

Example: CoS with IPv6 DiffServ Configuration

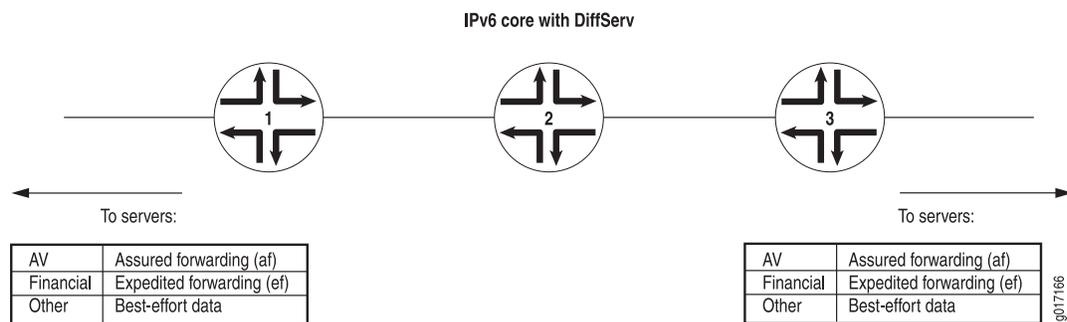
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Example: CoS with IPv6 DiffServ Configuration

The example assigns expedited forwarding to Q1 and a subset of the assured forwarding classes (af1x) to Q2, and distributes resources among all four forwarding classes.

Figure 1 shows the topology of the three routers and links that are used as a case study in this chapter.

Figure 1: Basic IPv6 DiffServ Topology



In this case study, the service provider has agreed to provide high-priority delivery of packets for two applications between the customer’s servers at two sites. The first application generates streams of high-definition audiovisual (television) packet flows and the second generates large quantities of time-sensitive financial information. In all cases, the packet flow is from server to server. The service provider marks the packets appropriately as they enter the network from either site, configures special queues and forwarding classes for this traffic on the three routers, and uses DiffServ for IPv6 for this purpose.

Routers 1 and 3 use multifield (MF) classifiers on the customer-facing interfaces to detect high-priority packets and rewrite the Differentiated Services code points (DSCPs) appropriately. Best-effort data and network control packets are not affected. All three routers are configured with consistent schedulers and resources to handle high-priority packets properly.

Figure 2: IPv6 DiffServ Configuration

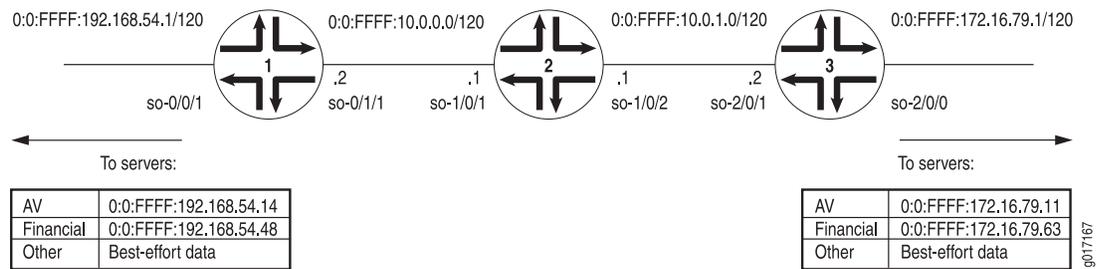


Figure 2 shows the complete topology for IPv6 DiffServ, complete with interfaces and IPv6 addresses. The IPv4-mapped IPv6 address format described in RFC 1884 is used.

Begin your configuration on Router 2, the core router. This ensures that when DiffServ is enabled on the edge routers, class of service (CoS) is enabled end to end through the network. The core router configuration is a little simpler because no MF classification is configured in the core.

```

Router 2 [edit]
class-of-service {
  classifiers { # Router 2 classifiers.
    dscp-ipv6 IPv6-classifier {
      import default; # Uses the DSCP default map.
      forwarding-class be-DATA-class {
        loss-priority high code-points 000001;
      }
      forwarding-class ef-FIN-class {
        loss-priority high code-points 101111;
      }
      forwarding-class af-AV-class {
        loss-priority high code-points 001100;
      }
      forwarding-class nc-CONTROL-class {
        loss-priority high code-points 110001;
      }
    }
  }
  drop-profiles { # Router 2 drop profiles.
    af-AV-normal {
      interpolate {
        fill-level [95 100];
        drop-probability [0 100];
      }
    }
    af-AV-with-PLP {
      interpolate {
        fill-level [60 70 80 90 95];
        drop-probability [80 90 95 97 100];
      }
    }
  }
  forwarding-classes { # Router 2 forwarding classes.

