## Enabling CoS Shaping-Rate Adjustments for Subscriber Local Loops

You can enhance a CoS implementation by enabling an MX-series router to adjust the hierarchical CoS policy shaping rate configured for static interface sets that consist of two or more VLANs and represent subscriber local loops. Whenever the digital subscriber line access multiplexer (DSLAM) resynchronizes its data transmission rate to a digital subscriber line (DSL), the router adjusts the shaping rate for the associated subscriber interface so that the maximum bandwidth allocation cannot exceed the current data rate for the associated subscriber local loop. This feature ensures that data transmission rate adjustments by the DSLAM do not cause bandwidth contention at the subscriber's residential gateway.

This topic includes the following tasks:



### *Configuring Static Logical Interface Sets to Serve as CoS Hierarchical Scheduler Nodes for Subscriber Loops*

To configure a logical interface set, begin by including the interface-set statement with the *interface-set-name* option at the [edit interfaces] hierarchy level.

An interface set is composed of two or more logical interfaces on the same physical interface. Each logical interface in an interface set corresponds to an individual subscriber service, such as voice, video, or data. To specify either a list of logical unit numbers or the single outer VLAN tag used to identify the logical interfaces that compose the interface set, include statements at the [edit interfaces interface-set *interface-set-name*] hierarchy level:

- For an interface set composed of a list of logical interfaces identified by an inner VLAN tag on Ethernet frames (called the customer VLAN, or C-VLAN, tag), you must specify each logical interface by including the unit statement with the *logical-unit-number* option.

```
[edit]
interfaces {
    interface-set interface-set-name {
        interface ethernet-interface-name { # EQ DPC port
            unit logical-unit-number;
            unit logical-unit-number;
```

```
        . . .
      }
      . . .
    }
  }
```

- For an interface set composed of a set of VLANs grouped at the DSLAM and identified by the same service VLAN (S-VLAN) tag), you must specify the S-VLAN tag as the outer VLAN tag for each VLAN by including the vlan-tags-outer statement with the *vlan-tag* option.

```
[edit]
interfaces {
  interface-set interface-set-name {
    interface ethernet-interface-name { # EQ DPC port
      vlan-tags-outer vlan-tag; # Identify the DSLAM
    }
    . . .
  }
}
```

For more information about configuring CoS hierarchical schedulers, see the *JUNOS Class of Service Configuration Guide*.

## Configuring the Logical Interfaces That Compose the Static Logical Interface Sets

Each underlying physical interface must be configured to operate in hierarchical scheduler mode and to support stacked VLAN tagging on all logical interfaces. To configure, include the hierarchical-scheduler statement and the stacked-vlan-tagging statement at the [edit interfaces *ethernet-interface-name*] hierarchy level.

To associate the individual logical interfaces of an interface set with specific subscriber services provided by the subscriber local loop, bind an S-VLAN tag and a C-VLAN tag to each logical interface that belongs to a scheduler node that represents a subscriber local loop. Ethernet frames sent from the logical interfaces contain an outer VLAN tag that identifies a DSLAM and an inner VLAN tag that identifies a subscriber port on the DSLAM. To configure, include the vlan-tags statement at each logical interface:

```
[edit]
interfaces {
  ethernet-interface-name { # EQ DPC port underlying an interface set
    hierarchical-scheduler;
    stacked-vlan-tagging; # Support 802.1Q VLAN dual-tagged frames
    unit logical-unit-number { # Bind S-VLAN and C-VLAN tags to logical interface
      vlan-tags inner tpid.vlan-id outer tpid.vlan-id;
    }
    . . .
  }
}
```

For more information about configuring 802.1Q VLANs, see the *JUNOS Network Interfaces Configuration Guide*.

### *Configuring Hierarchical CoS on the Static Logical Interface Sets That Serve as Hierarchical Scheduler Nodes for Subscriber Local Loops*

To configure hierarchical CoS on the static logical interface set that serves as the hierarchical scheduler node for a subscriber local loop:

1. For each scheduler node that represents a subscriber local loop, configure an initial shaping rate.

**NOTE:** The CoS shaping-rate feature is supported only for scheduler nodes with a configured shaping rate. The initial shaping rate must be configured by applying a traffic-control profile that includes the shaping-rate statement. Specify the initial shaping rate as a peak rate, in bits per second (bps), and not as a percentage. Other methods of configuring a shaping rate are not supported with this feature.

- To enable traffic heading downstream (from the router to the DSLAM) to be gathered into an interface set, include the interface-set statement and define the logical interface set name as the *interface-set-name* option at the [edit class-of-service interfaces] hierarchy level.
- To apply output traffic scheduling and shaping parameters at the logical interface set level (rather than at the logical unit level), include the output-traffic-control-profile statement and specify the name of a traffic-control profile as the *profile-name* option at the [edit class-of-service interfaces interface-set *interface-set-name*] hierarchy level.

To configure, include the following statements:

```
interfaces { # Configure interface-specific CoS for incoming packets
    interface-set interface-set-name { # Configure a hierarchical scheduler
        output-traffic-control-profile tc-profile-name; # Level 3 scheduler node
    }
    . . .
}
traffic-control-profiles { # Define traffic-control profiles
    tc-profile-name { # Specify a scheduler map and traffic-shaping parameters
        scheduler-map map-name;
        shaping-rate rate; # This is the "configured shaping rate"
        guaranteed-rate (percent percentage | rate);
        delay-buffer-rate (percent percentage | rate);
    }
    . . .
}
```

You can include the statements at the following hierarchy levels:

- [edit class-of-service]
- [edit dynamic-profiles *profile-name* class-of-service]

2. Configure the scheduler maps referenced in the traffic-control profiles applied to the interface sets, the schedulers referenced in those scheduler maps, and the drop profiles referenced in those schedulers.

