

Configuring QoS on the Satellite System

Release	Modification
Release 6.1.2	Included details for QoS offload on NCS 5000 Series Satellite.

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QoS on the Satellite System

AutoQoS which automates consistent deployment of QoS features is enabled on the satellite system. All the user-configured Layer2 and Layer3 QoS features are applied on the ASR9000 and no separate Qos configuration required for the satellite system. Auto-Qos handles the over-subscription of the ICL links. All other QoS features, including broadband QoS, on regular ports are supported on satellite ports as well. System congestion handling between the ASR9000 Series Router and satellite ports is setup to maintain priority and protection. AutoQoS Provide sufficient differentiation between different classes of traffic that flow on the satellite ICLs between the ASR9000 Series Router and the Satellite .

The system can support up to 14 unique shape rates for 1G port shapers. 1G ports are represented using a L0 entity in the Traffic Manager (TM) hierarchy. Port shapers are applied at this level. When speed changes on satellite ports, QOS EA would automatically reconfigure any policy-maps based on underlying satellite ports speed. However if there are no policies, then the Policy Manager (PM) needs to setup the speed of the port by calling the port-shaper API (Application Programming Interface). The system shall modify any policies which are percentage-based when the underlying ports speed changes due to AN. There would be a timelag for the Autonegotiated speed to be propagated to the policies on the ASR9000 series router and during that time, packet drops are expected in the satellite device.

Note On satellite access ports, the port and top-level policy shapers calculate traffic rates using the full Layer 1 frame size, including physical and internal overheads. This approach enforces accurate bandwidth limits based on actual transmission usage.

For more information about QoS for the satellite system, refer the *Modular QoS Configuration Guide for Cisco ASR 9000 Series Routers*.

Limitations

- Queueing on an ingress service-policy is not supported on satellite interfaces.
- Only flat and 2-level HQoS policies are supported on satellite interfaces in L2 Fabric and simple ring topologies.
- The burst size can be set to a wide range of sizes up to 2000 ms. However, for satellite ports, the actual burst size when queuing (shaping) is used is always set to 500 usec of 1Gbits or less. This is because of constraints in the hardware.

Auto QoS

Traffic from the Satellite nV system to the Cisco ASR 9000 series router and traffic from the Cisco ASR 9000 series router to the Satellite nV system have been discussed.

Satellite to Cisco ASR 9000 Series Router

- Traffic is handled using the trusted port model.
- Automatic packet classification rules determine whether a packet is control packet (LACP, STP, CDP, CFM, ARP, OSPF etc), high priority data (VLAN COS 5,6,7, IP prec 5, 6, 7) or normal priority data and queued accordingly.

Note Cisco NCS 5000 Series satellite does not classify further into LACP, OAM, BFD and so on as on earlier satellites.

- All user-configured Layer 2 and Layer 3 features(including QoS) are applied on the Cisco ASR 9000 Series Host and not on the satellite.
- Protocol types auto-prioritized by the satellite - all IEEE control protocols (01 80 C2 xx xx xx), LACP, 802.3ah, CFM, STP, CDP, LLDP, ARP, OSPF, BFD, RIP, BGP, IGMP, RSVP, HSRP, VRRP p2 q.

Note Cisco NCS 5000 Series satellite does not auto prioritize the protocols mentioned above.

- User data packets auto-prioritized by the satellite - VLAN COS 5, 6, 7, IP precedence 5, 6, 7 MPLS EXP 5, 6, 7. MPLS EXP is not classified in the case of Cisco NCS 5000 series satellite.

Note Cisco NCS 5000 Series devices used as nV satellite

Figure 1: AutoQoS, Cisco ASR 9000v satellite to host

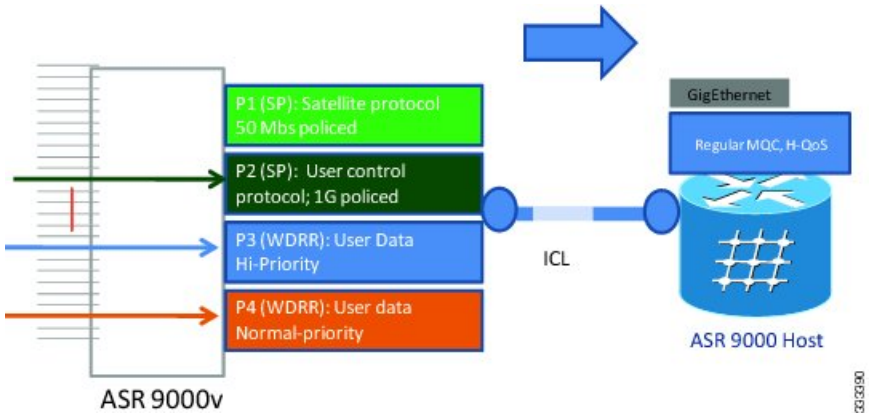
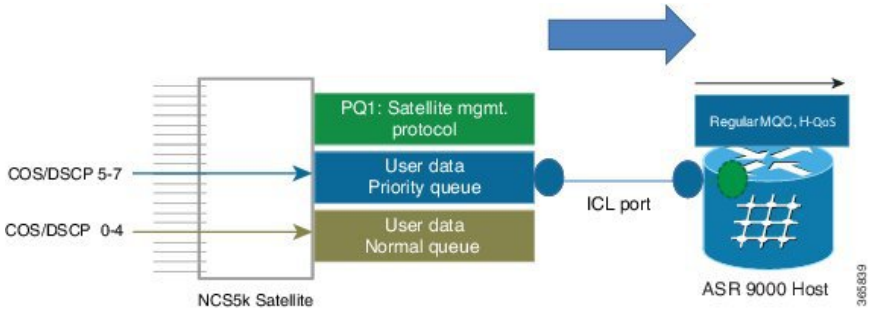


Figure 2: AutoQoS, Cisco NCS 500x series satellite to host



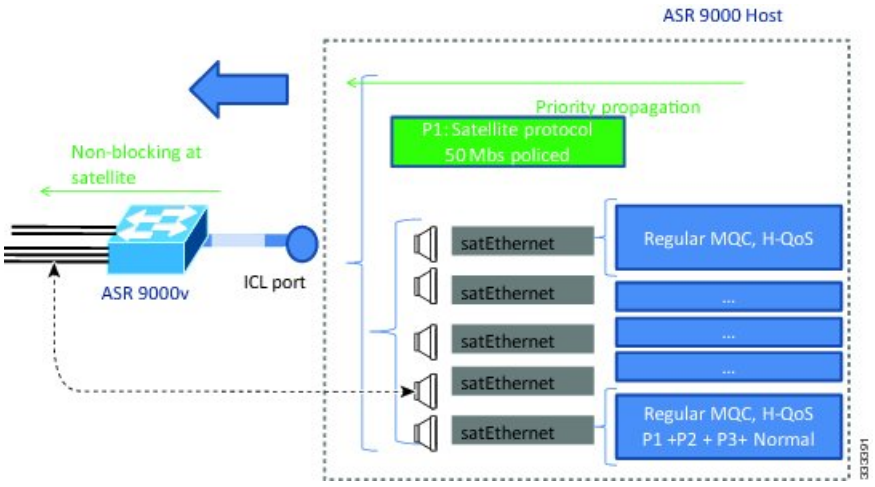
Cisco ASR 9000 Series Router to Satellite

- Traffic targeted to a satellite egress port is shaped on Cisco ASR 9000 to match downstream access port speed.

