority (high | low);
    queue queue-number class-name priority (high | low);
  }
  interfaces {
    interface-name {
      unit logical-unit-number {
        forwarding-class class-name;
      }
    }
  }
  restricted-queues {
    forwarding-class class-name queue queue-number;
  }
}

```

This chapter discusses the following topics:

- Default Forwarding Classes on page 86
- Configuring Forwarding Classes on page 89
- Assigning a Forwarding Class to an Interface on page 90
- Overriding Fabric Priority Queuing on page 90
- Configuring Up to 16 Forwarding Classes on page 91
- Configuring Up to Eight Forwarding Classes on page 98

## Default Forwarding Classes

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By default, four queues are assigned to four forwarding classes. Table 16 on page 87 shows the four forwarding classes defined by default. These default mappings apply to all platforms.

If desired, you can rename the forwarding classes associated with the queues supported on your hardware. Assigning a new class name to an output queue does not alter the default classification or scheduling that is applicable to that queue. CoS configurations can be quite complicated, so unless it is required by your scenario, we recommend that you not alter the default class names or queue number associations.

Some platforms support eight queues. Queues 4 through 7 have no default mappings to forwarding classes. To use queues 4 through 7, you must create custom forwarding class names and map them to the queues. For more information, see “Configuring Up to Eight Forwarding Classes” on page 98.

**Table 16: Default Forwarding Classes**

Queue	Forwarding Class Name	Comments
Queue 0	best-effort (be)	The software does not apply any special CoS handling to packets with 000000 in the DiffServ field, a backward compatibility feature. These packets are usually dropped under congested network conditions.
Queue 1	expedited-forwarding (ef)	The software delivers assured bandwidth, low loss, low delay, and low delay variation (jitter) end-to-end for packets in this service class.  Routers accept excess traffic in this class, but in contrast to assured forwarding, out-of-profile expedited-forwarding packets can be forwarded out of sequence or dropped.
Queue 2	assured-forwarding (af)	The software offers a high level of assurance that the packets are delivered as long as the packet flow from the customer stays within a certain service profile that you define.  The software accepts excess traffic, but applies a RED drop profile to determine if the excess packets are dropped and not forwarded.  Depending on platform type, up to four drop probabilities (low, medium-low, medium-high, and high) are defined for this service class.
Queue 3	network-control (nc)	The software delivers packets in this service class with a low priority. (These packets are not delay sensitive.)  Typically, these packets represent routing protocol hello or keepalive messages. Because loss of these packets jeopardizes proper network operation, delay is preferable to discard.

The following rules govern queue assignment:

- If classifiers fail to classify a packet, the packet always receives the default classification to the class associated with queue 0.
- The number of queues is dependent on the hardware plugged into the chassis. CoS configurations are inherently contingent on the number of queues on the system. Only two classes, **best-effort** and **network-control**, are referenced in the default configuration. The default configuration works on all platforms.
- CoS configurations that specify more queues than the platform can support are not accepted. The commit fails with a detailed message that states the total number of queues available.

- All default CoS configuration is based on queue number. The name of the forwarding class that shows up when the default configuration is displayed is the forwarding class currently associated with that queue.

This is the default configuration for **forwarding-classes**:

```
[edit class-of-service]
forwarding-classes {
  queue 0 best-effort;
  queue 1 expedited-forwarding;
  queue 2 assured-forwarding;
  queue 3 network-control;
}
```

If you reassign the forwarding-class names, the **best-effort** forwarding-class name appears in the locations in the configuration previously occupied by **network-control** as follows:

