QoS

Bintec User's Guide - X2250
Version 1.0

Purpose

This document is part of the user's guide to the installation and configuration of Bintec gateways running software release 7.1.16 or later. For up-to-the-minute information and instructions concerning the latest software release, you should always read our **Release Notes**, especially when carrying out a software update to a later release level. The latest **Release Notes** can be found at www.funkwerk-ec.com.

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1 QoS Menu

The fields of the *QoS* menu are described below.

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS]: QoS Configuration                                    MyGateway


                IP Filter
                IP Classification and Signalling

                Interfaces and Policies


                EXIT
```

More and more applications need increasingly larger bandwidths, which are not always available. Quality of Service (QoS) makes it possible to distribute the available bandwidths effectively and intelligently. Certain applications can be given preference and bandwidth reserved for them. This is an enormous advantage, especially for time-critical applications such as VoIP (= Voice over IP), SAP applications, etc.

The ***QoS*** menu is for configuring all the settings for Quality of Service.

The ***QoS*** menu provides access to the following submenus:

- ***IP Filter***
- ***IP Classification and Signalling***
- ***Interfaces and Policies***.

1 QoS Menu

2 IP Filter Submenu

The *IP FILTER* submenu is described below.

➤➤ **IP** filters are defined in the ***QOS*** ➜ ***IP FILTER*** submenu to enable certain IP packets or services to be specified.

This submenu shows a list of all IP ➤➤ **filters** configured (the illustration shows example values):

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS][FILTER]: Configure IP Classification Filter           MyGateway


Abbreviations:sa (source IP address)      sp (source port)
              da (destination IP address) dp (destination port)
              it (icmp type)              estab (TCP established)

 Index Descr            Conditions
 1     FromVoIPServer   sa 192.168.100.20/32
 2     all


    ADD                 DELETE              EXIT
```

The configuration of the IP filters is set up in ***IP FILTER*** ➜ ***ADD/EDIT*** (the illustration shows example values).

```
X2250 Setup Tool                              Bintec Access Networks GmbH
[QOS][FILTER][EDIT][ADD]                                        MyGateway

 Description                FromVoIPServer
 Index                      1

 Protocol                   any

 Source Address             192.168.100.20
 Source Mask                255.255.255.255


 Destination Address
 Destination Mask


 Type of Service (TOS)      00000000  TOS Mask  00000000

         SAVE                                    CANCEL
```

The menu contains the following fields:

Field	Description
Description	Designation of the filter. Note that only the first 10 or 15 characters are visible in other menus.
Index	Cannot be changed. Here the gateway assigns a number automatically to new filters defined.
Protocol	Defines a protocol. Possible values: *any, tcp/udp-port, icmp, ggp, ip, tcp, egp, igp, pup, chaos, udp, hmp, xns_idp, rdp, rsvp, gre, esp, ah, tlsp, skip, kryptolan, iso-ip, igrp, ospf, ipip, ipx-in-ip, vrrp, l2tp*. The *any* option (default value) matches any protocol.

Field	Description
Type	Only if ***PROTOCOL*** = *icmp*. Possible values: *any, echo reply, destination unreachable, source quench, redirect, echo, time exceeded, param problem, timestamp, timestamp reply, address mask, address mask reply*. See RFC 792. The default value is *any*.
Connection State	If ***PROTOCOL*** = *tcp*, you can define a filter that takes the status of the TCP connections into account. Possible values: ■ *established*: All TCP packets that would not open any new TCP connection on routing over the **X2250** gateway match the filter. ■ *any* (default value): All TCP packets match the filter.
Source Address	Source IP address of the data packets.
Source Mask	Netmask for ***SOURCE ADDRESS***.
Source Port	Only if ***PROTOCOL*** = *tcp/udp-port, tcp* or *udp*. Source port number or range of source port numbers. Possible values: see “Source Port and Destination Port selection options” on page 8 The default value is *any*.
Specify Port ..to Port	If ***SOURCE PORT*** or ***DESTINATION PORT*** = *specify* or *specify range* Port numbers or range of port numbers.
Destination Address	Defines the destination IP address of the data packets.
Destination Mask	Netmask for ***DESTINATION ADDRESS***.