Note There is no need for further QoS on the satellite itself, since Cisco ASR 9000 QoS is sufficient and provides necessary deep buffering normally not available on Cisco ASR 9000v satellite device with its 4 MB buffers or Cisco NCS 5000 Series standalone device with its 16 MB buffers.

- Traffic is streamed based on the full 3-level egress queuing hierarchy.
- Each remotely managed satellite access GigE port is auto-shaped to match access line speed.
- Satellite protocols going over ICL default queues get highest scheduling priority while full 3 level MQC hierarchy is supported on the egress satellite ports.

Figure 3: AutoQoS, host to satellite



Note The above connections are also applicable to the Cisco NCS 5000 Series devices used as nV satellite.

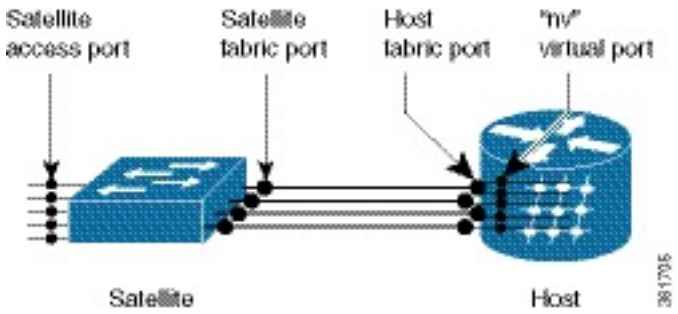
QoS Offload on Satellite

The Cisco ASR 9000 Series Router Satellite System enables you to configure a topology in which one or more satellite switches complement one or more Cisco ASR 9000 Series Router, to collectively deploy a single virtual switching system. In this system, the satellite switches act under the management control of the routers. The connections between the Cisco ASR 9000 Series Router and the satellite switches are called the Inter-chassis link (ICL), which is established using standard Ethernet interfaces.

The ICL link between the Cisco ASR 9000 Series Router and the satellite gets oversubscribed by the access interfaces on the satellite box. This is because the QoS policies applied on the satellite interfaces are programmed on the Cisco ASR 9000 Series Router Line card locally. Therefore, the flow of traffic on the ICL from the satellite switch is not controlled. This leads a loss of high-priority traffic due to congestion on the ICL.

This figure shows the ports where the QoS policies may be applied.

Figure 4: Satellite and Host connection



Benefits of QoS Offload

The QoS offload feature protects the control packets when Satellite fabric links (SFL) is congested. The offloading of QoS policies helps to drop excess traffic at the ingress direction (or access ports) and prioritize the protocol control traffic at the egress direction (or SFL).

Supported Platform-Specific Information for QoS Offload

This section describes the supported capability matrix, various supported classification combinations, and the supported scalability matrix for 9000v and ASR 901 satellites.

Supported Capability Matrix

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
Classification					
Ingress					
COS	Yes	Yes	Yes	0-7	The cos classification is done on the outer vlan tag. **Note** The cos classification based on match-rule is not applicable for untagged packets on the ingress direction.
IP DSCP	Yes	Yes	Yes	0-63	IP DSCP is supported for untagged, single-tagged, double-tagged, and mac-in-mac packets on the ingress direction, from the access-side. IP DSCP is supported for IPv4 and IPv6.

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
IP PREC	Yes	Yes	Yes	0-7	IP PREC is supported for untagged, single-tagged, double-tagged, and mac-in-mac packets on the ingress direction, from the access-side. IP PR is supported only for IPv4.
MPLS EXPERIMENTAL TOPMOST	Yes	No	Yes	0-7	The mpls experimental topmost feature is supported only for the untagged packets on the ingress direction, from the access-side.
VLAN	Yes	No	No	1-4096	The vlan classification is done on the outer vlan tag based on the policies and the cos value applied on the outer vlan tag. **Note** The vlan classification based on outer vlan tag is not applicable for untagged packets on the ingress direction.
Egress					

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
QOS-GROUP	Yes	Yes	Yes	• 1-5 for 9000v • 1-7 for Cisco NCS 500x	A class-map with multiple "match qos-group" statements is not supported. **Note** • qos-group 0 corresponds to class-default, hence, it cannot be configured. • For 9000v, qos-group 6 and qos-group 7 are reserved, and hence, it cannot be configured.
IP DSCP	No	No	Yes	0-63	—
IP PREC	No	No	Yes	0-7	—
Marking					
Ingress					
COS	Yes	Only outer COS	No	0-7	The cos marking is done on the vlan tag that is added by the satellite on the direction towards host.
DISCARDCLASS	NA	NA	Yes	0-2	The discard-class feature is used along with WRED. But, WRED is not supported in 9000v. Hence, this feature is supported only in 901 satellites.

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
IP DSCP	Yes **Note** IP DSCP marking is supported for IPv4 and IPv6.	Yes	Yes **Note** IP DSCP marking is supported for IPv4.	0-63	IP DSCP is supported for untagged, single-tagged, double-tagged, and mac-in-mac packets on the ingress direction, from the access-side.
MPLS EXPERIMENTAL IMPOSITION	No	No	Yes	0-7	—
IP PREC	Yes	No	Yes	0-7	IP PREC is supported for untagged, single-tagged, double-tagged, and mac-in-mac packets on the ingress direction, from the access-side.
QOS-GROUP	Yes	Yes	Yes	• 1-5 for 9000v • 1-7 for Cisco NCS 500x	The qos-group marking feature is only used to redirect packets to a particular queue. The set qos-group 0 on ingress policy is necessary to send the packets to queue 0 on ICL. **Note** If the QoS classification rule at the ICL interface in the egress and ingress direction matches, then the packets are directed to the configured group, else the packets are directed to the class-default group.

