

User's Guide
bintec R4100 / R4300
QoS

Purpose This document is part of the user's guide to the installation and configuration of bintec gateways running software release 7.4.5 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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Guidelines and standards bintec gateways comply with the following guidelines and standards:

R&TTE Directive 1999/5/EG

CE marking for all EU countries and Switzerland

You will find detailed information in the Declarations of Conformity at www.funkwerk-ec.com.

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1 QoS Menu

The fields of the QoS menu are described below.

R4100 Setup Tool	Funkwerk Enterprise Communications 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.**

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):

```

R4100 Setup Tool                               Funkwerk Enterprise Communications 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).

R4100 Setup Tool		Funkwerk Enterprise Communications 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	<p>Defines a protocol. Possible values:</p> <p><i>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.</i></p> <p>The <i>any</i> option (default value) matches any protocol.</p>

Field	Description
Type	<p>Only if PROTOCOL = <i>icmp</i>. Possible values: <i>any, echo reply, destination unreachable, source quench, redirect, echo, time exceeded, param problem, timestamp, timestamp reply, address mask, address mask reply.</i></p> <p>See RFC 792.</p> <p>The default value is <i>any</i>.</p>
Connection State	<p>If PROTOCOL = <i>tcp</i>, you can define a filter that takes the status of the TCP connections into account. Possible values:</p> <ul style="list-style-type: none"> ■ <i>established</i>: All TCP packets that would not open any new TCP connection on routing over the R4100 / R4300 gateway match the filter. ■ <i>any</i> (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	<p>Only if PROTOCOL = <i>tcp/udp-port, tcp</i> or <i>udp</i>. Source port number or range of source port numbers.</p> <p>Possible values: see “Source Port and Destination Port selection options” on page 8</p> <p>The default value is <i>any</i>.</p>
Specify Port ..to Port	<p>If SOURCE PORT or DESTINATION PORT = <i>specify</i> or <i>specify range</i></p> <p>Port numbers or range of port numbers.</p>
Destination Address	Defines the destination IP address of the data packets.
Destination Mask	Netmask for DESTINATION ADDRESS .

Field	Description
Destination Port	Only if PROTOCOL = <i>tcp/udp-port, tcp</i> or <i>udp</i> . 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 <i>any</i> .
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.

R4100 Setup Tool		Funkwerk Enterprise Communications 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)				Val (Tos value)				
				Rem (Remark-Tos value)				
RI	FI	NRI	TOS	Prio	Val	Rem	Filter	Conditions
1	1	2	keep	M High	0	0	FromVoIPSe	sa 192.168.100.20/32
2	2	0	keep	M Nl	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.

R4100 Setup Tool		Funkwerk Enterprise Communications GmbH	
[QOS] [CLASS] [EDIT]		MyGateway	
Index	1		
Filter	FromVoIPServer (1)		
Direction	outgoing		
Action	classify (keep TOS) M		
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: <ul style="list-style-type: none"> ■ <i>incoming</i>: incoming data packets ■ <i>outgoing</i> (default value): outgoing data packets ■ <i>both</i>: 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 <i>none</i> .
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	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 (default value)	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.

R4100 Setup Tool		Funkwerk Enterprise Communications 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: <ul style="list-style-type: none"> ■ <i>normal</i> (default value) ■ <i>high priority</i>
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.

R4100 Setup Tool	Funkwerk Enterprise Communications GmbH
[QoS] [CLASS] [EDIT] [SIG]: Configure IP QoS Signalling	MyGateway
Set Type of Service (TOS) Field	00000000
Specify ToS Set Rate Limitation	none
OK	CANCEL

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: <ul style="list-style-type: none"> ■ <i>none</i> (default value) ■ <i>packets</i> (packets) ■ <i>throughput</i> (bits)

Field	Description
Maximum Rate (Packets per Second) Maximum Rate (Bits per Second)	<p>Only for SPECIFY TOS SET RATE LIMITATION = packets</p> <p>Only for SPECIFY TOS SET RATE LIMITATION = throughput</p> <p>Number of packets or bits to be manipulated per second.</p> <p>Possible values for <i>packets</i>: 0 to 512000.</p> <p>Possible values for <i>throughput</i>: 0 to 4096000.</p> <p>The default value is 0.</p>
Maximum Burst Size (Number of Packets) Maximum Burst Size (Number of Bits)	<p>Only for SPECIFY TOS SET RATE LIMITATION = packets</p> <p>Only for SPECIFY TOS SET RATE LIMITATION = throughput</p> <p>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.</p> <p>Possible values for <i>packets</i>: 0 to 512000.</p> <p>Possible values for <i>throughput</i>: 0 to 4096000.</p> <p>The default value is 0.</p>
Specify ToS Set Exceed Action	<p>This parameter specifies how the packets above the configured limit are to be marked.</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ <i>none</i> (default value): The TOS field is not manipulated. ■ <i>remark-tos</i>: 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.

R4100 Setup Tool		Funkwerk Enterprise Communications GmbH		
[QoS][INTERFACES]: Enable IP QoS Classification		MyGateway		
and Policies				
Interface	First Rule	First Filter	Scheduler	TxRate Limit
QoS-Line				
en1-0		no IP QoS classification		