Field	Description
Destination Port	Only if ***PROTOCOL*** = *tcp/udp-port, tcp* or *udp*. Destination port number or range of destination port numbers. Possible values: see “Source Port and Destination Port selection options” on page 8 The default value is *any*.
Type of Service (TOS)	Indicates the priority of the IP packet, cf. RFC 1349 and 1812. (Shown in binary format)
TOS Mask	Bit mask for ***TYPE OF SERVICE (TOS).*** (Shown in binary format)

Table 2-1: ***FILTER*** menu fields

SOURCE PORT and ***DESTINATION PORT*** contain the following selection options:

Description	Meaning
any (default value)	The route is valid for all ➤➤ **port** numbers.
specify	Enables the entry of a port number.
specify range	Enables the entry of a range of port numbers.
priv (0...1023)	Privileged port numbers: 0 ... 1023.
server (5000....32767)	Server port numbers: 5000 ... 32767.
clients 1 (1024....4999)	Client port numbers: 1024 ... 4999.
clients 2 (32768....65535)	Client port numbers: 32768 ... 65535.
unpriv (1024...65535)	Unprivileged port numbers: 1024 ... 65535.

Table 2-2: ***SOURCE PORT*** and ***DESTINATION PORT*** selection options

3 IP Classification and Signalling Submenu

The *IP CLASSIFICATION AND SIGNALLING* submenu is described below.

This menu shows a list of the configured classification and signalling rules.

```
X2250 Setup Tool                              Bintec Access Networks GmbH
[QOS][CLASS]: Configure IP QoS Classification and Signalling MyGateway

 Abbreviations:  RI(Rule Index)       M(Action if filter matches)
                FI(Filter Index)    !M(Action if filter does not match)
                 NRI (Next Rule Index)

RI FI NRI TOS    Prio  Val  Rem  Filter       Conditions
1  1  2   keepM  High  0    0    FromVoIPSe   sa 192.168.100.20/32
2  2  0   keepM  N255  0    0    All


    ADD             DELETE         REORG        EXIT
```

The ***QoS*** ➜ ***IP CLASSIFICATION AND SIGNALLING*** submenu is for creating rule chains for classification of ➤➤ **IP** packets using previously defined IP ➤➤ **filters**.

A number of rules can be interlinked to divide the traffic flow into different packet classes. This means totally different types of IP packets can be combined in a packet class and then handled with the same priority. The signalling for other network components (e.g. switches) in the TOS field is also defined by these rule chains.

The configuration is set up in the ***QoS*** ➜ ***IP CLASSIFICATION AND SIGNALLING*** ➜ ***ADD/EDIT*** menu.

```
X2250 Setup Tool                                Bintec Access Networks GmbH
[QOS][CLASS][EDIT]                                                MyGateway

  Index                     1

  Filter                    FromVoIPServer (1)
  Direction                 outgoing

  Action                    classify (keep TOS)


  Classification >
  Signalling (TOS) >


  Next Rule                 RI 2 FI 2 (All)

          SAVE                                      CANCEL
```

The menu consists of the following fields:

Field	Description
Index	Only visible if an existing rule is edited. This field cannot be changed. The gateway assigns a number automatically.
Filter	Selection of the IP filter to be used. Can only be selected if at least one filter is already configured.
Direction	Direction of data packets to be classified. Possible values: ■ *incoming*: incoming data packets ■ *outgoing* (default value): outgoing data packets ■ *both*: incoming and outgoing data packets

Field	Description
Action	Defines the action to be taken for a data packet that matches the ***FILTER*** and ***DIRECTION*** (Possible values: see table “Action selection options,” on page 12).
Insert behind Rule	Appears only if a new rule is defined and at least one rule already exists. Defines the rule behind which the new rule is inserted. You can start a new independent chain with *none*.
Next Rule	Appears only if an existing rule is edited. Defines the next rule to be used.