```

```

queue 0 be-DATA-class;
queue 1 ef-FIN-class;
queue 2 af-AV-class;
queue 3 nc-CONTROL-class;
}
interfaces { # Router 2 class-of-service interfaces.
  so-1/0/1 { # Connected to R1.
    scheduler-map diffserv-cos-map;
    unit 0 {
      classifiers {
        dscp-ipv6 IPv6-classifier;
      }
      rewrite-rules {
        dscp-ipv6 rewrite-IPv6-dscp;
      }
    }
  }
  so-1/0/2 { # Connected to R3.
    scheduler-map diffserv-cos-map;
    unit 0 {
      classifiers {
        dscp-ipv6 IPv6-classifier;
      }
      rewrite-rules {
        dscp-ipv6 rewrite-IPv6-dscp;
      }
    }
  }
}
rewrite-rules rewrite-IPv6-dscps { # Router 2 rewrite rules.
  forwarding-class be-DATA-class {
    loss-priority low code points 000000;
    loss-priority high code points 000001;
  }
  forwarding-class ef-FIN-class {
    loss-priority low code points 101110;
    loss-priority high code points 101111;
  }
  forwarding-class af-AV-class {
    loss-priority low code points 001010;
    loss-priority high code points 001100;
  }
  forwarding-class nc-CONTROL-class {
    loss-priority low code points 110000;
    loss-priority high code points 110001;
  }
}
scheduler-maps { # Router 2 scheduler maps.
  diffserv-cos-map {
    forwarding-class be-DATA-class scheduler be-DATA-scheduler;
    forwarding-class ef-FIN-class scheduler ef-FIN-scheduler;
    forwarding-class af-AV-class scheduler af-AV-scheduler;
    forwarding-class nc-CONTROL-class scheduler nc-CONTROL-scheduler;
  }
}
schedulers { # Router 2 schedulers.

```

```

be-DATA-scheduler {
    transmit-rate percent 40;
    buffer-size percent 40;
    priority low;
}
ef-FIN-scheduler {
    transmit-rate percent 10;
    buffer-size percent 10;
    priority high;
}
af-AV-scheduler {
    transmit-rate percent 45;
    buffer-size percent 45;
    priority high;
    drop-profile-map loss-priority low protocol any drop-profile af-AV-normal;
    drop-profile-map loss-priority high protocol any drop-profile af-AV-with-PLP;
}
nc-CONTROL-scheduler {
    transmit-rate percent 5;
    buffer-size percent 5;
    priority low;
}
}
}
interfaces { # R2 interfaces.
    so-1/0/1 { # Connected to R1.
        unit 0 {
            family inet {
                address 10.0.0.1/24;
            }
            family inet6 {
                address 0:0:FFFF:10.0.0.1/120;
            }
        }
    }
    so-1/0/2 { # Connected to R3.
        unit 0 {
            family inet {
                address 10.0.1.1/24;
            }
            family inet6 {
                address 0:0:FFFF:10.0.1.1/120;
            }
        }
    }
}
}

```

Continue your configuration on Router 1 and Router 3, the edge routers. These routers get firewall-filter-based MF classifiers and rewrite rules for markers as well as schedulers and drop profiles on the core-facing interfaces.

```

Router 1 [edit]
class-of-service {
    classifiers { # Router 1 classifiers.
        dscp-ipv6 IPv6-classifier {