```
forwarding-classes {
  queue 0 network-control;
  queue 1 assured-forwarding;
  queue 2 expedited-forwarding;
  queue 3 best-effort;
}
```

All the default rules of classification and scheduling that applied to queue 3 still apply. Queue 3 is simply now renamed **best-effort**.

On M320 and T-series platforms, you can assign multiple forwarding classes to a single queue. If you do so, the first forwarding class that you assign to queue 0 acquires the default BE classification and scheduling. The first forwarding class that you assign to queue 1 acquires the default EF classification and scheduling. The first forwarding class that you assign to queue 2 acquires the default AF classification and scheduling. The first forwarding class that you assign to queue 3 acquires the default NC classification and scheduling. For more information, see “Configuring Up to 16 Forwarding Classes” on page 91.

- In the current default configuration:
  - Only IP precedence classifiers are associated with interfaces.
  - The only classes designated are **best-effort** and **network-control**.
  - Schedulers are not defined for the **expedited-forwarding** or **assured-forwarding** classes.

- You must explicitly classify packets to the **expedited-forwarding** or **assured-forwarding** class and define schedulers for these classes.
- For ATM interfaces on M-series platforms, when you use fixed classification with multiple logical interfaces classifying to separate queues, a logical interface without a classifier attached inherits the most recent classifier applied on a different logical interface. For example, suppose you configure traffic through logical unit 0 to be classified into Q1, and you configure traffic through logical unit 1 to be classified into Q3. You want traffic through logical unit 2 to be classified into the default classifier, which is Q0. In this case, traffic through logical unit 2 is classified into Q3, because the configuration of logical unit 1 was committed last.

For more information, see “Routing Engine Protocol Queue Assignments” on page 35.

## Configuring Forwarding Classes

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You assign each forwarding class to an internal queue number by including the `forwarding-classes` statement at the `[edit class-of-service]` hierarchy level:

```
[edit class-of-service]
forwarding-classes {
    queue queue-number class-name;
}
```

You cannot commit a configuration that assigns the same forwarding class to two different queues.



**CAUTION:** We do not recommend classifying packets into a forwarding class that has no associated scheduler on the egress interface. Such a configuration can cause unnecessary packet drops because an unconfigured scheduling class might lack adequate buffer space. For example, if you configure a custom scheduler map that does not define queue 0, and the default classifier assigns incoming packets to the best-effort class (queue 0), the unconfigured egress queue for the best-effort forwarding class might not have enough space to accommodate even short packet bursts.

A default congestion and transmission control mechanism is used when an output interface is not configured for a certain forwarding class, but receives packets destined for that unconfigured forwarding class. This default mechanism uses the delay buffer and weighted round robin (WRR) credit allocated to the designated forwarding class, with a default drop profile. Because the buffer and WRR credit allocation is minimal, packets might be lost if a larger number of packets are forwarded without configuring the forwarding class for the interface.

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## Assigning a Forwarding Class to an Interface

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You can configure *fixed classification* on a logical interface by specifying a forwarding class to be applied to all packets received by the logical interface, regardless of the packet contents.

To assign a forwarding class configuration to the input logical interface, include the `forwarding-class` statement at the [edit class-of-service interfaces *interface-name* unit *logical-unit-number*] hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number]
  forwarding-class class-name;
```

You can include interface wildcards for *interface-name* and *logical-unit-number*.

In the following example, all packets coming into the router from the `ge-3/0/0.0` interface are assigned to the `assured-forwarding` forwarding class:

```
class-of-service {
  interfaces {
    ge-3/0/0 {
      unit 0 {
        forwarding-class assured-forwarding;
      }
    }
  }
}
```

## Overriding Fabric Priority Queuing

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On M320 and T-series platforms, the default behavior is for fabric priority queuing on egress interfaces to match the scheduling priority you assign. High-priority egress traffic is automatically assigned to high-priority fabric queues. Likewise, low-priority egress traffic is automatically assigned to low-priority fabric queues.

You can override the default fabric priority queuing of egress traffic by including the `priority` statement at the [edit class-of-service forwarding-classes queue *queue-number* *class-name*] hierarchy level:

```
[edit class-of-service forwarding-classes queue queue-number class-name]
  priority (high | low);
```

For information about associating a scheduler with a fabric priority, see “Associating a Scheduler with a Fabric Priority” on page 169.