Table 3-1: ***IP CLASSIFICATION AND SIGNALLING ➜ ADD/EDIT*** menu fields

ACTION offers the following selection options:

Description	Meaning
classify & set TOS M (default value)	Classify IP packets that match the ***FILTER*** and ***DIRECTION*** and set TOS field to ***SIGNALLING TOS ➜ SET TYPE OF SERVICE (TOS) FIELD***.
classify & set TOS !M	Classify IP packets that do not match the ***FILTER*** and ***DIRECTION*** and set TOS field to ***SIGNALLING TOS ➜ SET TYPE OF SERVICE (TOS) FIELD***.
disable	Rule is deactivated. Continue with ***NEXT RULE***, if available.
classify (keep TOS) M	Classify IP packets that match the ***FILTER*** and ***DIRECTION***.

Description	Meaning
classify (keep TOS) !M	Classify IP packets that do not match the ***FILTER*** and ***DIRECTION***.

Table 3-2: ***ACTION*** selection options

3.1 Classification Submenu

The *CLASSIFICATION* submenu is described below.

```
X2250 Setup Tool                              Bintec Access Networks GmbH
[QOS][CLASS][EDIT][CLASS]: Configure IP QoS Classification   MyGateway

 Class Type                    normal
 Class ID                      1

              OK                                CANCEL
```

The IP packets concerned are classified in the ***QOS*** ➜ ***IP CLASSIFICATION AND SIGNALLING*** ➜ ***CLASSIFICATION*** submenu.

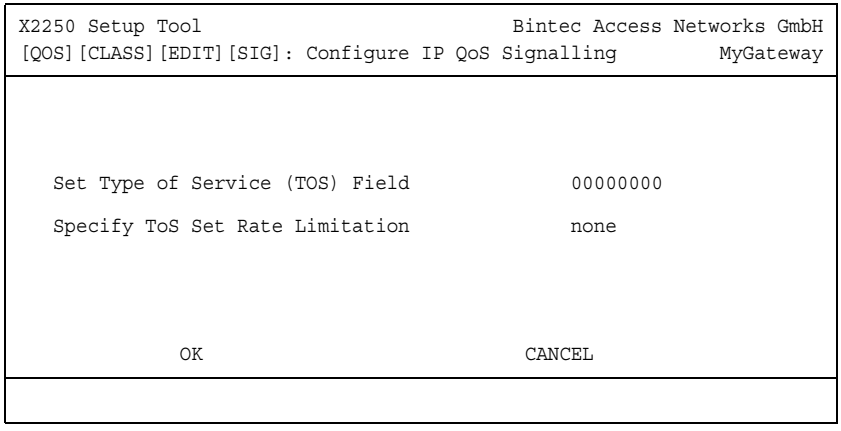
The ***CLASSIFICATION*** menu consists of the following fields:

Field	Description
Class Type	Defines the type of QoS packet class. Possible values: ■ *normal* (default value) ■ *high priority*
Class ID	Only for ***CLASS TYPE*** = *normal*. Defines the QoS packet class. Possible values: *1* (default value) to *255*.

Table 3-3: ***CLASSIFICATION*** menu fields

3.2 Signalling (TOS) Submenu

The *SIGNALLING (TOS)* submenu is described below.



The ***QOS*** ➜ ***IP CLASSIFICATION AND SIGNALLING*** ➜ ***SIGNALLING (TOS)*** submenu is used for defining a value for the TOS field of the IP packets concerned, if necessary. Limits can be entered to define the maximum number of packets to be manipulated per second.

