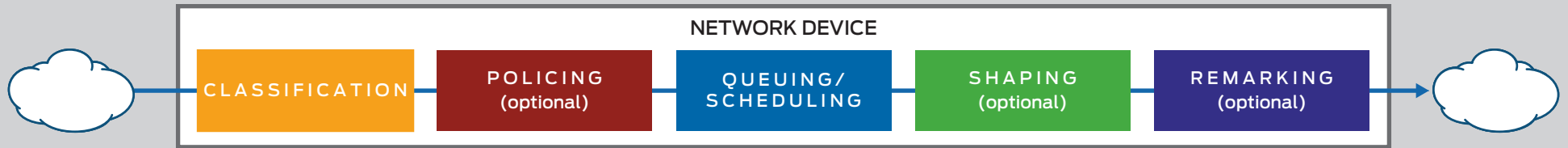


Obtain Quality of Service with Junos CoS

Junos CoS enables prioritization of traffic flows over a common path. It offers a means to recognize and control different types of traffic, provides the ability for applications to be considered more or less important, and provides mechanisms to manage congestion. Junos CoS is implemented "hop by hop", at each device in the data path.

→ Packet flow through a device running the Junos OS →



CLASSIFICATION

Classifiers assign inbound traffic to forwarding classes.

- Forwarding classes are linked to physical queues in the device.
- Classifiers also specify packet loss priority (drop precedence).
- Used by policers and schedulers to help determine which traffic to drop under congestion.

Junos OS includes four default classes:

- Best effort (BE), Expedited forwarding (EF), Assured forwarding (AF), Network control (NC).

Three methods of classification:

- Behavior aggregate (BA) – separates incoming traffic based on existing CoS markings.
- Multifield (MF) – separates incoming traffic based on packet header fields.
- Fixed – assigns all of an interface's incoming traffic to one forwarding class.

POLICING

Policing controls inbound traffic burstiness.

- Defines what is considered "too much" traffic.
- Provides first-level congestion management.

Thresholds determine in-profile vs. excess traffic.

- Bandwidth – data rate for traffic sent through policer (in bps).
- Burst size – number of bytes allowed during a burst (in bytes).
- Both thresholds exceeded together = excess traffic.

Two policer actions:

- 'Hard' policer – drops excess traffic.
- 'Soft' policer – marks excess traffic with lower priority.

QUEUING/SCHEDULING

Queuing and scheduling control the prioritization of traffic flows.

- Defines treatment of packets and queues.

Each queue has four configurable characteristics:

- Transmission rate – bandwidth assigned to the queue.
- Priority – importance of the queue (relative to other queues).
- Delay buffer – storage space during congestion.
- Congestion management (drop profiles) – amount and type of traffic to drop as congestion increases.

SHAPING

Shaping controls outbound traffic flow.

- Throttles the amount of traffic passing through an interface or queue to less than line rate.
- Provides egress rate-limiting for downstream congestion management.

REMARKING

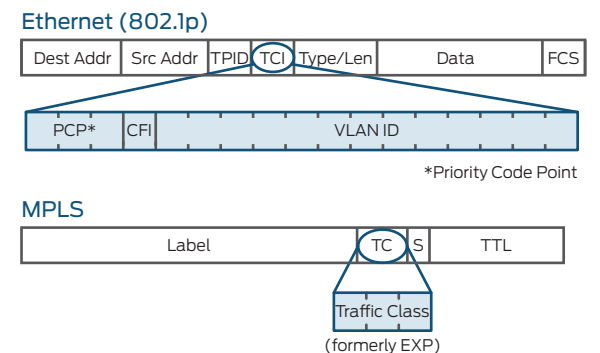
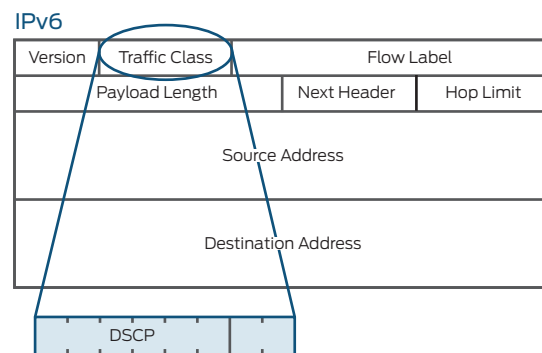
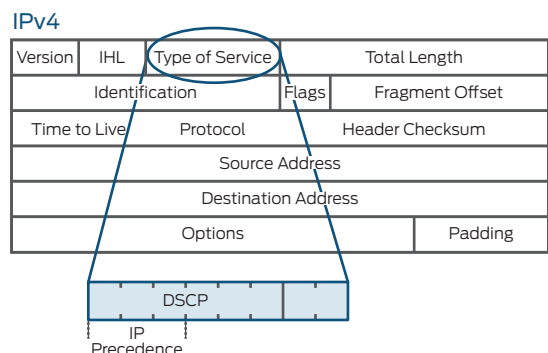
Remarking applies CoS values to outbound traffic.