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
Police Actions (Ingress Marking)					
QOS-GROUP TRANSMIT	Yes	Yes	Yes	0-5	The set qos-group 6 and 7 is not configurable. On 901 satellites, qos-group 0 is not configurable.
PREC-TRANSMIT	Yes	Yes	Yes	0-7	—
DISCARD-CLASS	No	No	Yes	0-2	—
DSCP-TRANSMIT	Yes	Yes	Yes	0-63	—
COS-TRANSMIT	Yes	Yes	No	0-7	The cos-transmit is done on the vlan tag that is added by the satellite on the host direction.
Egress (Marking)					
IP DSCP	No	No	Yes	0-63	—
IP PREC	No	No	Yes	0-7	—
MPLS EXPERIMENTAL TOPMOST	No	No	Yes	0-7	—
Queuing					
Egress					
Note: For 901 satellite, queuing related actions such as bandwidth, priority, or shape is supported only with **qos-group** classification.					

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
Bandwidth Value	Yes	No	No	8-10000000	For a 9000v satellite, bandwidth value cannot be configured under qos-group 3. A combination of bandwidth types cannot be configured. For example, the bandwidth command can be configured either with kbps, or remaining percent, or remaining ratio, but not with a combination of all.
Bandwidth Percent	Yes	No	Yes	—	
Bandwidth Remaining	Yes	Yes	Yes	1-127	
Bandwidth Remaining Percent	Yes	Yes	Yes	—	
Ratio	Yes	Yes	No	—	
Priority lev 1-3	Yes	Only Priority level 1 is supported	Yes	—	On 9000v satellites, when a priority level is configured at the host, it by default gets configured to priority percent 85 on the satellite. On 9000v satellites, the priority action cannot be combined with other queuing actions. On 9000v satellites, only one class-map with a priority action can be configured. On 9000v satellites, the priority action is only supported under qos-group 3.
Priority Percent	Yes	NA	Yes	—	
Random Detect ~~Discard-class-based~~	No	No	Yes	Discard-class: 0-2 Thresholds: 1-8192000	—

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
Shape Average	Yes	Yes	Yes	8000-10000000000	On 9000v satellites, the shape average command cannot be configured under qos-group 3. On 901 satellites, the shape command cannot be used in the class-default class map unless you use hierarchical policy maps and apply shaping to the parent policy map.
Shape Average Percent	Yes	Yes	No	—	On 9000v satellites, the shape average percent command cannot be configured under qos-group 3.
HQOS	Yes	No	Yes	—	Only **class-default** can be configured in the parent policy map, while configuring H-QoS in the egress direction. Only shape average is supported under the class-default of the parent policy map. For a 9000v satellite, the minimum value that is supported is 40 mbps. For a 901 satellite, the minimum value that is supported is 250 kbps.
Rate Limiting					

Feature	Support on 9000v Platform	Support on Cisco NCS 5000 Series Router (Only from R6.1.2 onwards)	Support on 901 Platform (Not supported from R5.3.3 onwards).	Range	Restrictions
1R2C	Yes	Yes. For more information, please refer *Modular QoS Configuration Guide for Cisco NCS 5000 Series Routers*	Yes	CIR/PIR: 8000-100000000000 Burst bytes: 1000-256000000 Burst ms:1-2000	The bytes can be configured in milliseconds (ms) only if CIR is in percent. **Note** • CIR stands for Committed Information Rate and PIR stands for Peak Information Rate. • Transmit and marking actions are not supported together.
1R3C 2R3C	Yes	NA	Yes		If the exceed-action command is configured, then violate-action is copied from exceed-action, by default. If the exceed-action is not configured, then violate-action and exceed-action are dropped. **Note** • On ASR 9000v platform, 1R3C and 2R3C statistics are supported only for conform & violate actions. • Transmit and marking actions are not supported together. On 901 satellites, only green and red counters are supported.

Supported Capability Matrix for Cisco 8000 Series satellites

Feature	Support on Cisco 8000 Series Routers	Range
Classification		
Ingress		
COS	Yes	0-7
IP DSCP	Yes	0-63
IPv4 DSCP	Yes	—
IPv6 DSCP	Yes	—
IP PREC (IPv4 and IPv6)	Yes	0-7
MPLS EXPERIMENTAL TOPMOST	Yes	0-7
VLAN	No	—
Egress		
TRAFFIC-CLASS	Yes	1-7
IP DSCP	No	—
IP PREC	No	—
Marking		
Ingress		
COS	Only outer COS	0-7
DISCARD-CLASS	No	—
IP DSCP	Yes	0-63
MPLS EXPERIMENTAL TOPMOST	Yes	0-7
IP PREC	Yes	0-7
TRAFFIC-CLASS	Yes	1-7
Police Actions (Ingress Marking)		
QOS-GROUP TRANSMIT	No	—
PREC-TRANSMIT	No	—
DISCARD-CLASS	No	—

Feature	Support on Cisco 8000 Series Routers	Range
DSCP-TRANSMIT	No	—
COS-TRANSMIT	No	—
Egress (Marking)		
IP DSCP	No	
IP PREC	No	
MPLS EXPERIMENTAL TOPMOST	No	
Queuing		
Egress		
Bandwidth Value	No	—
Bandwidth Percent	No	—
Bandwidth Remaining Ratio	Yes	—
Priority lev	Yes	1-7
Priority Percent	No	—
Random Detect Discard-class-based	No	—
Shape Average	Yes	8000- 10000000000
Shape Average Percent	Yes	—
HQOS	No	—
Rate Limiting		
1R2C	Yes	CIR/PIR: 8000-10000000000 Burst bytes: 1000- 256000000 Burst ms:1-2000
1R3C	No	
2R3C	Yes	