The ***SIGNALLING (TOS)*** menu consists of the following fields:

Field	Description
Set Type of Service (TOS) Field	The value to be set for the TOS field in the IP header. Possible values: *0* to *255* (shown in binary format)
Specify ToS Set Rate Limitation	Activates or deactivates limitation of the max. number of packets to be manipulated in terms of packets or bits/s. Possible values: ■ *none* (default value) ■ *packets* (packets) ■ *throughput* (bits)

Field	Description
Maximum Rate (Packets per Second) Maximum Rate (Bits per Second)	Only for ***SPECIFY TOS SET RATE LIMITATION*** = *packets* Only for ***SPECIFY TOS SET RATE LIMITATION*** = *throughput* Number of packets or bits to be manipulated per second. Possible values for *packets*: *0* to *512000*. Possible values for *throughput*: *0* to *4096000*. The default value is *0*.
Maximum Burst Size (Number of Packets) Maximum Burst Size (Number of Bits)	Only for ***SPECIFY TOS SET RATE LIMITATION*** = *packets* Only for ***SPECIFY TOS SET RATE LIMITATION*** = *throughput* Defines the maximum number of packets or bits for which the TOS field can still be set when the previously defined maximum packet/bit rate has been reached. Possible values for *packets*: *0* to *512000*. Possible values for *throughput*: *0* to *4096000*. The default value is *0*.
Specify ToS Set Exceed Action	This parameter specifies how the packets above the configured limit are to be marked. Possible values: ■ *none* (default value): The TOS field is not manipulated. ■ *remark-tos*: The value defined in ***SET REMARK TYPE OF SERVICE (TOS) FIELD*** is set in the TOS field.

Field	Description
Set Remark Type of Service (TOS) Field	Only for ***SPECIFY TOS SET EXCEED ACTION*** = *remark-tos*. The value that is to be set for the TOS field, if necessary.

Table 3-4: ***SIGNALLING (TOS)*** menu fields

4 Interfaces and Policies Submenu

The *INTERFACES AND POLICIES* submenu is described below.

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS][INTERFACES]: Enable IP QoS Classification              MyGateway
                   and Policies

Interface First Rule First Filter Scheduler TxRate Limit

QoS Line
en0-1          no IP QoS classification
en0-1-snap     no IP QoS classification
en0-2          no IP QoS classification
en0-2-snap     no IP QoS classification
en0-3          no IP QoS classification
en0-3-snap     no IP QoS classification
test           no IP QoS classification


 EXIT
```

The ***QOS*** ➜ ***INTERFACES AND POLICIES*** submenu is used to define the interface and rule chain that are to be used to classify the data.

The settings for scheduling, shaping and policies are also made here.

- Scheduling: For defining the algorithm for processing the queues.
- Shaping: For defining the maximum data rate in the send direction for the selected interface.
- Policies: For defining queues.

It is possible to assign or guarantee each queue and thus each packet class a certain part of the total bandwidth of the interface.

Note

Data can only be prioritized in the outgoing direction.

Packets of the high-priority type always take priority over the other data.

The configuration for an existing interface is set up in ***QOS*** ➜ ***INTERFACES AND POLICIES*** ➜ ***EDIT***:

```
X2250 Setup Tool                              Bintec Access Networks GmbH
[QOS][INTERFACES][EDIT]                                        MyGateway

