

RTN HQoS Technical White Paper

Transmission Architecture and Design Department



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Change History

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Abstract

The RTN HQoS technology supports five-level scheduling mechanism, which includes flow queue (FQ), subscriber queue (SQ), group queue (GQ), class queue (CQ), and port queue (PQ) in ascending order. They are used to control the bandwidth and priority of services on the user access side and the carrier network to guarantee the quality of end-to-end services on networks.

Acronyms and Abbreviations

Acronym or Abbreviation	Full Name
HQoS	Hierarchical quality of service
FQ	Flow queue
SQ	Subscriber queue
GQ	Group queue
CQ	Class queue
WRR	Weighted round robin



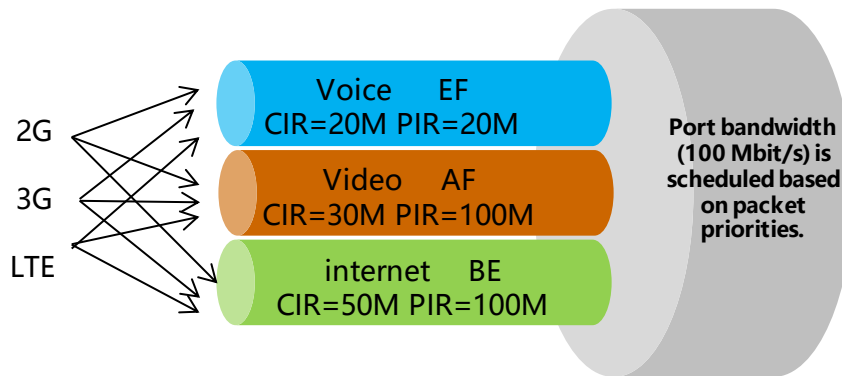
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1 Overview

In traditional DiffServ QoS technology, service flows are classified into eight priorities through traffic classification on the user access side and network side. Subscriber and service packets with the same priority share queue bandwidth and compete for the same queue resource. As a result, traditional QoS fails to meet end-to-end QoS requirements.

Figure 1-1 Traditional QoS scheduling module



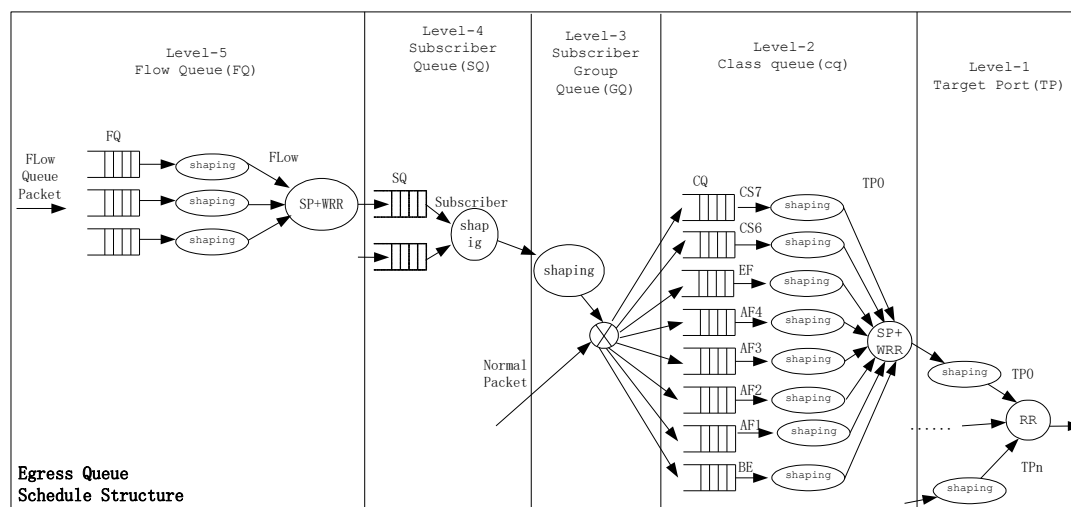
In the HQoS technology recommended by TR-059 on the DSL Forum, data flows are classified into subscriber queues and service queues. The bandwidth and priority scheduling of subscriber and service data are ensured separately through hierarchical scheduling technology. Therefore, the HQoS technology prevents bandwidth preemption among users and services.