The example shows how to configure the access policy at the ingress of the access interface and ICL policy at the egress of the ICL interface.

```
Router#sh run interface TenGigE 100/0/0/4
Mon May 25 11:32:13.773 IST
interface TenGigE100/0/0/4
 shutdown
 nv
  service-policy input policymap_6_0_0_12
 !
```

```
!

Router#sh run interface TenGigE0/1/0/2/1
Mon May 25 11:32:20.702 IST
interface TenGigE0/1/0/2/1
 nv
  satellite-fabric-link satellite 100
   service-policy output icl_qos_offload_egress_policy
   remote-ports TenGigE 0/0/16-20,22-24
  !
 !
!
Router#sh run policy-map icl_qos_offload_egress_policy
Mon May 25 11:32:46.542 IST
policy-map icl_qos_offload_egress_policy
 class TC7
  priority level 1
 !
 class TC5
  priority level 3
 !
 class TC4
  priority level 4
 !
 class TC6
  priority level 2
 !
 class TC3
  shape average percent 12
 !
 class TC1
  shape average percent 10
 !
 class TC2
  shape average percent 5
 !
 class class-default
  bandwidth remaining ratio 25
 !
 end-policy-map
!

Router#sh run policy-map access_ingress_policy
Mon May 25 11:35:12.026 IST
policy-map access_ingress_policy
 class classmap_6_1_0_0
  police rate percent 4 peak-rate percent 8
  !
  set traffic-class 1
 !
 class classmap_6_2_0_0
  police rate percent 4 peak-rate percent 8
  !
  set traffic-class 2
 !
 class classmap_6_3_0_0
  police rate percent 4 peak-rate percent 8
  !
  set traffic-class 3
 !
 class classmap_6_4_0_0
  police rate percent 4 peak-rate percent 8
  !
  set traffic-class 4
```

```
 !
 class classmap_6_6_0_0
  police rate percent 6
  !
  set traffic-class 6
 !
 class classmap_6_7_0_0
  set dscp 56
  set traffic-class 7
 !
 class classmap_1_5_0_0
  set traffic-class 5
  police rate percent 4 peak-rate percent 8
  !
 !
 class class-default
  police rate percent 6
  !
 !
 end-policy-map
!
```

The example shows the service policy status of the ICL interface.

```
Router#show qos status interface TenGigE0/1/0/2/1 nv
Mon May 25 11:36:38.236 IST
TenGigE0/1/0/2/1 direction input: Service Policy not installed

TenGigE0/1/0/2/1  Satellite: 100 output: icl_qos_offload_egress_policy

     Last Operation Attempted :  ADD
     Status                   :  ACTIVE
```

The example shows the service policy status of the access interface.

```
Router#show qos status interface TenGigE 100/0/0/5 nv
Mon May 25 11:36:19.760 IST

TenGigE100/0/0/5  Satellite: 100 input: access_ingress_policy

     Last Operation Attempted :  IN-PLACE MODIFY
     Status                   :  ACTIVE
TenGigE100/0/0/5 direction output: Service Policy not installed
```

Supported Classification Combination

These are the allowed classification combination in Cisco ASR 9000 Series Router :

- COS + IP DSCP
- IP DSCP +VLAN
- COS + VLAN
- IP DSCP + IP PREC

Note The IP DSCP + IP PREC combination is not supported for 9000v.

The table lists the allowed classification combinations in 9000v:

Match-all class map	DSCP + PREC + COS
	PREC + DSCP + VLAN
Match-any class map	VLAN + COS + PREC + DSCP
	DSCP + VLAN + COS
	DSCP + PREC + COS
	VLAN + COS + PREC

Note For NCS 5000 Series Satellite, COS+DSCP match is the only supported classification combination on ingress. For Egress, policies can only match on qos-group (1 per class-map). For Egress offload policies on NCS 5000 Series Satellite, it is mandatory to configure eight class-maps including class-default for eight queues, even if all the class maps are not in use.

Supported Scalability Matrix for 9000v

Class-map with options	Number of Field Programmable (FP) entries needed per policy-map(max 8 classes)	Max policy-maps supported
cos (0-7)	7 + 1 (class default)	2304/8 = 288
ip dscp (0-63)	7 + 1	2304/8 = 288
ip precedence (0-7)	7 + 1	2304/8 = 288
vlan (1-4094)	7 + 1	2304/8 = 288
match-any or match-all with single argument		
cos + dscp cos+ prec cos + vlan dscp + vlan prec + vlan	2 *7 + 1 (class-default) = 15	2304/15 = 153.6

Class-map with options	Number of Field Programmable (FP) entries needed per policy-map(max 8 classes)	Max policy-maps supported
match-any with maximum arguments to the match parameters		
cos (max 4)+ ip precedence (max 4)	8 * 7 + 1 (class-default) = 57	2304/57 = 40.4
cos (4) + ip dscp (8)	12 * 7 + 1 (class-default)= 85	2304/85 = 27.1
cos (4) + vlan (30)	34 * 7 + 1 = 239	2304/239 = 9.6
vlan (30) + ip prec (4)	34 *7 + 1 = 239	2304/239 = 9.6
vlan (30)+ip dscp (8)	38*7 + 1 =267	2304/267 = 8.6
match-all with maximum arguments		
cos (4) + ip dscp (8)	32 *7 + 1=225	2304/225 = 10.2
cos (4) + vlan (30)	120 *7+ 1=841	2304/841 = 2.7
vlan (30) + ip prec (4)	120*7+1=841	2304/841 = 2.7
cos (4) + ip prec (4)	16 *7 +1= 113	2304/113 = 20.3
vlan (30) + ip dscp (8)	240 *7 + 1 = 1681	2304/1681 =1.3

Supported Scalability Matrix for 901

ASR 901 satellites are not supported from R5.3.3 onwards.



Note Any number of class-maps can be configured per policy-map. However, a maximum of only 32 policy-maps can be configured.

Class-map with options	Maximum Number of Field Programmable (FP) Entries
Class-map with options	300
cos (0-7)	
ip dscp (0-63)	
ip precedence (0-7)	
mpls exp topmost (0-7)	

QoS Offload Configuration Overview

Three steps to configure QoS Offload are:

1. Create a class-map of the type ‘qos’.
2. Create a policy-map of the type ‘qos’ using the above configured class map.
3. Bind QoS policy to Satellite interfaces such as physical access, bundle access, physical ICL, and bundle ICL.

To modify a QoS Offload configuration:

1. Modify the class-map or policy-map without unbinding the policy-map from the applied interface.



Note QoS Offload configuration with **police rate** in **pps** unit is not supported.

Sample QoS Offload Configuration

```
class-map match-any my_class
 match dscp 10
 end-class-map
!
policy-map my_policy
 class my_class
 police rate percent 30
!
end-policy-map
!
interface GigabitEthernet100/0/0/9
 ipv4 address 10.1.1.1 255.255.255.0
  nv
   service-policy input my_policy
!
!
```

Prerequisites for QoS Offload Configuration

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance. Before configuring the QoS offload feature, you must have these hardware and software installed in your chassis.

- Hardware—Cisco ASR 9000 Series Aggregation Services Routers with Cisco ASR 9000 Enhanced Ethernet line cards as the location of Inter Chassis Links and Cisco ASR9000v or Cisco ASR9000v-V2 or Cisco NCS 500x Series as Satellite box.
- Software—Cisco IOS XR Software Release 5.1.1 or higher for ASR9000v and ASR 901 satellites. Cisco IOS XR Software Release 6.1.2 or higher for QoS offload and QoS offload on bundle ICL features, on Cisco NCS 5000 Series satellites.