```

```

import default; # Uses the DSCP default map.
forwarding-class be-DATA-class {
    loss-priority high code-points 000001;
}
forwarding-class ef-FIN-class {
    loss-priority high code-points 101111;
}
forwarding-class af-AV-class {
    loss-priority high code-points 001100;
}
forwarding-class nc-CONTROL-class {
    loss-priority high code-points 110001;
}
}
}
drop-profiles { # Router 1 drop profiles.
af-AV-normal {
    interpolate {
        fill-level [95 100];
        drop-probability [0 100];
    }
}
af-AV-with-PLP {
    interpolate {
        fill-level [60 70 80 90 95];
        drop-probability [80 90 95 97 100];
    }
}
}
forwarding-classes { # Router 1 forwarding classes.
    queue 0 be-DATA-class;
    queue 1 ef-FIN-class;
    queue 2 af-AV-class;
    queue 3 nc-CONTROL-class;
}
interfaces { # Router 1 class-of-service interfaces.
    so-0/1/1 { # To servers.
        scheduler-map diffserv-cos-map;
        unit 0 {
            classifiers {
                dscp-ipv6 IPv6-classifier;
            }
            rewrite-rules {
                dscp-ipv6 rewrite-IPv6-dscp;
            }
        }
    }
}
rewrite-rules rewrite-IPv6-dscps { # Router 1 rewrite rules.
    forwarding-class be-DATA-class {
        loss-priority low code points 000000;
        loss-priority high code points 000001;
    }
    forwarding-class ef-FIN-class {
        loss-priority low code points 101110;
        loss-priority high code points 101111;
    }
}

```

```

forwarding-class af-AV-class {
    loss-priority low code points 001010;
    loss-priority high code points 001100;
}
forwarding-class nc-CONTROL-class {
    loss-priority low code points 110000;
    loss-priority high code points 110001;
}
}
scheduler-maps { # Router 1 scheduler map.
diffserv-cos-map {
    forwarding-class be-DATA-class scheduler be-DATA-scheduler;
    forwarding-class ef-FIN-class scheduler ef-FIN-scheduler;
    forwarding-class af-AV-class scheduler af-AV-scheduler;
    forwarding-class nc-CONTROL-class scheduler nc-CONTROL-scheduler;
}
}
schedulers { # Router 1 schedulers.
be-DATA-scheduler {
    transmit-rate percent 40;
    buffer-size percent 40;
    priority low;
}
ef-FIN-scheduler {
    transmit-rate percent 10;
    buffer-size percent 10;
    priority high;
}
af-AV-scheduler {
    transmit-rate percent 45;
    buffer-size percent 45;
    priority high;
    drop-profile-map loss-priority low protocol any drop-profile af-AV-normal;
    drop-profile-map loss-priority high protocol any drop-profile af-AV-with-PLP;
}
nc-CONTROL-scheduler {
    transmit-rate percent 5;
    buffer-size percent 5;
    priority low;
}
}
}
firewall { # Router 1 firewall policer and filter.
    policer ef-FIN-Policer-Profile {
        if-exceeding {
            bandwidth-percent 10;
            burst-size-limit 2k;
        }
        then loss-priority high;
    }
    family inet6 {
        filter mf-classifier {
            filter-specific;
            term AV {
                from {
                    destination-address {

```



```

    }
  }
}

```

Router 3

```

[edit]
class-of-service {
  classifiers { # Router 3 classifiers.
    dscp-ipv6 IPv6-classifier {
      import default; # Uses the DSCP default map.
      forwarding-class be-DATA-class {
        loss-priority high code-points 000001;
      }
      forwarding-class ef-FIN-class {
        loss-priority high code-points 101111;
      }
      forwarding-class af-AV-class {
        loss-priority high code-points 001100;
      }
      forwarding-class nc-CONTROL-class {
        loss-priority high code-points 110001;
      }
    }
  }
}
drop-profiles { # Router 3 drop profiles.
  af-AV-normal {
    interpolate {
      fill-level [95 100];
      drop-probability [0 100];
    }
  }
  af-AV-with-PLP {
    interpolate {
      fill-level [60 70 80 90 95];
      drop-probability [80 90 95 97 100];
    }
  }
}
forwarding-classes { # Router 3 forwarding classes.
  queue 0 be-DATA-class;
  queue 1 ef-FIN-class;
  queue 2 af-AV-class;
  queue 3 nc-CONTROL-class;
}
interfaces { # Router 3 class-of-service interfaces.
  so-2/0/1 { # To servers.
    scheduler-map diffserv-cos-map;
    unit 0 {
      classifiers {
        dscp-ipv6 IPv6-classifier;
      }
      rewrite-rules {
        dscp-ipv6 rewrite-IPv6-dscp;
      }
    }
  }
}