OptiX RTN equipment adopts the HQoS mechanism on the user access side and network side. VPNs that share the same link and bandwidth are scheduled hierarchically to ensure the bandwidth of each VPN. Different services in a VPN are also scheduled based on their priorities. End-to-end bandwidth and priority scheduling are ensured for subscriber and service packets.

The following sections describe the principles, modules, and application scenarios of the RTN HQoS technology.

2 RTN HQoS

The RTN HQoS technology supports five-level scheduling mechanism, which includes flow queue (FQ), subscriber queue (SQ), group queue (GQ), class queue (CQ), and port queue (PQ) in ascending order. They are used to control the bandwidth and priority of services on the user access side and the carrier network.

**Figure 2-1** HQoS scheduling module

Flow Queue (FQ)

The flow queue is used to buffer subscriber flows of a specified priority. The flows of each subscriber can be configured with eight priority levels. That is, each subscriber can use a maximum of eight FQs. FQs cannot be shared among different subscribers. The Maximum bandwidth of each FQ can be configured through traffic shaping.

FQ attributes include:

Queue priority and weight

Queue shaping rate PIR

Discard policy: Tail Drop or WRED

Subscriber Queue (SQ)

Each SQ represents a subscriber (for example, a VLAN or PW). The CIR and PIR can be configured per SQ.

Each SQ includes eight FQs that share the SQ bandwidth. If an FQ is idle, other FQs can use the bandwidth of the FQ, but the bandwidth used by an FQ cannot exceed the PIR of the FQ.

An SQ can schedule multiple FQs. The SP and WRR scheduling algorithms can be configured for FQs. An FQ whose priority is BE, EF, CS6, or CS7 adopts the SP scheduling algorithm by default. An FQ whose priority is AF1, AF2, AF3, or AF4 adopts the WRR scheduling algorithm with a scheduling weight of 1:1:1:1 by default.

Group Queue (GQ)

Multiple SQs can be defined as a GQ. For example, all SQs that share bandwidth or all Gold-level SQs can be mapped into a GQ.

A GQ can be bound with multiple SQs, but an SQ can be mapped into only one GQ.

A GQ scheduler adopts the DRR+SP algorithm to schedule all the SQs contained in a GQ. The DRR algorithm is used to preferentially schedule the SQs whose rate is lower than the committed information rate (CIR). After that, the SQs whose rate is between the CIR and peak information rate (PIR), namely excess information rate (EIR), are scheduled if there is remaining bandwidth. The SP algorithm is used to schedule these SQs. The CIR bandwidth is guaranteed, and the packets that exceed the PIR are discarded. If a GQ can obtain a PIR bandwidth, the CIR bandwidth for each SQ in the GQ is guaranteed, and the PIR bandwidth may be obtained if any bandwidth remains.

Class Queue (CQ)

CQs are divided into eight priorities. CQ attributes include:

Queue priority and weight

Queue shaping rate PIR

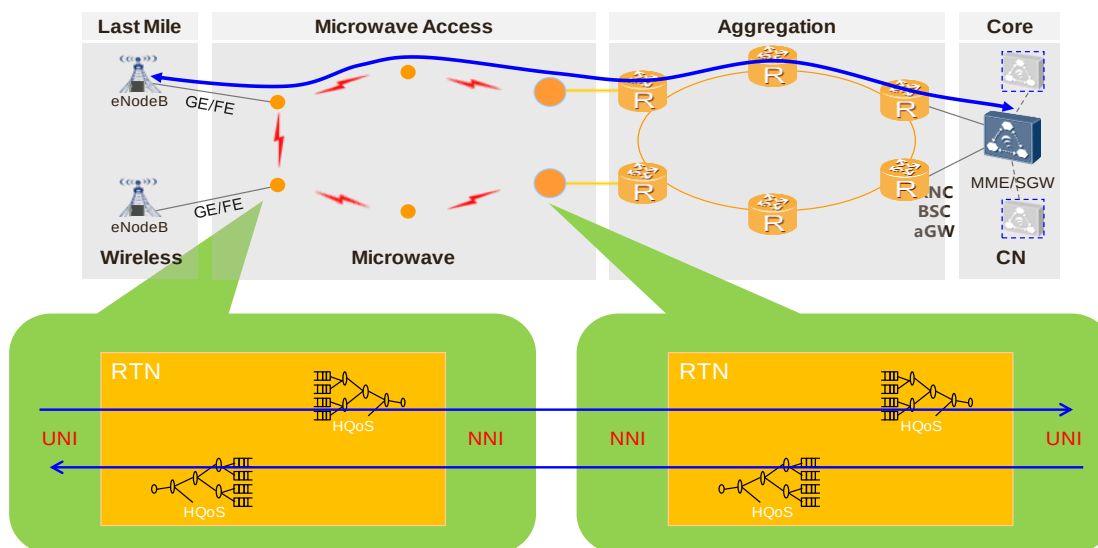
Discard policy: Tail Drop or WRED

Port

Each port contains eight CQs of different priorities. CQs are scheduled by using the SP+WRR algorithm. The PIR can be configured at a port to limit the traffic rate.

The RTN HQoS defines an FQ as flow level, corresponding to a subscriber service flow. An SQ is defined as subscriber service, corresponding to a V-UNI or PW. A GQ is defined as subscriber group, corresponding to a V-UNI group or tunnel.

Figure 2-2 Application of RTN HQoS on a network



The HQoS can be configured on the service access point and aggregation point, namely on the UNI side and NNI side of an NE. Figure 2-3 and Figure 2-4 describe the scheduling hierarchies on the UNI side and NNI side.

Figure 2-3 RTN HQoS service module (UNI side)

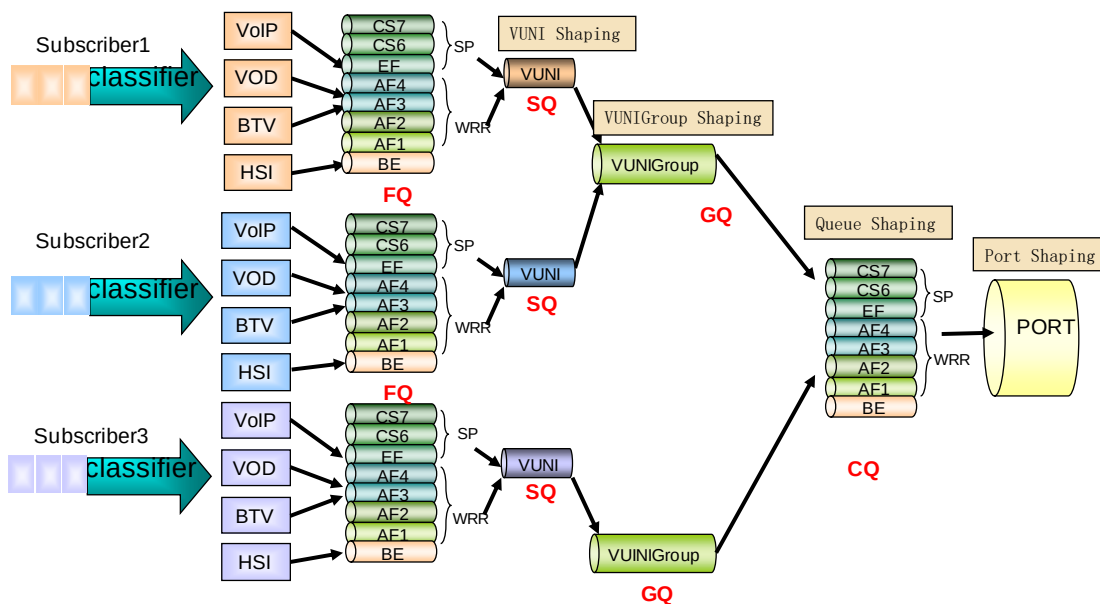
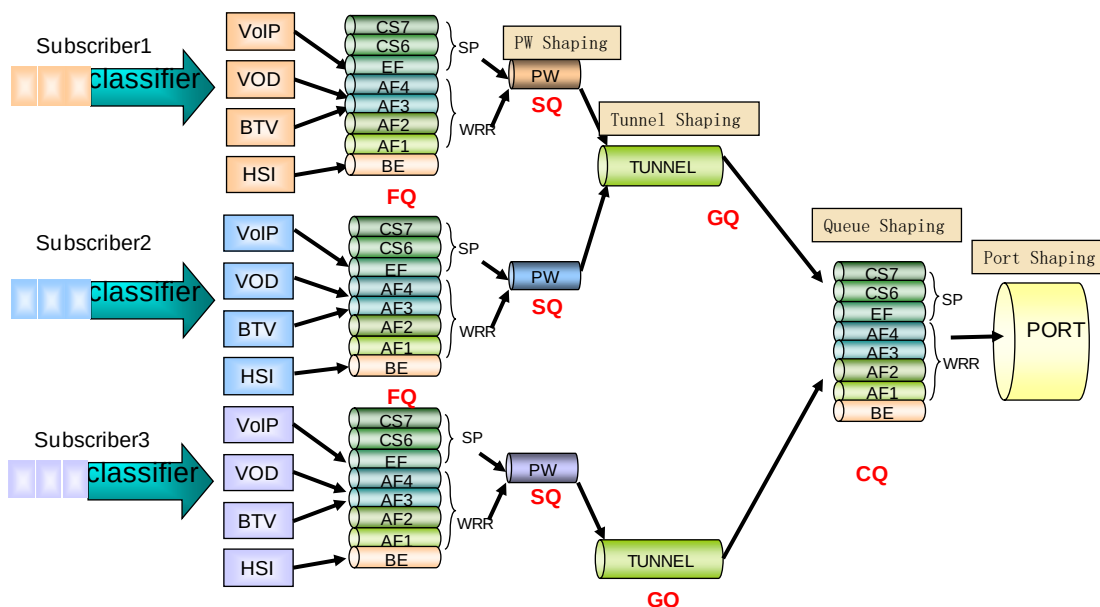