  Interface                          QoS-Line

  IP QoS Classification via          none

  QoS Scheduling and Shaping >
  Class-Based QoS Policies >

  MLPPP Interleave Mode              yes
  MLPPP                              250

           SAVE                                    CANCEL
```

The menu consists of the following fields:

Field	Description
Interface	Shows the interface for which QoS is to be configured. This field cannot be edited.
IP QoS Classification via	Selection of the start of a rule chain that is to be used to the classify the data packets. The default value is *none*.

Field	Description
MLPPP Interleave Mode	Only if a PPP interface is selected as ***INTERFACE***. The ***MLPPP INTERLEAVE MODE*** allows the fragmentation of packets without high priority so that high-priority data can be inserted between the fragments. Possible values: ■ *yes*: Activates the Multilink PPP Interleave Mode. ■ *no* (default value): Deactivates the Multilink PPP Interleave Mode.
MLPPP Fragment Size	Only for ***MLPPP INTERLEAVE MODE*** = *yes*. The maximum size of the fragments for a non-high-priority packet. Possible values: *30* to *1500*. The default value is *250*.

Table 4-1: ***INTERFACES AND POLICIES*** menu fields

4.1 QoS Scheduling and Shaping Submenu

The *QOS SCHEDULING AND SHAPING* submenu is described below.

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS][INTERFACES][EDIT][SCHEDULER]: Configure QoS            MyGateway
                                    Scheduling and Shaping

 Queueing and Scheduling Algorithm       priority queueing (PQ)
 Specify Traffic Shaping                 yes
 Maximum Transmit Rate (Bits per Second) 120000

            OK                              CANCEL
```

The ***QoS*** ➜ ***Interfaces and Policies*** ➜ ***EDIT*** ➜ ***QoS Scheduling and Shaping*** menu is for setting the queueing and scheduling algorithm and specifying the traffic shaping by defining the maximum bit rate for the selected interface in the send direction.

The ***QoS Scheduling and Shaping*** menu consists of the following fields:

Field	Description
Queueing and Scheduling Algorithm	Selection of the algorithm used for processing the queues of the selected interface and thus the activation and deactivation of QoS on the selected interface. Possible values: ■ *disabled* (default value) QoS is deactivated on the interface. Any existing queueing and scheduling configuration is not deleted, but can be activated again if required.

Field	Description
Queueing and Scheduling Algorithm (cont.)	■ *delete* QoS is deactivated on the interface. The queueing and scheduling configuration is deleted. ■ *priority queueing (PQ)* QoS is activated on the interface. The available bandwidth is distributed strictly according to the queue priority. ■ *weighted round-robin scheduling (WRR)* QoS is activated on the interface. The available bandwidth is distributed according to the weighting (***WEIGHT***) of the queue. Exception: High-priority packets are always handled with priority. ■ *weighted fair queueing (WFQ)* QoS is activated on the interface. The available bandwidth is distributed as “fairly” as possible among the (automatically detected) traffic flows in a queue. Exception: High-priority packets are always handled with priority.
Specify Traffic Shaping	Only for ***QUEUEING AND SCHEDULING ALGORITHM*** = *priority queueing (PQ)*, *weighted round-robin scheduling (WRR)* or *weighted fair queueing (WFQ)*. Activation or deactivation of data rate limiting (= traffic shaping) in the send direction. Possible values: ■ *yes*: Feature is activated. ■ *no*: Feature is deactivated. The default value is *no*.

Field	Description
Maximum Transmit Rate (Bits per Second)	Only for ***SPECIFY TRAFFIC SHAPING*** = *yes*. Entry of maximum data rate in bits per second in the send direction. Possible values: *0* (default value) to *2048000*.

Table 4-2: ***QOS SCHEDULING AND SHAPING*** menu fields

4.2 Class-Based QoS Policies Submenu

The *CLASS-BASED QOS POLICIES* submenu is described below.

The ***QOS*** ➜ ***INTERFACES AND POLICIES*** ➜ ***EDIT*** ➜ ***CLASS-BASED QOS POLICIES*** menu shows a list of all policies/queues of the selected interface that are already configured.

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS][INTERFACES][EDIT][POLICY]: Configure QoS Policies      MyGateway

  Configure QoS Policies

 Type            ID      Tx Rate    Limitation




  ADD                 DELETE              EXIT
```

The configuration is set up in ***QOS*** ➜ ***INTERFACES AND POLICIES*** ➜ ***EDIT*** ➜ ***CLASS-BASED QOS POLICIES*** ➜ ***ADD/EDIT***.