```

```

rewrite-rules rewrite-IPv6-dscps { # Router 3 rewrite rules.
  forwarding-class be-DATA-class {
    loss-priority low code points 000000;
    loss-priority high code points 000001;
  }
  forwarding-class ef-FIN-class {
    loss-priority low code points 101110;
    loss-priority high code points 101111;
  }
  forwarding-class af-AV-class {
    loss-priority low code points 001010;
    loss-priority high code points 001100;
  }
  forwarding-class nc-CONTROL-class {
    loss-priority low code points 110000;
    loss-priority high code points 110001;
  }
}
scheduler-maps { # Router 3 scheduler map.
  diffserv-cos-map {
    forwarding-class be-DATA-class scheduler be-DATA-scheduler;
    forwarding-class ef-FIN-class scheduler ef-FIN-scheduler;
    forwarding-class af-AV-class scheduler af-AV-scheduler;
    forwarding-class nc-CONTROL-class scheduler nc-CONTROL-scheduler;
  }
}
schedulers { # Router 3 schedulers.
  be-DATA-scheduler {
    transmit-rate percent 40;
    buffer-size percent 40;
    priority low;
  }
  ef-FIN-scheduler {
    transmit-rate percent 10;
    buffer-size percent 10;
    priority high;
  }
  af-AV-scheduler {
    transmit-rate percent 45;
    buffer-size percent 45;
    priority high;
    drop-profile-map loss-priority low protocol any drop-profile af-AV-normal;
    drop-profile-map loss-priority high protocol any drop-profile af-AV-with-PLP;
  }
  nc-CONTROL-scheduler {
    transmit-rate percent 5;
    buffer-size percent 5;
    priority low;
  }
}
firewall { # Router 3 firewall policer and filter.
  policer ef-FIN-Policer-Profile {
    if-exceeding {
      bandwidth-percent 10;
      burst-size-limit 2k;
    }
  }
}

```

```

    then loss-priority high;
  }
family inet6 {
  filter mf-classifier {
    filter-specific;
    term AV {
      from {
        destination-address {
          0:0:FFFF:172.16.79.11;
        }
      }
      then {
        loss-priority low;
        forwarding-class af-AV-class;
      }
    }
    term Finance {
      from {
        destination-address {
          0:0:FFFF:172.16.79.63;
        }
      }
      then {
        policer ef-FIN-Policer-Profile;
        forwarding-class ef-FIN-class;
      }
    }
    term Network-Control {
      from {
        traffic-class 192; # 192 is the 110000 traffic class.
      }
      then {
        forwarding-class nc-CONTROL-class; # This is network control traffic.
      }
    }
    term Data {
      then forwarding-class be-DATA-class; # The rest is data.
    }
  }
}
interfaces { # Router 3 interfaces.
  so-2/0/0 { # To servers.
    unit 0 {
      family inet {
        address 1172.16.79.1/24;
      }
      family inet6 {
        filter {
          input mf-classifier;
        }
        address 0:0:FFFF:172.16.79.1/120;
      }
    }
  }
  so-2/0/1 { # to R2

```


010100	be-DATA-class	low
010101	be-DATA-class	low
010110	be-DATA-class	low
010111	be-DATA-class	low
011000	be-DATA-class	low
011001	be-DATA-class	low
011010	be-DATA-class	low
011011	be-DATA-class	low
011100	be-DATA-class	low
011101	be-DATA-class	low
011110	be-DATA-class	low
011111	be-DATA-class	low
100000	be-DATA-class	low
100001	be-DATA-class	low
100010	be-DATA-class	low
100011	be-DATA-class	low
100100	be-DATA-class	low
100101	be-DATA-class	low
100110	be-DATA-class	low
100111	be-DATA-class	low
101000	be-DATA-class	low
101001	be-DATA-class	low
101010	be-DATA-class	low
101011	be-DATA-class	low
101100	be-DATA-class	low
101101	be-DATA-class	low
101110	ef-FIN-class	low
101111	be-DATA-class	low
110000	nc-CONTROL-class	low
110001	be-DATA-class	low
110010	be-DATA-class	low
110011	be-DATA-class	low
110100	be-DATA-class	low
110101	be-DATA-class	low
110110	be-DATA-class	low
110111	be-DATA-class	low
111000	nc-CONTROL-class	low
111001	be-DATA-class	low
111010	be-DATA-class	low
111011	be-DATA-class	low
111100	be-DATA-class	low
111101	be-DATA-class	low
111110	be-DATA-class	low
111111	be-DATA-class	low
Classifier: IPv6-classifier, Code point type: dscp-ipv6, Index: 18301		
Code point	Forwarding class	Loss priority
000000	be-DATA-class	low
000001	be-DATA-class	high
000010	be-DATA-class	low
000011	be-DATA-class	low
000100	be-DATA-class	low
000101	be-DATA-class	low
000110	be-DATA-class	low
000111	be-DATA-class	low
001000	be-DATA-class	low
001001	be-DATA-class	low
001010	af-AV-class	low
001011	be-DATA-class	low
001100	af-AV-class	high
001101	be-DATA-class	low
001110	af-AV-class	high