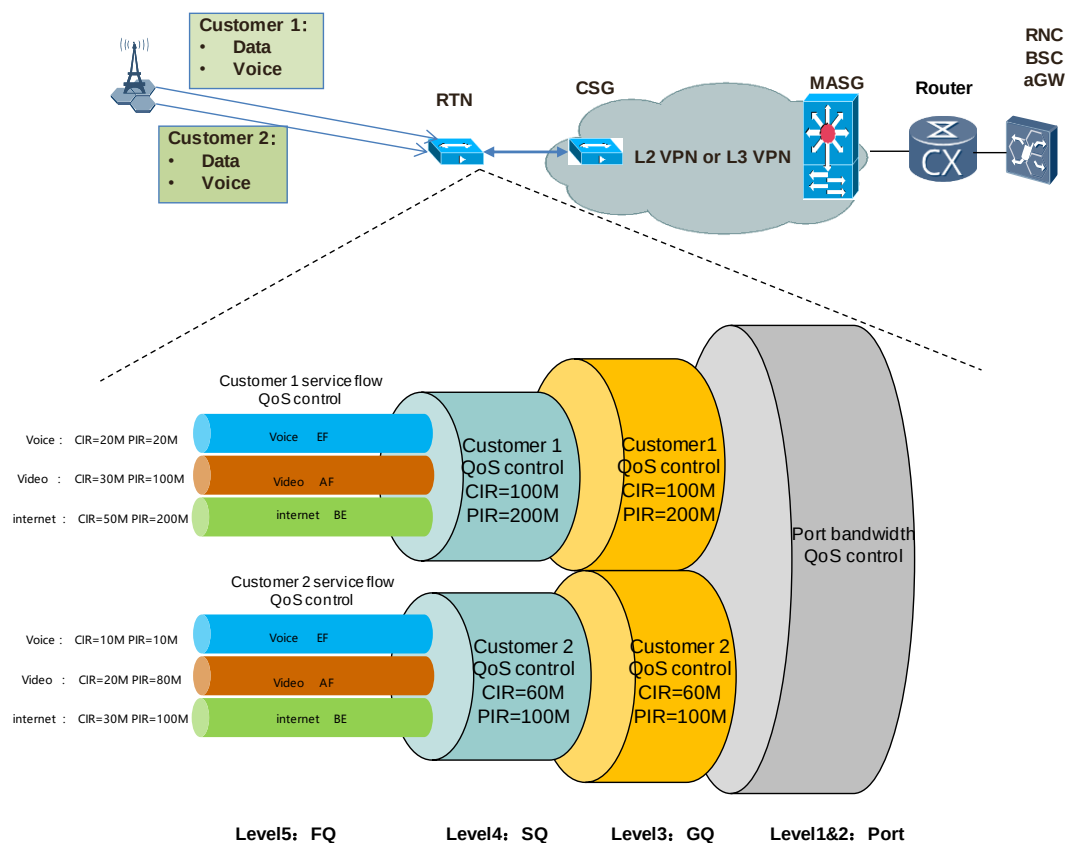
Figure 2-4 RTN HQoS service module (NNI side)