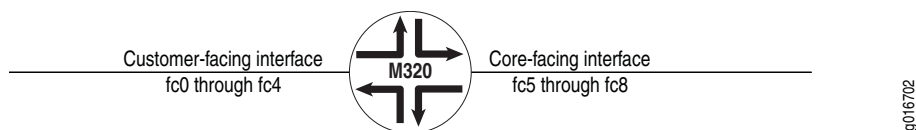
## Configuring Up to 16 Forwarding Classes

By default on all platforms, four output queues are mapped to four forwarding classes, as shown in Table 16 on page 87. For J-series, M320, and T-series platforms, you can configure more than four forwarding classes and queues.

On J-series Services Routers, you can configure up to eight forwarding classes and eight queues with one-to-one mapping of forwarding classes to queues. On M320 and T-series platforms, you can configure up to 16 forwarding classes and eight queues, with multiple forwarding classes assigned to single queues. The concept of assigning multiple forwarding classes to a queue is sometimes referred to as creating forwarding-class aliases. This section discusses the M320 and T-series platform configuration. For information about the J-series platform configuration, see “Configuring Up to Eight Forwarding Classes” on page 98.

Mapping multiple forwarding classes to single queues is useful. Suppose, for example, that forwarding classes are set based on multifield (MF) packet classification, and the MF classifiers are different for core-facing interfaces and customer-facing interfaces. Suppose you need four queues for a core-facing interface and five queues for a customer-facing interface, where `fc0` through `fc4` correspond to the classifiers for the customer-facing interface, and `fc5` through `fc8` correspond to classifiers for the core-facing interface, as shown in Figure 7.

**Figure 7: Customer-Facing and Core-Facing Forwarding Classes**



In this example, there are nine classifiers and, therefore, nine forwarding classes. The forwarding class-to-queue mapping is shown in Table 17.

**Table 17: Sample Forwarding Class-to-Queue Mapping**

Forwarding Class Names	Queue Number
fc0 fc5	0
fc1 fc6	1
fc2 fc7	2
fc3 fc8	3
fc4	4

To configure up to 16 forwarding classes, include the `class` and `queue-num` statements at the `[edit class-of-service forwarding-classes]` hierarchy level:

```
[edit class-of-service forwarding-classes]
class class-name queue-num queue-number;
```

You can configure up to 16 different forwarding-class names. The corresponding output queue number can be from 0 through 7. Therefore, you can map multiple forwarding classes to a single queue. If you map multiple forwarding classes to a queue, the multiple forwarding classes must refer to the same scheduler (at the [edit class-of-service scheduler-maps *map-name* forwarding-class *class-name* scheduler *scheduler-name*] hierarchy level).

When you configure up to 16 forwarding classes, you can use them as you can any other forwarding class—in classifiers, schedulers, firewall filters (MF classifiers), policers, CoS-based forwarding, and rewrite rules.



**NOTE:** The following limitations apply:

- The `class` and `queue` statements at [edit class-of-service forwarding-classes] hierarchy level are mutually exclusive. In other words, you can include one or the other of the following configurations, but not both:

```
[edit class-of-service forwarding-classes]
queue queue-number class-name;
```

```
[edit class-of-service forwarding-classes]
class class-name queue-num queue-number;
```

- When you configure IEEE 802.1P rewrite marking on Gigabit Ethernet IQ and Gigabit Ethernet IQ2 PICs, you cannot configure more than eight forwarding classes.
- For GRE and IP-IP tunnels, IP precedence and DSCP rewrite marking of the inner header do not work with more than eight forwarding classes.
- If the ID assigned to a forwarding class is from 8 through 15 and if the incoming interface is on a Gigabit Ethernet IQ2 PIC, fixed classification does not work. Fixed classification works on Gigabit Ethernet IQ2 PICs if the forwarding class used for fixed classification has an ID from 0 through 7.

You can determine the ID number assigned to a forwarding class by issuing the `show class-of-service forwarding-class` command. You can determine whether the classification is fixed by issuing the `show class-of-service forwarding-table classifier mapping` command. In the command output, if the `Table Type` field appears as `Fixed`, the classification is fixed. For more information about fixed classification, see “Assigning a Forwarding Class to an Interface” on page 90.