Offloading Service-policy on Physical Access Port

Perform these tasks to offload the service-policy on the physical access port. This procedure offloads the service-policy in the ingress direction of the Satellite Ethernet interface.

SUMMARY STEPS

1. **configure**
2. **class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name*
3. **match precedence***precedence-value* [*precedence-value1 ... precedence-value6*]
4. **end-class-map**
5. **policy-map** [**type qos**] *policy-name*
6. **class** *class-name*
7. **set qos-group** *qos-group-value*
8. **exit**
9. **end-policy-map**
10. **interface** *type interface-path-id*
11. (Optional) **l2transport**
12. **nv**
13. **service-policy input** *policy-map*
14. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name* **Example:** `RP/0/RSP0/CPU0:router(config)# class-map match-any class1`	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. If you specify **match-any**, one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. This is the default. If you specify **match-all**, the traffic must match all the match criteria.
Step 3	**match precedence***precedence-value* [*precedence-value1 ... precedence-value6*] **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match precedence 5`	Identifies IP precedence values as match criteria. • Value range is from 0 to 7. • Reserved keywords can be specified instead of numeric values.

	Command or Action	Purpose
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration.
Step 5	**policy-map** [**type qos**] *policy-name* **Example:** `RP/0/RSP0/CPU0:router(config)# policy-map policy1`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters the policy map configuration mode.
Step 6	**class** *class-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class1`	Specifies the name of the class whose policy you want to create or change.
Step 7	**set qos-group** *qos-group-value* **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# set qos-group 5`	Sets the QoS group identifiers on IPv4 or MPLS packets.
Step 8	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# exit`	Returns the router to policy map configuration mode.
Step 9	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# end-policy-map`	Ends the policy map configuration.
Step 10	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface gigabitethernet 100/0/0/0`	Configures an interface and enters the interface configuration mode.
Step 11	(Optional) **l2transport** **Example:** `RP/0/RSP0/CPU0:router(config-if)# l2transport`	Configures the L2 transport offload for satellite.
Step 12	**nv** **Example:**	Enters the satellite network virtualization (nV) configuration submode.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-if)# nv`	
Step 13	**service-policy input** *policy-map* **Example:** `RP/0/RSP0/CPU0:router(config-if-nV)# service-policy input policy1`	Attaches a policy map to an input interface to be used as the service policy for that interface.
Step 14	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Offloading Service-policy on Bundle Access Port

Perform these tasks to offload the service-policy on the bundle access port. This procedure offloads the service-policy in the ingress direction of the Satellite Ethernet interface.

SUMMARY STEPS

1. **configure**
2. **class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name*
3. **match precedence***precedence-value*
4. **end-class-map**
5. **policy-map** [**type qos**] *policy-name*
6. **class** *class-name*
7. **set qos-group** *qos-group-value*
8. **exit**
9. **end-policy-map**
10. **interface** *type interface-path-id*
11. **bundle id** *bundle-id*
12. (Optional) **l2transport**
13. **nv**
14. **service-policy input** *policy-map*
15. Use the **commit** or **end** command.
16. **exit**
17. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name* **Example:** `RP/0/RSP0/CPU0:router(config)# class-map match-any class2`	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. If you specify **match-any**, one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. This is the default. If you specify **match-all**, the traffic must match all the match criteria.
Step 3	**match precedence***precedence-value* **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match precedence 6`	Identifies IP precedence values as match criteria. • Value range is from 0 to 7. • Reserved keywords can be specified instead of numeric values.
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration.
Step 5	**policy-map** [**type qos**] *policy-name* **Example:** `RP/0/RSP0/CPU0:router(config)# policy-map policy2`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters the policy map configuration mode.
Step 6	**class** *class-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class2`	Specifies the name of the class whose policy you want to create or change.
Step 7	**set qos-group** *qos-group-value* **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# set qos-group 5`	Sets the QoS group identifiers on IPv4 or MPLS packets.

	Command or Action	Purpose
Step 8	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# exit`	Returns the router to policy map configuration mode.
Step 9	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# end-policy-map`	Ends the policy map configuration.
Step 10	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface bundle-ether 1`	Configures an interface and enters the interface configuration mode.
Step 11	**bundle id** *bundle-id* **Example:** `RP/0/RSP0/CPU0:router(config-if)# bundle id 1`	Creates a multilink interface bundle with the specified bundle ID.
Step 12	(Optional) **l2transport** **Example:** `RP/0/RSP0/CPU0:router(config-if)# l2transport`	Configures the L2 transport offload for satellite.
Step 13	**nv** **Example:** `RP/0/RSP0/CPU0:router(config-if)# nv`	Enters the satellite network virtualization (nV) configuration submode.
Step 14	**service-policy input** *policy-map* **Example:** `RP/0/RSP0/CPU0:router(config-if-nV)# service-policy input policy2`	Attaches a policy map to an input interface to be used as the service policy for that interface.
Step 15	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes.

	Command or Action	Purpose
		• **Cancel** —Remains in the configuration session, without committing the configuration changes.
Step 16	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-if)# exit`	Returns the router to global configuration mode.
Step 17	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Offloading Service-policy on Physical Satellite Fabric Link

Perform these tasks to offload the service-policy on the physical Satellite Fabric Link (SFL). This procedure offloads the service-policy in the egress direction of SFL.