- Simplifies packet classification processing for downstream devices.
- CoS values are assigned based on packets' forwarding class and packet loss priority (PLP) settings.

Reverse function of classification:

- Classification = inbound packet → forwarding class (and PLP).
- Remarking = Forwarding class (and PLP) → CoS-marked outbound packet.

CoS Fields in Packet Headers



For additional technical resources, please visit: www.juniper.net/documentation/



Class of Service Feature Guide for Routing Devices



Learning Bytes Series: Class of Service Basics



Day One: Deploying Basic QoS



Day One: Junos QoS for IOS Engineers



Training Course: Junos Class of Service (JCOS)



Learn About: Quality of Service (QoS)

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DAY ONE POSTER

Junos CoS

Juniper Networks Information and Learning Experience (iLX)

www.juniper.net/posters

Configuring Junos CoS

This example contains the main CoS configuration elements for a device running the Junos OS: forwarding classes, classifiers, policers, schedulers, shapers, and rewrite rules. Note that this example is for illustrative purposes only; while functional, there are many more configuration options and advanced settings not displayed here.

Class of Service Stanza

```

class-of-service {
  classifiers {
    dscp DSCP-BA-CLASSIFIER { A
      forwarding-class Voice {
        loss-priority low code-points ef;
      }
      forwarding-class Data-1 {
        loss-priority low code-points af41;
        loss-priority medium-high code-points cs4;
        loss-priority high code-points cs3;
      }
      forwarding-class Data-2 {
        loss-priority low code-points af21;
        loss-priority high code-points cs2;
      }
      forwarding-class Data-3-BE {
        loss-priority low code-points be;
        loss-priority high code-points cs1;
      }
      forwarding-class Network-Control {
        loss-priority low code-points [ cs6 cs7 ];
      }
    }
  }
  drop-profiles {
    WRED-DROP-PROFILE-MODERATE { D
      fill-level 75 drop-probability 20;
      fill-level 85 drop-probability 35;
      fill-level 95 drop-probability 50;
      fill-level 100 drop-probability 100;
    }
    WRED-DROP-PROFILE-AGGRESSIVE { D
      fill-level 50 drop-probability 10;
      fill-level 70 drop-probability 40;
      fill-level 85 drop-probability 75;
      fill-level 100 drop-probability 100;
    }
  }
  forwarding-classes {
    queue 0 Data-3-BE;
    queue 2 Voice;
    queue 3 Network-Control;
    queue 4 Data-2;
    queue 6 Data-1;
  }
  interfaces {
    ge-* {
      scheduler-map SCHEDULER-MAP-A; F
      unit * {
        classifiers {
          dscp DSCP-BA-CLASSIFIER; A
        }
        rewrite-rules {
          dscp DSCP-REMARKING; G
        }
      }
    }
    ge-0/0/1 {
      scheduler-map SCHEDULER-MAP-A; F
    }
  }
  rewrite-rules {
    dscp DSCP-REMARKING { G
      forwarding-class Voice {
        loss-priority low code-point ef;
      }
      forwarding-class Data-1 {
        loss-priority low code-point af41;
        loss-priority medium-high code-point cs4;
        loss-priority high code-point cs3;
      }
      forwarding-class Data-2 {
        loss-priority low code-point af21;
        loss-priority high code-point cs2;
      }
      forwarding-class Data-3-BE {
        loss-priority low code-point be;
        loss-priority high code-point cs1;
      }
    }
  }
  scheduler-maps {
    SCHEDULER-MAP-A { F
      forwarding-class Voice scheduler Voice-Scheduler;
      forwarding-class Data-1 scheduler Data-1-Scheduler;
      forwarding-class Data-2 scheduler Data-2-Scheduler;
      forwarding-class Data-3-BE scheduler Data-3-Scheduler;
      forwarding-class Network-Control scheduler Nwk-Ctl-Scheduler;
    }
  }
  schedulers {
    Voice-Scheduler {
      transmit-rate percent 10;
      buffer-size percent 5;
      priority high;
    }
    Data-1-Scheduler {
      transmit-rate percent 10;
      buffer-size percent 10;
      priority medium-high;
    }
    Data-2-Scheduler {
      transmit-rate percent 40;
      buffer-size percent 25;
      priority medium-low;
      drop-profile-map loss-priority low protocol any drop-profile WRED-DROP-PROFILE-MODERATE; D
    }
    Data-3-Scheduler {
      transmit-rate {
        remainder;
      }
      buffer-size {
        remainder;
      }
      priority low;
      drop-profile-map loss-priority low protocol any drop-profile WRED-DROP-PROFILE-AGGRESSIVE; D
    }
    Nwk-Ctl-Scheduler {
      transmit-rate percent 5;
      buffer-size percent 5;
      priority high;
    }
  }
}