This section discusses the following topics:

- Enabling Eight Queues on Interfaces on page 93
- Multiple Forwarding Classes and Default Forwarding Classes on page 94
- PICs Restricted to Four Queues on page 95
- Examples: Configuring Up to 16 Forwarding Classes on page 96

For information about configuring eight forwarding classes on ATM2 IQ interfaces, see “Enabling Eight Queues on ATM2 IQ Interfaces” on page 261.

### **Enabling Eight Queues on Interfaces**

By default, PICs on T-series and M320 platforms are restricted to a maximum of four egress queues per interface. You can enable eight egress queues on some interfaces by including the `max-queues-per-interface` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
max-queues-per-interface (4 | 8);
```

The numerical value can be 4 or 8.

For J-series platforms, this statement is not supported. J-series platforms always have eight queues available.

The `max-queues-per-interface` statement is supported on the following PICs:

- 2-port ATM2 IQ OC3
- 4-port ATM2 IQ OC3
- 2-port ATM2 IQ E3
- 4-port ATM2 IQ E3
- 2-port ATM2 IQ DS3
- 4-port ATM2 IQ DS3
- 1-port ATM2 IQ OC12
- 2-port ATM2 IQ OC12
- 1-port ATM2 IQ OC48
- 2-port Channelized DS3 IQ
- 4-port Channelized DS3 IQ
- 10-port Channelized E1 IQ
- 10-port Channelized T1 IQ
- 1-port Channelized OC12 IQ
- 1-port Channelized STM1 IQ
- 2-port Channelized STM1 IQ
- 4-port E3 IQ
- 1-port Gigabit Ethernet IQ

- 2-port Gigabit Ethernet IQ
- 8-port Gigabit Ethernet IQ2
- 4-port Gigabit Ethernet IQ2
- 1-port 10-Gigabit Ethernet IQ2
- 1-port 10-Gigabit Ethernet IQ2, Type 3
- 8-port Gigabit Ethernet IQ2, Type 3
- 4-port SONET OC3
- 4-port SONET OC3 for the M160 platform

To determine how many queues an interface supports, you can check the CoS queues output field of the `show interfaces interface-name extensive` command:

```
user@host> show interfaces so-1/0/0 extensive
CoS queues: 8 supported
```

If you include the `max-queues-per-interface` statement, all ports on the PIC use the configured maximum. When you change between four queues and eight queues, all physical interfaces on the PIC are deleted and re-added.

For 4-port OC3c/STM1 Type I and Type II PICs on M320 and T-series platforms, when you include the `max-queues-per-interface 8` statement, you can configure up to eight queues on ports 0 and 2. After you commit the configuration, the PIC goes offline and comes back online with only ports 0 and 2 operational. No interfaces can be configured on ports 1 and 3. If you do not include the `max-queues-per-interface` statement or if you include the `max-queues-per-interface 4` statement, you can use all four ports and configure up to four queues per port.

For more information, see the *JUNOS System Basics Configuration Guide*.

## Multiple Forwarding Classes and Default Forwarding Classes

For queues 0 through 3, if you assign multiple forwarding classes to a single queue, default forwarding class assignment works as follows:

- The first forwarding class that you assign to queue 0 acquires the default BE classification and scheduling.
- The first forwarding class that you assign to queue 1 acquires the default EF classification and scheduling.
- The first forwarding class that you assign to queue 2 acquires the default AF classification and scheduling.
- The first forwarding class that you assign to queue 3 acquires the default NC classification and scheduling.

Of course you can override the default classification and scheduling by configuring custom classifiers and schedulers.

If you do not explicitly map forwarding classes to queues 0 through 3, then the respective default classes are automatically assigned to those queues. When you are counting the 16 forwarding classes, you must include in the total any default forwarding classes automatically assigned to queues 0 through 3. As a result, you can map up to 13 forwarding classes to a single queue when the single queue is queue 0, 1, 2, or 3. You can map up to 12 forwarding classes to a single queue when the single queue is queue 4, 5, 6, or 7. In summary, there must be at least one forwarding class each (default or otherwise) assigned to queue 0 through 3, and you can assign the remaining 12 forwarding classes (16–4) to any queue.

For example, suppose you assign two forwarding classes to queue 0 and you assign no forwarding classes to queues 1 through 3. The software automatically assigns one default forwarding class each to queues 1 through 3. This means 11 forwarding classes (16–5) are available for you to assign to queues 4 through 7.

For more information about default forwarding classes, see “Default Forwarding Classes” on page 86.

### **PICs Restricted to Four Queues**

Some T-series PICs support up to 16 forwarding classes and are restricted to 4 queues. Contact Juniper Networks customer support for a current list of T-series PICs that are restricted to four queues. To determine how many queues an interface supports, you can check the CoS queues output field of the `show interfaces interface-name extensive` command:

```
user@host> show interfaces so-1/0/0 extensive
CoS queues: 8 supported
```

By default, for T-series PICs that are restricted to four queues, the routing platform overrides the global configuration based on the following formula:

$$Q_r = Q_d \text{ mod } R_{\text{max}}$$

$Q_r$  is the queue number assigned if the PIC is restricted to four queues.

$Q_d$  is the queue number that would have been mapped if this PIC were not restricted.

$R_{\text{max}}$  is the maximum number of restricted queues available. Currently, this is four.

For example, assume you map the forwarding class `ef` to queue 6. For a PIC restricted to four queues, the queue number for forwarding class `ef` is

$$Q_r = 6 \text{ mod } 4 = 2.$$

To determine which queue is assigned to a forwarding class, use the `show class-of-service forwarding-class` command from the top level of the CLI. The output shows queue assignments for both global queue mappings and restricted queue mappings:

```
user@host> show class-of-service forwarding-class
Forwarding class      Queue  Restricted Queue  Fabric
priority
be                    0      2                 low
ef                    1      2                 low
assured-forwarding   2      2                 low
network-control      3      3                 low
```

For T-series PICs restricted to four queues, you can override the formula-derived queue assignment by including the `restricted-queues` statement at the `[edit class-of-service]` hierarchy level:

```
[edit class-of-service]
restricted-queues {
    forwarding-class class-name queue queue-number;
}
```

You can configure up to 16 forwarding classes. The output queue number can be from 0 through 3. Therefore, for PICs restricted to four queues, you can map multiple forwarding classes to single queues. If you map multiple forwarding classes to a queue, the multiple forwarding classes must refer to the same scheduler. The class name you configure at the `[edit class-of-service restricted-queues]` hierarchy level must be either a default forwarding class name from Table 16 on page 87, or a forwarding class you configure at the `[edit class-of-service forwarding-classes]` hierarchy level.

## Examples: Configuring Up to 16 Forwarding Classes

This section includes the following examples:

- Configuring 16 Forwarding Classes on page 96
- Restricted Queues: Mapping Two Forwarding Classes to Each Queue on page 97
- Configuring a Scheduler Map Applicable to an Interface Restricted to Four Queues on page 97

### Configuring 16 Forwarding Classes

Configure 16 forwarding classes:

```
class-of-service {
    forwarding-classes {
        class fc0 queue-num 0;
        class fc1 queue-num 0;
        class fc2 queue-num 1;
        class fc3 queue-num 1;
        class fc4 queue-num 2;
        class fc5 queue-num 2;
        class fc6 queue-num 3;
        class fc7 queue-num 3;
        class fc8 queue-num 4;
        class fc9 queue-num 4;
        class fc10 queue-num 5;
```

```

        class fc11 queue-num 5;
        class fc12 queue-num 6;
        class fc13 queue-num 6;
        class fc14 queue-num 7;
        class fc15 queue-num 7;
    }
}

```

**Restricted Queues:  
Mapping Two  
Forwarding Classes to  
Each Queue**

For PICs restricted to four queues, map four forwarding classes to each queue:

```

[edit class-of-service]
restricted-queues {
    forwarding-class fc0 queue 0;
    forwarding-class fc1 queue 0;
    forwarding-class fc2 queue 0;
    forwarding-class fc3 queue 0;
    forwarding-class fc4 queue 1;
    forwarding-class fc5 queue 1;
    forwarding-class fc6 queue 1;
    forwarding-class fc7 queue 1;
    forwarding-class fc8 queue 2;
    forwarding-class fc9 queue 2;
    forwarding-class fc10 queue 2;
    forwarding-class fc11 queue 2;
    forwarding-class fc12 queue 3;
    forwarding-class fc13 queue 3;
    forwarding-class fc14 queue 3;
    forwarding-class fc15 queue 3;
}

```

**Configuring a Scheduler  
Map Applicable to an  
Interface Restricted to  
Four Queues**

For PICs restricted to four queues, if you map multiple forwarding classes to a queue, the multiple forwarding classes must refer to the same scheduler:

```

[edit class-of-service]
scheduler-maps {
    interface-restricted {
        forwarding-class be scheduler Q0;
        forwarding-class ef scheduler Q1;
        forwarding-class ef1 scheduler Q1;
        forwarding-class ef2 scheduler Q1;
        forwarding-class af1 scheduler Q2;
        forwarding-class af scheduler Q2;
        forwarding-class nc scheduler Q3;
        forwarding-class nc1 scheduler Q3;
    }
}
[edit class-of-service]
restricted-queues {
    forwarding-class be queue 0;
    forwarding-class ef queue 1;
    forwarding-class ef1 queue 1;
    forwarding-class ef2 queue 1;
    forwarding-class af queue 2;
    forwarding-class af1 queue 2;
    forwarding-class nc queue 3;
    forwarding-class nc1 queue 3;
}

```

## Configuring Up to Eight Forwarding Classes

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By default on all platforms, four output queues are mapped to four forwarding classes, as shown in Table 16 on page 87. For J-series, M320, and T-series platforms, you can configure more than four forwarding classes and queues.

On J-series Services Routers, you can configure up to eight forwarding classes and eight queues. On M320 and T-series platforms, you can configure up to 16 forwarding classes and eight queues, with multiple forwarding classes assigned to single queues. This section discusses the J-series platform configuration of eight forwarding classes and queues with a one-to-one mapping. For information about the M320 and T-series platform configuration, see “Configuring Up to 16 Forwarding Classes” on page 91.

To configure up to eight forwarding classes, include the `queue` statement at the `[edit class-of-service forwarding-classes]` hierarchy level:

```
[edit class-of-service forwarding-classes]
queue queue-number class-name;
```

The output queue number can be from 0 through 7, and you must map the forwarding classes one-to-one with the output queues. The default scheduler transmission rate and buffer size percentages for queues 0 through 7 are 95, 0, 0, 5, 0, 0, 0, and 0 percent.

For information about configuring eight forwarding classes on ATM2 IQ interfaces, see “Enabling Eight Queues on ATM2 IQ Interfaces” on page 261.

### Examples: Configuring Up to Eight Forwarding Classes

Configure a one-to-one mapping between eight forwarding classes and eight queues:

```
[edit class-of-service]
forwarding-classes {
  queue 0 be;
  queue 1 ef;
  queue 2 af;
  queue 3 nc;
  queue 4 ef1;
  queue 5 ef2;
  queue 6 af1;
  queue 7 nc1;
}
```

**Defining Eight Classifiers**

```
[edit class-of-service]
classifiers {
  dscp dscp-table {
    forwarding-class ef {
      loss-priority low code-points [101000, 101001];
      loss-priority high code-points [101010, 101011];
    }
    forwarding-class af {
      loss-priority low code-points [010000, 010001];
      loss-priority high code-points [010010, 010011];
    }
    forwarding-class be {
      loss-priority low code-points [000000];
    }
    forwarding-class nc {
      loss-priority low code-points [111000];
    }
    forwarding-class ef1 {
      loss-priority low code-points [101100, 101101];
      loss-priority high code-points [101110];
    }
    forwarding-class af1 {
      loss-priority high code-points [101110];
    }
    forwarding-class ef2 {
      loss-priority low code-points [101111];
    }
    forwarding-class af2 {
      loss-priority low code-points [010000];
    }
  }
}
```

**Adding Eight Schedulers to a Scheduler Map**

Configure a custom scheduler map that applies globally to all interfaces, except those that are restricted to four queues:

```
[edit class-of-service]
scheduler-maps {
  sched {
    forwarding-class be scheduler Q0;
    forwarding-class ef scheduler Q1;
    forwarding-class af scheduler Q2;
    forwarding-class nc scheduler Q3;
    forwarding-class ef1 scheduler Q4;
    forwarding-class ef2 scheduler Q5;
    forwarding-class af1 scheduler Q6;
    forwarding-class nc1 scheduler Q7;
  }
}
schedulers {
  Q0 {
    transmit-rate percent 25;
    buffer-size percent 25;
    priority low;
    drop-profile-map loss-priority any protocol both drop-default;
  }
  Q1 {
    buffer-size temporal 2000;
    priority strict-high;
    drop-profile-map loss-priority any protocol both drop-ef;
  }
  Q2 {
    transmit-rate percent 35;
    buffer-size percent 35;
    priority low;
    drop-profile-map loss-priority any protocol both drop-default;
  }
  Q3 {
    transmit-rate percent 5;
    buffer-size percent 5;
    drop-profile-map loss-priority any protocol both drop-default;
  }
  Q4 {
    transmit-rate percent 5;
    priority high;
    drop-profile-map loss-priority any protocol both drop-ef;
  }
  Q5 {
    transmit-rate percent 10;
    priority high;
    drop-profile-map loss-priority any protocol both drop-ef;
  }
  Q6 {
    transmit-rate remainder;
    priority low;
    drop-profile-map loss-priority any protocol both drop-default;
  }
}
```

**Configuring an IP  
Precedence Classifier  
and Rewrite Tables**

```

Q7 {
    transmit-rate percent 5;
    priority high;
    drop-profile-map loss-priority any protocol both drop-default;
}
}

[edit class-of-service]
classifiers {
    inet-precedence inet-classifier {
        forwarding-class be {
            loss-priority low code-points 000;
        }
        forwarding-class af11 {
            loss-priority high code-points 001;
        }
        forwarding-class ef {
            loss-priority low code-points 010;
        }
        forwarding-class nc1 {
            loss-priority high code-points 011;
        }
        forwarding-class {
            loss-priority low code-points 100;
        }
        forwarding-class af12 {
            loss-priority high code-points 101;
        }
        forwarding-class ef1 {
            loss-priority low code-points 110;
        }
        forwarding-class nc2 {
            loss-priority high code-points 111;
        }
    }
}

exp exp-rw-table {
    forwarding-class be {
        loss-priority low code-point 000;
    }
    forwarding-class af11 {
        loss-priority high code-point 001;
    }
    forwarding-class ef {
        loss-priority low code-point 010;
    }
    forwarding-class nc1 {
        loss-priority high code-point 111;
    }
    forwarding-class be1 {
        loss-priority low code-point 100;
    }
    forwarding-class af12 {
        loss-priority high code-point 101;
    }
}

```

```
        forwarding-class ef1 {
            loss-priority low code-point 110;
        }
        forwarding-class nc2 {
            loss-priority low code-point 111;
        }
    }
inet-precedence inet-rw-table {
    forwarding-class be {
        loss-priority low code-point 000;
    }
    forwarding-class af11 {
        loss-priority high code-point 001;
    }
    forwarding-class ef1 {
        loss-priority low code-point 010;
    }
    forwarding-class nc1 {
        loss-priority low code-point 111;
    }
    forwarding-class be1 {
        loss-priority low code-point 100;
    }
    forwarding-class af12 {
        loss-priority high code-point 101;
    }
    forwarding-class ef1 {
        loss-priority low code-point 111;
    }
    forwarding-class nc2 {
        loss-priority low code-point 110;
    }
}
```