SUMMARY STEPS

1. **configure**
2. **class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name*
3. **match qos-group** [*qos-group-value*]
4. **end-class-map**
5. **policy-map** [**type qos**] *policy-name*
6. **class** *class-name*
7. **bandwidth** {*bandwidth* [*units*] | **percent** *value*}
8. **exit**
9. **end-policy-map**
10. **interface** *type interface-path-id*
11. **nv**
12. **satellite-fabric-link satellite** *satellite_id*
13. **remote-ports** *interface_type remote_subslot*
14. **service-policy output** *policy-map*
15. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name* **Example:** `RP/0/RSP0/CPU0:router(config)# class-map match-any class3`	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. If you specify **match-any**, one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. This is the default. If you specify **match-all**, the traffic must match all the match criteria.
Step 3	**match qos-group** [*qos-group-value*] **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match qos-group 5`	Specifies service (QoS) group values in a class map to match packets. • *qos-group-value* identifier argument is specified as the exact value or range of values from 0 to 63. • Up to eight values (separated by spaces) can be entered in one match statement. • **match qos-group**command is supported only for an egress policy.
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration.
Step 5	**policy-map** [**type qos**] *policy-name* **Example:** `RP/0/RSP0/CPU0:router(config)# policy-map policy3`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters the policy map configuration mode.
Step 6	**class** *class-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class3`	Specifies the name of the class whose policy you want to create or change.
Step 7	**bandwidth** {*bandwidth* [*units*] | **percent** *value*} **Example:**	Specifies the bandwidth allocated for a class belonging to a policy map.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-pmap-c)# bandwidth percent 13`	
Step 8	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# exit`	Returns the router to policy map configuration mode.
Step 9	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# end-policy-map`	Ends the policy map configuration.
Step 10	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface TenGigE 0/1/0/0`	Configures an interface and enters the interface configuration mode.
Step 11	**nv** **Example:** `RP/0/RSP0/CPU0:router(config-if)# nv`	Enters the satellite network virtualization (nV) configuration submode.
Step 12	**satellite-fabric-link satellite** *satellite_id* **Example:** `RP/0/RSP0/CPU0:router(config-if-nV)# satellite-fabric-link satellite 100`	Specifies an interface as an Interface Control Plane Extender(ICPE) inter-chassis link (ICL). **Note** The Interface Control Plane Extender(ICPE) infrastructure has a mechanism to provide the Control Plane of an interface physically located on the Satellite device in the local Cisco IOS XR software.
Step 13	**remote-ports** *interface_type remote_subslot* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# remote-ports Satellite-Ether 0/0/0-9`	Configures the remote satellite ports 0 to 9.
Step 14	**service-policy output** *policy-map* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# service-policy output policy3`	Attaches a policy map to an output interface to be used as the service policy for that interface.
Step 15	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions:

	Command or Action	Purpose
		• **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Offloading Service-policy on Bundle SFL

Perform these tasks to offload the service-policy on the bundle Satellite Fabric Link (SFL). This procedure offloads the service-policy in the egress direction of SFL.

SUMMARY STEPS

1. **configure**
2. **class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name*
3. **match qos-group** [*qos-group-value*]
4. **end-class-map**
5. **policy-map** [**type qos**] *policy-name*
6. **class** *class-name*
7. **bandwidth** {*bandwidth* [*units*] | **percent** *value*}
8. **exit**
9. **end-policy-map**
10. **interface** *type interface-path-id*
11. **bundle id** *bundle-id*
12. **nv**
13. **satellite-fabric-link satellite** *satellite_id*
14. **remote-ports***interface_type remote_subslot*
15. **service-policy output** *policy-map*
16. Use the **commit** or **end** command.
17. **exit**
18. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name* **Example:** `RP/0/RSP0/CPU0:router(config)# class-map match-any class4`	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. If you specify **match-any**, one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. This is the default. If you specify **match-all**, the traffic must match all the match criteria.
Step 3	**match qos-group** [*qos-group-value*] **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match qos-group 5`	Specifies service (QoS) group values in a class map to match packets. • *qos-group-value* identifier argument is specified as the exact value or range of values from 0 to 63. • Up to eight values (separated by spaces) can be entered in one match statement. • **match qos-group**command is supported only for an egress policy.
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration.
Step 5	**policy-map** [**type qos**] *policy-name* **Example:** `RP/0/RSP0/CPU0:router(config)# policy-map policy4`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters the policy map configuration mode.
Step 6	**class** *class-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class4`	Specifies the name of the class whose policy you want to create or change.
Step 7	**bandwidth** {*bandwidth* [*units*] | **percent** *value*} **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# bandwidth percent 13`	Specifies the bandwidth allocated for a class belonging to a policy map.
Step 8	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# exit`	Returns the router to policy map configuration mode.

	Command or Action	Purpose
Step 9	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# end-policy-map`	Ends the policy map configuration.
Step 10	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface Bundle-Ether 2`	Configures an interface and enters the interface configuration mode.
Step 11	**bundle id** *bundle-id* **Example:** `RP/0/RSP0/CPU0:router(config-if)# bundle id 2`	Creates a multilink interface bundle with the specified bundle ID.
Step 12	**nv** **Example:** `RP/0/RSP0/CPU0:router(config-if)# nv`	Enters the satellite network virtualization (nV) configuration submode.
Step 13	**satellite-fabric-link satellite** *satellite_id* **Example:** `RP/0/RSP0/CPU0:router(config-if)# satellite-fabric-link satellite 100`	Specifies an interface as an Interface Control Plane Extender(ICPE) inter-chassis link (ICL). **Note** The Interface Control Plane Extender(ICPE) infrastructure has a mechanism to provide the Control Plane of an interface physically located on the Satellite device in the local Cisco IOS XR software.
Step 14	**remote-ports***interface_type remote_subslot* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# remote-ports GigabitEthernet 0/0/0-5`	Configures the remote satellite ports 0 to 5.
Step 15	**service-policy output** *policy-map* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# service-policy output policy4`	Attaches a policy map to an output interface to be used as the service policy for that interface.
Step 16	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session.

	Command or Action	Purpose
		• **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.
Step 17	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-if)# exit`	Returns the router to global configuration mode.
Step 18	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Offloading Service-policy on L2 Fabric Physical SFL

Perform these tasks to offload the service-policy on L2 Fabric physical Satellite Fabric Link (SFL). This procedure offloads the service-policy in the egress direction of SFL.