3 Promotion

3.1 RAN Sharing Scenario

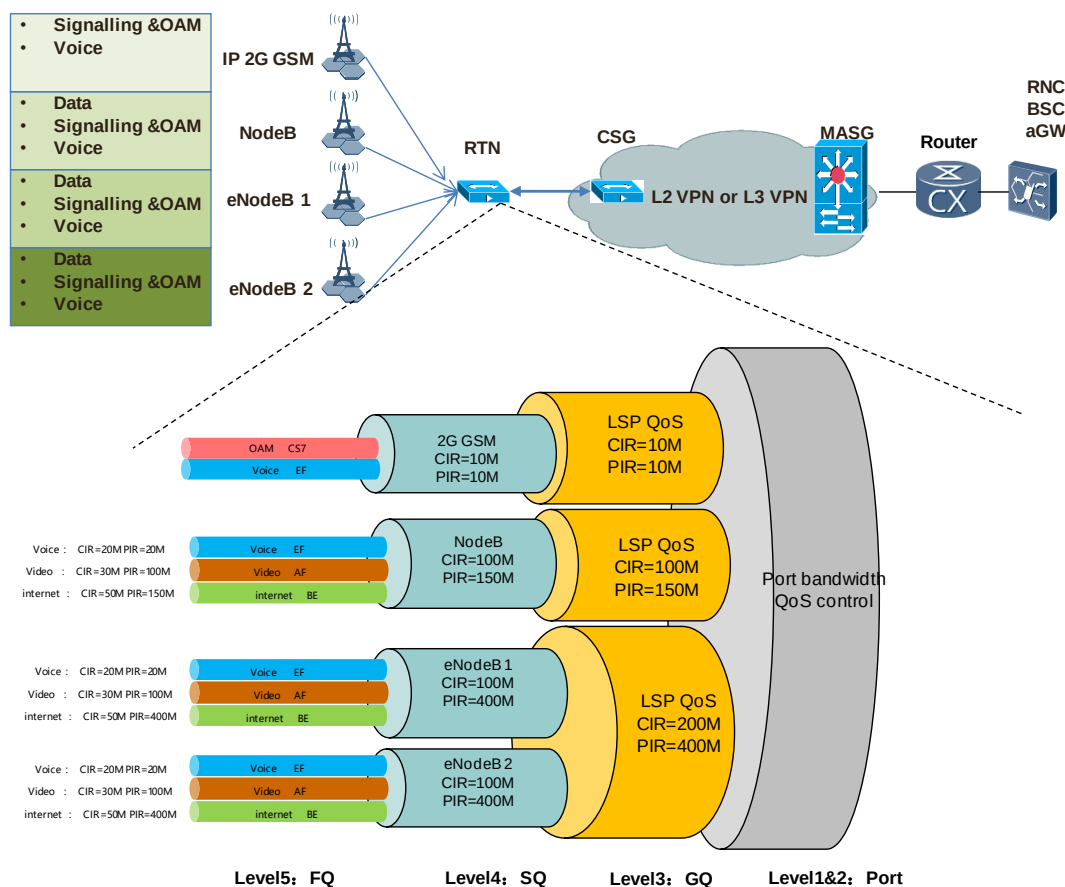
Figure 3-1 RAN Sharing application



In an RAN Sharing scenario, independent bandwidths are assigned based on subscriber service flows. Each bandwidth is configured with a CIR and a PIR. The bandwidth can be multiplexed if the CIR bandwidth is guaranteed. QoS is implemented on each subscriber service flow separately based on bandwidth configurations and scheduling policies.

3.2 Bandwidth Shared by Multiple Base Stations

Figure 3-2 Bandwidth shared by multiple base stations



Bandwidth is allocated on a per base-station basis when an RTN device receives services from multiple base stations. QoS is implemented on service flows separately based on the bandwidth configurations and scheduling policies in each base station. Traffic rate limiting can be configured on each port.

4 Conclusion

The RTN HQoS technology supports the five-level scheduling mechanism. Subscriber and service packets are classified in the egress direction on the UNI side and NNI side into queues with different priorities and bandwidth resources. The bandwidth and forwarding behavior of each queue are ensured. The QoS requirements of an RAN Sharing scenario or multiple-base-station accesses scenario are met.

5 References

- [1] TR-059 (2003) on the DSL Forum