```
X2250 Setup Tool                          Bintec Access Networks GmbH
[QOS][INTERFACES][EDIT][POLICY][ADD]                          MyGateway

 Class                                      class-based
 Class ID                                   1

 Transmit Rate (Bits per Second)            0


 Weight                                     1
 Priority                                   0

 Shaping Algorithm                          token-bucket
 Congestion Avoidance Algorithm             none
 Dropping Algorithm                         tail-drop
 Lower Queue Threshold (Bytes)              0
 Upper Queue Threshold (Bytes)              16384

             OK                           CANCEL
```

The ***CLASS-BASED QOS POLICIES*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Field	Description
Class	Selection of type of queue. Possible values: ■ *class-based* (default value): Queue for data classified as “normal”. ■ *default*: Queue for data that has not been classified or data of a class for which no queue has been configured. ■ *high priority*: Queue for data classified as “high priority”.
Class ID	Only for ***CLASS*** = *class-based*. Selection of the QoS packet class to which this queue is to apply.

Field	Description
Transmit Rate (Bits per Second)	Entry of a data rate for the queue in bits per second. Possible values: *0* (default value) to *4096000*.
Bound Transmit Rate (Shaping)	Only for ***TRANSMIT RATE (BITS PER SECOND)*** larger than 0. Defines whether ***TRANSMIT RATE (BITS PER SECOND)*** may be exceeded. Possible values: ■ *yes* (bounded): A long burst exceeding the ***TRANSMIT RATE (BITS PER SECOND)*** is not allowed. ■ *no* (not bounded): A long burst exceeding the ***TRANSMIT RATE (BITS PER SECOND)*** is allowed with a guaranteed data rate, which is defined in ***TRANSMIT RATE (BITS PER SECOND)***. The excessive data rate is handled according to the queue priority.
Transmit Rate Burst	Only for ***TRANSMIT RATE (BITS PER SECOND)*** larger than 0. Entry of the maximum number of bytes that may still be sent in the short term when the throughput ***TRANSMIT RATE (BITS PER SECOND)*** determined for this queue has already been reached. Possible values: *0* (default value) to *64000*.
Weight	Only for ***QUEUEING AND SCHEDULING ALGORITHM*** = *weighted round-robin scheduling (WRR)* and ***CLASS*** = *default* or *class-based*. Relative weighting of this class. Possible values: *1* (default value) to *255*.

Field	Description
Priority	Only for ***Queueing and Scheduling Algorithm*** = *priority queueing (PQ)* and ***Class*** = *default* or *class-based*. Relative priority of this class. Possible values: *0* (highest priority, default value) to *255* (lowest priority).
Shaping Algorithm	No selection options. Until now only Token Bucket procedure for assignment/limitation of the bandwidth for a queue.
Congestion Avoidance Algorithm	Selection of procedure for dropping packets between the ***Lower Queue Threshold (Bytes)*** and ***Upper Queue Threshold (Bytes)*** as a precaution to prevent a queue overflow. Possible values: ■ *none* (default value): No preventive dropping of packets. ■ *weighted-random (RED)*: Packets are dropped according to the level of the queue. The fuller the queue, the more packets are dropped. This procedure ensures a smaller long-term queue size for TCP-based data traffic, so that traffic bursts can also usually be transmitted without large packet losses.

Field	Description
Dropping Algorithm	Selection of the procedure to be used for dropping packets above the ***UPPER QUEUE THRESHOLD (BYTES)*** (equates to the maximum size of this queue). Possible values: ■ *tail-drop* (default value): The newest packet received is dropped. ■ *head-drop*: The oldest packet in the queue is dropped. ■ *random-drop*: A randomly selected packet is dropped from the queue.
Lower Queue Threshold (Bytes)	Lower Threshold for Congestion Avoidance. Possible values: *0* (default value) to *262143*.
Upper Queue Threshold (Bytes)	Upper threshold for congestion avoidance and value above which the ***DROPPING ALGORITHM*** is used. Possible values: *0* to *262143*. The default value is *16384*.

Table 4-3: ***CLASS-BASED QOS POLICIES*** menu fields

Index: QoS