001111	be-DATA-class	low
010000	be-DATA-class	low
010001	be-DATA-class	low
010010	be-DATA-class	low
010011	be-DATA-class	low
010100	be-DATA-class	low
010101	be-DATA-class	low
010110	be-DATA-class	low
010111	be-DATA-class	low
011000	be-DATA-class	low
011001	be-DATA-class	low
011010	be-DATA-class	low
011011	be-DATA-class	low
011100	be-DATA-class	low
011101	be-DATA-class	low
011110	be-DATA-class	low
011111	be-DATA-class	low
100000	be-DATA-class	low
100001	be-DATA-class	low
100010	be-DATA-class	low
100011	be-DATA-class	low
100100	be-DATA-class	low
100101	be-DATA-class	low
100110	be-DATA-class	low
100111	be-DATA-class	low
101000	be-DATA-class	low
101001	be-DATA-class	low
101010	be-DATA-class	low
101011	be-DATA-class	low
101100	be-DATA-class	low
101101	be-DATA-class	low
101110	ef-FIN-class	low
101111	ef-FIN-class	high
110000	nc-CONTROL-class	low
110001	nc-CONTROL-class	high
110010	be-DATA-class	low
110011	be-DATA-class	low
110100	be-DATA-class	low
110101	be-DATA-class	low
110110	be-DATA-class	low
110111	be-DATA-class	low
111000	nc-CONTROL-class	low
111001	be-DATA-class	low
111010	be-DATA-class	low
111011	be-DATA-class	low
111100	be-DATA-class	low
111101	be-DATA-class	low
111110	be-DATA-class	low
111111	be-DATA-class	low

```

Rewrite Rules user@R1> show class-of-service rewrite-rule type dscp-ipv6
Rewrite rule: dscp-ipv6-default, Code point type: dscp-ipv6, Index: 20
  Forwarding class      Loss priority  Code point
  be-DATA-class         low           000000
  be-DATA-class         high          000000
  ef-FIN-class          low           101110
  ef-FIN-class         high          101110
  af-AV-class           low           001010
  af-AV-class           high          001100
  nc-CONTROL-class     low           110000
  nc-CONTROL-class     high          111000

```

```

Rewrite rule: rewrite-IPv6-dscp, Code point type: dscp-ipv6, Index: 58077
Forwarding class      Loss priority      Code point
be-DATA-class         low                000000
be-DATA-class         high              000001
ef-FIN-class          low               101110
ef-FIN-class          high              101111
af-AV-class           low               001010
af-AV-class           high              001100
nc-CONTROL-class     low               110000
nc-CONTROL-class     high              110001

```

Class-of-Service Interfaces

```

user@R1> show class-of-service interface
...
Physical interface: so-0/0/1, Index: 141
Queues supported: 4, Queues in use: 4
Scheduler map: diffserv-cos-map, Index: -543019056
Logical interface: so-0/0/1.0, Index: 68
Object      Name                Type                Index
Rewrite     rewrite-IPv6-dscp   dscp-ipv6           58077
Rewrite     exp-default         exp                  21
Classifier  IPv6-classifier    dscp-ipv6           18301
Classifier  exp-default         exp                  5
...
Physical interface: so-0/1/1, Index: 144
Queues supported: 4, Queues in use: 4
Scheduler map: <default>, Index: -113795564

Logical interface: so-0/1/1.0, Index: 69
Object      Name                Type                Index
Rewrite     exp-default         exp                  21
Classifier  exp-default         exp                  5
Classifier  ipprec-compatibility ip                    8