```

Code Point Aliases
(included by default on Junos devices)
can be used in place of numeric values

```

user@device> show class-of-service
code-point-aliases dscp

Code point type: dscp
Alias   Bit pattern
af11   001010
af12   001100
af13   001110
af21   010010
af22   010100
af23   010110
af31   011010
af32   011100
af33   011110
af41   100010
af42   100100
af43   100110
be     000000
cs1    001000
cs2    010000
cs3    011000
cs4    100000
cs5    101000
cs6    110000
cs7    111000
ef     101110
nc1    110000
nc2    111000

```

CoS uses a modularized configuration model. Some elements are created and then referenced elsewhere.

Create Reference

- A** Apply the BA classifier to the desired inbound interface(s)
- B** Apply the policers within the firewall filters (MF classifiers)
- C** Apply the firewall filter (MF classifier) to the desired inbound interface(s)
- D** Apply the drop profiles within the schedulers
- E** Use a scheduler-map to apply schedulers to traffic classes
- F** Apply the scheduler-map to the desired outbound interface(s)
- G** Apply the rewrite rule to the desired outbound interface(s)

Firewall Stanza

```

firewall {
  family inet {
    filter MF-CLASSIFIER { C
      term VOICE {
        from {
          protocol udp;
          port 16384-32767;
        }
        then {
          loss-priority low;
          forwarding-class Voice;
          accept;
        }
      }
      term INTERACTIVE-VIDEO {
        from {
          protocol [ tcp udp ];
          port 6060-6061;
        }
        then {
          loss-priority low;
          forwarding-class Data-1;
          accept;
        }
      }
      term CALL-SIGNALING {
        from {
          protocol tcp;
          port 1720;
        }
        then {
          loss-priority high;
          forwarding-class Data-1;
          accept;
        }
      }
      term NETWORK-MANAGEMENT-TELNET-SSH {
        from {
          protocol tcp;
          port [ telnet ssh ];
        }
        then {
          loss-priority high;
          forwarding-class Network-Control;
          accept;
        }
      }
      term ICMP-POLICE {
        from {
          protocol [ icmp icmp6 ];
        }
        then {
          policer POLICER-ICMP-5M-DISCARD; B
          forwarding-class Data-2;
          accept;
        }
      }
      term BEST-EFFORT-INTRANET-TRAFFIC {
        from {
          protocol tcp;
          port 8080;
        }
        then {
          policer POLICER-250M-FC_D3-BE; B
          forwarding-class Data-2;
          accept;
        }
      }
      term BEST-EFFORT-TRAFFIC {
        from {
          protocol tcp;
          port [ ftp ftp-data http https ];
        }
        then {
          loss-priority high;
          forwarding-class Data-3-BE;
          accept;
        }
      }
      term all-else {
        then accept;
      }
    }
  }
  policer POLICER-ICMP-5M-DISCARD { B
    if-exceeding {
      bandwidth-limit 10m;
      burst-size-limit 625k;
    }
    then discard;
  }
  policer POLICER-250M-FC_D3-BE { B
    if-exceeding {
      bandwidth-limit 250m;
      burst-size-limit 625k;
    }
    then {
      loss-priority low;
      forwarding-class Data-3-BE;
    }
  }
}

```

Interfaces Stanza

```

interfaces {
  ...
  ge-0/0/2 {
    unit 0 {
      family inet {
        filter {
          input MF-CLASSIFIER; C
        }
        address 192.168.1.254/24;
      }
    }
  }
  ...
}

```

For additional technical resources, please visit: www.juniper.net/documentation/