SUMMARY STEPS

1. **configure**
2. **class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name*
3. **match qos-group** [*qos-group-value1*]
4. **end-class-map**
5. **policy-map** [**type qos**] *policy-name*
6. **class** *class-name*
7. **bandwidth** {*bandwidth* [*units*] | **percent** *value*}
8. **exit**
9. **end-policy-map**
10. **interface** *type interface-path-id*
11. **encapsulation dot1q***vlan-identifier*
12. **nv**
13. **satellite-fabric-link satellite** *satellite_id*
14. **remote-ports***interface_type remote_subslot*
15. **service-policy output** *policy-map*
16. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**class-map** [**type qos**] [**match-any**] [**match-all**] *class-map-name* **Example:** `RP/0/RSP0/CPU0:router(config)# class-map match-any class5`	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. If you specify **match-any**, one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. This is the default. If you specify **match-all**, the traffic must match all the match criteria.
Step 3	**match qos-group** [*qos-group-value1*] **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match qos-group 5`	Specifies service (QoS) group values in a class map to match packets. • *qos-group-value* identifier argument is specified as the exact value or range of values from 0 to 63. • Up to eight values (separated by spaces) can be entered in one match statement. • **match qos-group**command is supported only for an egress policy.
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration.
Step 5	**policy-map** [**type qos**] *policy-name* **Example:** `RP/0/RSP0/CPU0:router(config)# policy-map policy5`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters the policy map configuration mode.
Step 6	**class** *class-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class5`	Specifies the name of the class whose policy you want to create or change.
Step 7	**bandwidth** {*bandwidth* [*units*] | **percent** *value*} **Example:**	Specifies the bandwidth allocated for a class belonging to a policy map.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-pmap-c)# bandwidth percent 13`	
Step 8	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# exit`	Returns the router to policy map configuration mode.
Step 9	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# end-policy-map`	Ends the policy map configuration.
Step 10	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface TenGigabitEthernet 0/1/0/0.1`	Configures an interface and enters the interface configuration mode.
Step 11	**encapsulation dot1q***vlan-identifier* **Example:** `RP/0/RSP0/CPU0:router(config-if)# encapsulation dot1q 20`	Defines the encapsulation format as IEEE 802.1Q (**dot1q**), and specifies the VLAN identifier.
Step 12	**nv** **Example:** `RP/0/RSP0/CPU0:router(config-subif)# nv`	Enters the satellite network virtualization (nV) configuration submode.
Step 13	**satellite-fabric-link satellite** *satellite_id* **Example:** `RP/0/RSP0/CPU0:router(config-if-nV)# satellite-fabric-link satellite 100`	Specifies an interface as an Interface Control Plane Extender(ICPE) inter-chassis link (ICL). **Note** The Interface Control Plane Extender(ICPE) infrastructure has a mechanism to provide the Control Plane of an interface physically located on the Satellite device in the local Cisco IOS XR software.
Step 14	**remote-ports***interface_type remote_subslot* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# remote-ports GigabitEthernet 0/0/0-5`	Configures the remote satellite ports 0 to 5.
Step 15	**service-policy output** *policy-map* **Example:**	Attaches a policy map to an output interface to be used as the service policy for that interface.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# service-policy output policy5`	
Step 16	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

How to Configure HQoS on a Satellite

Hierarchical QoS allows you to specify QoS behavior at multiple policy levels, which provides a high degree of granularity in traffic management. A hierarchical policy is a QoS model that enables you to specify QoS behavior at multiple levels of hierarchy.

Note HQoS is not supported on Cisco NCS 5000 Series satellites to Cisco ASR 9000 Series Hosts that have the Cisco ASR 9000 4th Generation QSFP28 based dense 100GE line cards. However, HQoS is supported on Cisco NCS 5000 Series satellites to Cisco ASR 9000 Series Hosts that have the Cisco ASR 9000 High-Density 100GE Ethernet line cards.

Configure the Traffic Class

Perform these tasks to create class-maps.

SUMMARY STEPS

1. **configure**
2. **class-map match-any** *class-map-name*
3. **match qos-group** [*qos-group-value*]
4. **end-class-map**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**class-map match-any** *class-map-name* **Example:**	Creates a class map to be used for matching packets to the class specified and enters the class map configuration mode. The **match-any** keyword indicates that atleast one of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class.
Step 3	**match qos-group** [*qos-group-value*] **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# match qos-group 5`	Specifies service (QoS) group values in a class map to match packets. **Note** The **match qos-group** [*qos-group-value*] is just an example of one of the match commands that can be used. For a list of other match commands, see the Supported Capability Matrix table.
Step 4	**end-class-map** **Example:** `RP/0/RSP0/CPU0:router(config-cmap)# end-class-map`	Ends the class map configuration. **Note** Repeat Steps 1 through 4 to configure additional class-maps.

Configure the Traffic Policy

This procedure creates both the child policy and the parent policy and applies the child policy to the parent policy.

SUMMARY STEPS

1. **configure**
2. **policy-map** *child-policy-map-name*
3. **class** {*class-name* | **class-default**}
4. **bandwidth** {*rate* [*units*] | **percent** *percentage-value*} **or bandwidth remaining** [**percent** *percentage-value* | **ratio** *ratio-value*]
5. **end-policy-map**
6. **configure**
7. **policy-map** *parent-policy-map-name*
8. **class class-default**
9. **shape average** *rate* [*units*]
10. **service-policy** *child-policy-map-name*

11. **end-policy-map**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**policy-map** *child-policy-map-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# policy-map child-policy`	Creates a child policy map and enters the policy map configuration mode.
Step 3	**class** {*class-name* | **class-default**} **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class4`	Assigns the traffic class that you specify to the policy map. Enters policy map class configuration mode.

Step 4	**bandwidth** {*rate* [*units*] | **percent** *percentage-value*} **or bandwidth remaining** [**percent** *percentage-value* | **ratio** *ratio-value*]
	Example:
	`RP/0/RSP0/CPU0:router(config-pmap-c)# bandwidth percent 30`
	`or`
	`RP/0/RSP0/CPU0:router(config-pmap-c)# bandwidth remaining percent 80`
		Specifies the minimum bandwidth allocated to a class as a percentage of link bandwidth.
		Specifies how to allocate excess bandwidth to a class.
		Note Repeat Steps 3 and 4 to include additional class-maps to the child-policy
		If you use "bandwidth remaining percent", minimum bandwidth is allocated for each queues based on the configured bandwidth, and the weights are equal for all the queues.
		If you use "bandwidth remaining ratio", the bandwidth is allocated for each queues based on weights and the minimum bandwidth requirement is zero.

Step 5	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# end-policy-map`	Ends the policy-map configuration.
Step 6	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.

	Command or Action	Purpose
Step 7	**policy-map** *parent-policy-map-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# policy-map parent-policy`	Creates a parent policy map and enters the policy map configuration mode.
Step 8	**class class-default** **Example:** `RP/0/RSP0/CPU0:router(config-pmap)# class class-default`	Configures the parent class-default class. **Note** • You can configure only the class-default class in a parent policy. Do not configure any other traffic class.
Step 9	**shape average** *rate* [*units*] **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# shape average 1 mbps`	Shapes traffic to the indicated bit rate. **Note** In the parent policy, only the **shape average** action is supported. For a 9000v satellite, the supported minimum value is 40 mbps. For a 901 satellite, the minimum value that is supported is 250 kbps.
Step 10	**service-policy** *child-policy-map-name* **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# service-policy child-policy`	Applies a child-level policy to the top-level class-default class. **Note** The service-policy command applies the child-policy-map to the parent-policy-map.
Step 11	**end-policy-map** **Example:** `RP/0/RSP0/CPU0:router(config-pmap-c)# end-policy-map`	Ends the policy-map configuration.