   - A scheduler map establishes the traffic output queues (forwarding classes) for a scheduler node and associates each queue with a specific scheduler map.
   - A scheduler defines queue properties (transmit rate, buffer size, priority, and drop profile) that specify how traffic is treated in the output queue.
   - A drop profile specifies how aggressively the MX-series router drops packets that are managed by a particular scheduler by defining either a segmented or interpolated graph that maps output queue fullness to packet drop probability.

   To configure, include the statements at the static [edit class-of-service] hierarchy level:

```
[edit]
class-of-service {
    scheduler-maps { # Assign queuing characteristics to output queues
        map-name { # Map output queues to
            forwarding-class class-name scheduler scheduler-name;
            forwarding-class class-name scheduler scheduler-name;
            ...
        }
        ...
    }
    schedulers { # Define queuing characteristics
        scheduler-name { # Specify queuing and buffer management
            transmit-rate transmit-rate-option;
            buffer-size buffer-size-option;
            priority priority-level;
            drop-profile-map loss-priority loss-priority-option protocol any drop-profile
                drop-profile-name;
            . . .
        }
    }
    drop-profiles { # Define random early detection (RED) for the delay buffer
        drop-profile–name { # Specify how to drop packets from an output queue
            drop-profile-name ( # Map a queue fullness to a drop probability
                fill-level percentage drop-probability percentage; # Option 1: segmented
                fill-level percentage drop-probability percentage;
                . . .
            }
                interpolate { # Option 2: interpolated
                    drop-probability [ values ];
                    fill-level [ values ];
                }
            }
        . . .
    }
}
```

For more information about configuring scheduler maps, schedulers, and drop profiles, see the *JUNOS Class of Service Configuration Guide*.

## *Configuring ANCP Functionality That Supports and Drives Shaping-Rate Adjustments for Subscriber Local Loops*

To configure the Access Node Control Protocol (ANCP) functionality that supports and drives the shaping-rate adjustments for subscriber local loops:

- Enable ANCP to monitor subscriber local loop rates at the DSLAMs and communicate this information to CoS.
- Configure each DSLAM as an ANCP neighbor of the router so that TCP connections can be established between the router and each DSLAM.
- Identify the subscriber interface sets whose traffic is monitored and shaped by ANCP, and associate those interface sets with the corresponding identifiers configured on the access node (DSLAM) to uniquely identify the subscriber local loops within the access network.

  ANCP uses this information to build a mapping of subscribers to subscriber interfaces. When ANCP receives port management messages from a DSLAM or other access node, it uses the access identifier contained in the message to determine which hierarchical scheduler node corresponds to the subscriber.

To configure, include statements at the [edit protocols ancp] hierarchy level:

```
[edit]
protocols {
    ancp {
        qos-adjust; # Enable ANCP to monitor and adjust CoS shaping rates
        neighbor ip-address; # Configure each DSLAM as an ANCP neighbor
        . . .
        interfaces { # Identify subscribers for which ANCP can adjust shaping rates
            interface-set {
                interface-set-name {
                    access-identifier identifier-string; # DSLAM ID for the local loop
                }
            }
            . . .
        }
        . . .
    }
    . . .
}
```

## *Displaying Configuration Information About ANCP*

If ANCP is enabled, the following operational commands display or clear information about the ANCP configuration:

- To display ANCP neighbor information, issue the show ancp neighbor operational command.
- To clear ANCP neighbors, issue the clear ancp neighbor operational command.

- To display ANCP subscriber information, issue the show ancp subscriber operational command.
- To display ANCP class-of-service information, issue the show ancp cos operational command.

If ANCP is not yet enabled, the process starts when you commit a configuration that contains the protocols ancp stanza.

For more information about ANCP, see ANCP Topology Discovery and Traffic Monitoring Overview and Configuring ANCP.

### *Displaying Configuration Information About Shaping-Rate Adjustments for Subscriber Local Loops*

To display the configured shaping rate and the adjusted shaping rate for each logical interface set configured for hierarchical CoS, issue the show class-of-service interface-set operational command.

**NOTE:** After shaping-rate adjustments are enabled and the router has performed shaping-rate adjustments on a scheduler node, you can configure a new shaping rate by including the shaping-rate statement in a traffic-control profile and then applying that profile to that scheduler node. However, this new shaping-rate value does not immediately result in shaping traffic at the new rate. The scheduler node continues to be shaped at rate set by ANCP. Only when the ANCP shaping-rate adjustment feature is disabled is the scheduler node shaped at the newly configured shaping-rate.

**Related Topics**

- CoS Shaping-Rate Adjustments for Subscriber Local Loops Overview
- Guidelines for Configuring CoS Shaping-Rate Adjustments for Subscriber Local Loops
- Disabling CoS Shaping-Rate Adjustments for Subscriber Local Loops
- Example: Configuring Hierarchical CoS Shaping-Rate Adjustments for Subscriber Local Loops