```

Classifier Mapping

```

user@R1> show class-of-service forwarding-table classifier mapping
Table Index/
Interface  Index  Q num  Table type
so-0/0/1.0  68    18301 IPv6 DSCP
so-0/1/1.0  69     8     IPv4 precedence

```

Rewrite Rule Mapping

```

user@R1> show class-of-service forwarding-table rewrite-rule mapping
Interface  Index  Table index  Type
so-0/1/1.0  68    58077       IPv6 DSCP

```

Scheduler Map

```

user@R1> show class-of-service scheduler-map diffserv-cos-map
Scheduler map: diffserv-cos-map, Index: 1094596010
Scheduler: be-DATA-scheduler, Forwarding class: be-DATA-class, Index: 14343
Transmit rate: 40 percent, Rate Limit: none, Buffer size: 40 percent,
Priority: low
Drop profiles:
Loss priority  Protocol  Index  Name
Low            non-TCP   1      <default-drop-profile>
Low            TCP       1      <default-drop-profile>
High           non-TCP   1      <default-drop-profile>
High           TCP       1      <default-drop-profile>
Scheduler: ef-FIN-scheduler, Forwarding class: ef-FIN-class, Index: 21707
Transmit rate: 10 percent, Rate Limit: none, Buffer size: 10 percent,
Priority: high
Drop profiles:
Loss priority  Protocol  Index  Name
Low            non-TCP   1      <default-drop-profile>
Low            TCP       1      <default-drop-profile>

```

```

    High          non-TCP      1    <default-drop-profile>
    High          TCP          1    <default-drop-profile>
Scheduler: af-AV-scheduler, Forwarding class: af-AV-class, Index: 51704
  Transmit rate: 45 percent, Rate Limit: none, Buffer size: 45 percent,
  Priority: high
  Drop profiles:
    Loss priority  Protocol  Index  Name
    Low           non-TCP   61474  af-AV-normal
    Low           TCP       61474  af-AV-normal
    High          non-TCP   65199  af-AV-with-PLP
    High          TCP       65199  af-AV-with-PLP
Scheduler: nc-CONTROL-scheduler, Forwarding class: nc-CONTROL-class, Index:
50404
  Transmit rate: 5 percent, Rate Limit: none, Buffer size: 5 percent,
  Priority: low
  Drop profiles:
    Loss priority  Protocol  Index  Name
    Low           non-TCP   1      <default-drop-profile>
    Low           TCP       1      <default-drop-profile>
    High          non-TCP   1      <default-drop-profile>
    High          TCP       1      <default-drop-profile>
user@R1> show class-of-service forwarding-table scheduler-map
...
Interface: so-0/0/1 (Index: 141, Map index: -543019056, Map type: FINAL,
Num of queues: 4):
  Entry 0 (Scheduler index: 14343, Queue #: 0):
    Tx rate: 0 Kb (40%), Buffer size: 40 percent
  Priority low
    PLP high: 1, PLP low: 1, TCP PLP high: 1, TCP PLP low: 1
  Entry 1 (Scheduler index: 21707, Queue #: 1):
    Tx rate: 0 Kb (10%), Buffer size: 10 percent
  Priority high
    PLP high: 1, PLP low: 1, TCP PLP high: 1, TCP PLP low: 1
  Entry 2 (Scheduler index: 51704, Queue #: 2):
    Tx rate: 0 Kb (45%), Buffer size: 45 percent
  Priority high
    PLP high: 65199, PLP low: 61474, TCP PLP high: 65199, TCP PLP low: 61474
  Entry 3 (Scheduler index: 50404, Queue #: 3):
    Tx rate: 0 Kb (5%), Buffer size: 5 percent
  Priority low
    PLP high: 1, PLP low: 1, TCP PLP high: 1, TCP PLP low: 1
  ...

```

- Related Topics**
- [Class of Service Using IPv6 Solutions Page](#)
 - [Overview of Class of Service Using IPv6 DiffServ](#)
 - [System Requirements for CoS with DiffServ for IPv6](#)
 - [Roadmap for Configuring CoS with IPv6 DiffServ](#)