en1-0-snap		no IP QoS classification		
en1-4		no IP QoS classification		
en1-4-snap		no IP QoS classification		
ethoa50-0		no IP QoS classification		
ethoa50-0-snap		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**:

R4100 Setup Tool [QoS] [INTERFACES] [EDIT]	Funkwerk Enterprise Communications GmbH 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 <i>none</i> .

Field	Description
MLPPP Interleave Mode	<p>Only if a PPP interface is selected as INTERFACE.</p> <p>The MLPPP INTERLEAVE MODE allows the fragmentation of packets without high priority so that high-priority data can be inserted between the fragments.</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ yes: Activates the Multilink PPP Interleave Mode. ■ no (default value): Deactivates the Multilink PPP Interleave Mode.
MLPPP Fragment Size	<p>Only for MLPPP INTERLEAVE MODE = yes.</p> <p>The maximum size of the fragments for a non-high-priority packet.</p> <p>Possible values: 30 to 1500.</p> <p>The default value is 250.</p>

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

4.1 QoS Scheduling and Shaping Submenu

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

R4100 Setup Tool		Funkwerk Enterprise Communications 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	<p>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.</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ <i>disabled</i> (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.)	<ul style="list-style-type: none"> <li>■ <i>delete</i> QoS is deactivated on the interface. The queueing and scheduling configuration is deleted. <li>■ <i>priority queueing (PQ)</i> QoS is activated on the interface. The available bandwidth is distributed strictly according to the queue priority. <li>■ <i>weighted round-robin scheduling (WRR)</i> 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. <li>■ <i>weighted fair queueing (WFQ)</i> 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	<p>Only for QUEUEING AND SCHEDULING ALGORITHM = <i>priority queueing (PQ)</i>, <i>weighted round-robin scheduling (WRR)</i> or <i>weighted fair queueing (WFQ)</i>.</p> <p>Activation or deactivation of data rate limiting (= traffic shaping) in the send direction.</p> <p>Possible values:</p> <ul style="list-style-type: none"> <li>■ <i>yes</i>: Feature is activated. <li>■ <i>no</i>: Feature is deactivated. <p>The default value is <i>no</i>.</p>

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.

R4100 Setup Tool		Funkwerk Enterprise Communications 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**.

R4100 Setup Tool		Funkwerk Enterprise Communications 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	<p>Selection of type of queue.</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ <i>class-based</i> (default value): Queue for data classified as “normal”. ■ <i>default</i>: Queue for data that has not been classified or data of a class for which no queue has been configured. ■ <i>high priority</i>: Queue for data classified as “high priority”.
Class ID	<p>Only for CLASS = <i>class-based</i>.</p> <p>Selection of the QoS packet class to which this queue is to apply.</p>

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: <ul style="list-style-type: none"> ■ 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	<p>Only for QUEUEING AND SCHEDULING ALGORITHM = <i>priority queueing (PQ)</i> and CLASS = <i>default</i> or <i>class-based</i>.</p> <p>Relative priority of this class.</p> <p>Possible values: 0 (highest priority, default value) to 255 (lowest priority).</p>
Shaping Algorithm	<p>No selection options. Until now only Token Bucket procedure for assignment/limitation of the bandwidth for a queue.</p>
Congestion Avoidance Algorithm	<p>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.</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ <i>none</i> (default value): No preventive dropping of packets. ■ <i>weighted-random (RED)</i>: 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	<p>Selection of the procedure to be used for dropping packets above the UPPER QUEUE THRESHOLD (BYTES) (equates to the maximum size of this queue).</p> <p>Possible values:</p> <ul style="list-style-type: none"> ■ <i>tail-drop</i> (default value): The newest packet received is dropped. ■ <i>head-drop</i>: The oldest packet in the queue is dropped. ■ <i>random-drop</i>: A randomly selected packet is dropped from the queue.
Lower Queue Threshold (Bytes)	<p>Lower Threshold for Congestion Avoidance.</p> <p>Possible values: 0 (default value) to 262143.</p>
Upper Queue Threshold (Bytes)	<p>Upper threshold for congestion avoidance and value above which the DROPPING ALGORITHM is used.</p> <p>Possible values: 0 to 262143.</p> <p>The default value is 16384.</p>

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

Index: QoS

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	Destination Port	8
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L	Lower Queue Threshold (Bytes)	26
M	Maximum Burst Size (Number of Bits)	14
	Maximum Burst Size (Number of Packets)	14
	Maximum Rate (Bits per Second)	14
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	MLPPP Fragment Size	19

	MLPPP Interleave Mode	19
N	Next Rule	11
P	Priority	25
	Protocol	6
Q	Queuing and Scheduling Algorithm	20
S	Set Remark Type of Service (TOS) Field	15
	Set Type of Service (TOS) Field	13
	Shaping Algorithm	25
	Source Address	7
	Source Mask	7
	Source Port	7, 8
	Specify Port	7
	Specify ToS Set Exceed Action	14
	Specify ToS Set Rate Limitation	13
	Specify Traffic Shaping	21
T	TOS Mask	8
	Transmit Rate (Bits per Second)	24
	Transmit Rate Burst	24
	Type	7
	Type of Service (TOS)	8
U	Upper Queue Threshold (Bytes)	26
W	Weight	24