Attach Hierarchical Policies to the Interface

This procedure attached the hierarchical policies to the interface.

SUMMARY STEPS

1. **interface** *type interface-path-id*
2. **ipv4 point-to-point**
3. **ipv4 unnumbered** *interface-type interface-instance*
4. **nv**
5. **satellite-fabric-link network**
6. **redundancy iccp-group** *group-number*
7. **satellite** *satellite-id*
8. **remote-ports***interface_type remote_subslot*

9. **service-policy output** *parent-policy-map-name*
10. Use the **commit** or **end** command.
11. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# interface GigabitEthernet0/2/0/1`	Configures an interface and enters the interface configuration mode.
Step 2	**ipv4 point-to-point** **Example:** `RP/0/RSP0/CPU0:router(config-if)# ipv4 point-to-point`	Configures the IPv4 point to point address.
Step 3	**ipv4 unnumbered** *interface-type interface-instance* **Example:** `RP/0/RSP0/CPU0:router(config-if)# ipv4 unnumbered Loopback10`	Enables IPv4 processing on a point-to-point interface without assigning an explicit IPv4 address to that interface.
Step 4	**nv** **Example:** `RP/0/RSP0/CPU0:router(config-if)# nv`	Enters the satellite network virtualization (nV) configuration submode.
Step 5	**satellite-fabric-link network** **Example:** `RP/0/RSP0/CPU0:router(config-if-nV)# satellite-fabric-link network`	Specifies the network type of Interface Control Plane Extender(ICPE) inter-chassis link (ICL).
Step 6	**redundancy iccp-group** *group-number* **Example:** `RP/0/RSP0/CPU0:router(config-sfl-network)# redundancy iccp-group 2`	Configures the ICCP redundancy group.
Step 7	**satellite** *satellite-id* **Example:** `RP/0/RSP0/CPU0:router(config-sfl-network) # satellite 500`	Specifies the satellite ID.

	Command or Action	Purpose
Step 8	**remote-ports***interface_type remote_subslot* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# remote-ports GigabitEthernet 0/0/0-9`	Configures the remote satellite ports 0 to 5.
Step 9	**service-policy output** *parent-policy-map-name* **Example:** `RP/0/RSP0/CPU0:router(config-satellite-fabric-link)# service-policy output parent-policy`	Attaches a policy map to an output interface to be used as the service policy for that interface. **Note** Repeat Steps 7 through 9 to attach the policy map to the satellite interfaces.
Step 10	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.
Step 11	**exit** **Example:** `RP/0/RSP0/CPU0:router(config-if)# exit`	Returns the router to global configuration mode.

Configuration Examples for QoS Offload

Note While the examples use 1G access ports and 10G fabric ports, the same can be applied to Cisco NCS 5000 series 10G access and 10G/100G fabric ports for supported scenarios.

Offloading Service-policy on Physical Access Port: Example

In this example, a service-policy called policy1 is created. This service policy is associated to a class map called class1 through the use of the class command, and then the service policy is attached in the input direction on a GigabitEthernet interface 100/0/0/0. This service-policy is configured under the nv mode and thus the QoS policy is offloaded to the satellite.

```
config
class-map match-any class1
```

```
 match precedence 6
 end-class-map
!
policy-map policy1
 class class1
  set qos-group 5
 !
interface gigabitEthernet 100/0/0/0
nv
service-policy input policy1
end or commit
```

Offloading Service-policy on Bundle Access Port: Example

In this example, a service-policy called policy2 is created. This service policy is associated to a class map called class2 through the use of the class command. The service policy is then attached in the input direction on a bundle-ether interface with bundle id as 1 that has two bundle member links—GigabitEthernet interface 100/0/0/1 and GigabitEthernet interface 100/0/0/2. This service-policy is configured under the nv mode and thus the QoS policy is offloaded to the satellite bundle-ether interface.

```
config
class-map match-any class2
 match precedence 6
 end-class-map
!
policy-map policy2
 class class2
  set qos-group 5
  end-policy-map
 !
interface bundle-ether 1
bundle-id 1
nv
service-policy input policy2
end or commit
!
end or commit
```

Offloading Service-policy on Physical SFL: Example

In this example, a service-policy called policy3 is created, which is associated to a class map called class3 through the use of the class command. The service policy is applied to the host-facing satellite fabric link (SFL) on the satellite 100 and attached in the output direction on a TenGigE interface 0/1/0/0. This is configured under the nv mode and thus the QoS policy is offloaded to the satellite.

```
config
class-map match-any class3
 match qos-group 5
 end-class-map
!
policy-map policy3
 class class3
  bandwidth percent 13
 !
interface TenGigE 0/1/0/0
nv satellite-fabric-link satellite 100
remote-ports GigabitEthernet 0/0/0-9
```

```
service-policy output policy3
end or commit
```

Offloading Service-policy on Bundle SFL: Example

In this example, a service-policy called policy4 is created, which is associated to a class map called class4 through the use of the class command. The service policy is applied to the host-facing bundle satellite fabric link (SFL) on the satellite 100 and attached in the output direction on the bundle-ether interface with bundle id 2 that has two bundle member links—TengGig interface 0/1/0/0 and TengGig interface 0/1/0/1. This is configured under the nv mode and thus the QoS policy is offloaded to the satellite.

```
config
class-map match-any class4
 match qos-group 5
 end-class-map
!
policy-map policy4
 class class4
  bandwidth percent 13
 !
interface Bundle-ether 2
nv satellite-fabric-link satellite 100
remote-ports GigabitEthernet 0/0/0-5
service-policy output policy4
exit/commit
interface TengGig 0/1/0/0
bundle-id 2
!
interface TengGig 0/1/0/1
bundle-id 2
!
end or commit
```

Offloading Service-policy on L2 Fabric physical SFL: Example

In this example, a service-policy called policy5 is created, which is associated to a class map called class5 through the use of the class command. The service policy is applied to the host-facing bundle SFL under the nv mode and attached in the output direction on the TenGigabitEthernet 0/1/0/0.1 sub-interface. The QoS policy is offloaded to the satellite 100 in the L2 Fabric network.

```
config
class-map match-any class5
 match qos-group 5
 end-class-map
!
policy-map policy5
 class class5
  bandwidth percent 13
 !
interface TenGigabitEthernet 0/1/0/0.1
encapsulation dot1q 20
nv satellite-fabric-link satellite 100
remote-ports GigabitEthernet 0/0/0-5
service-policy output policy5
end or commit
```