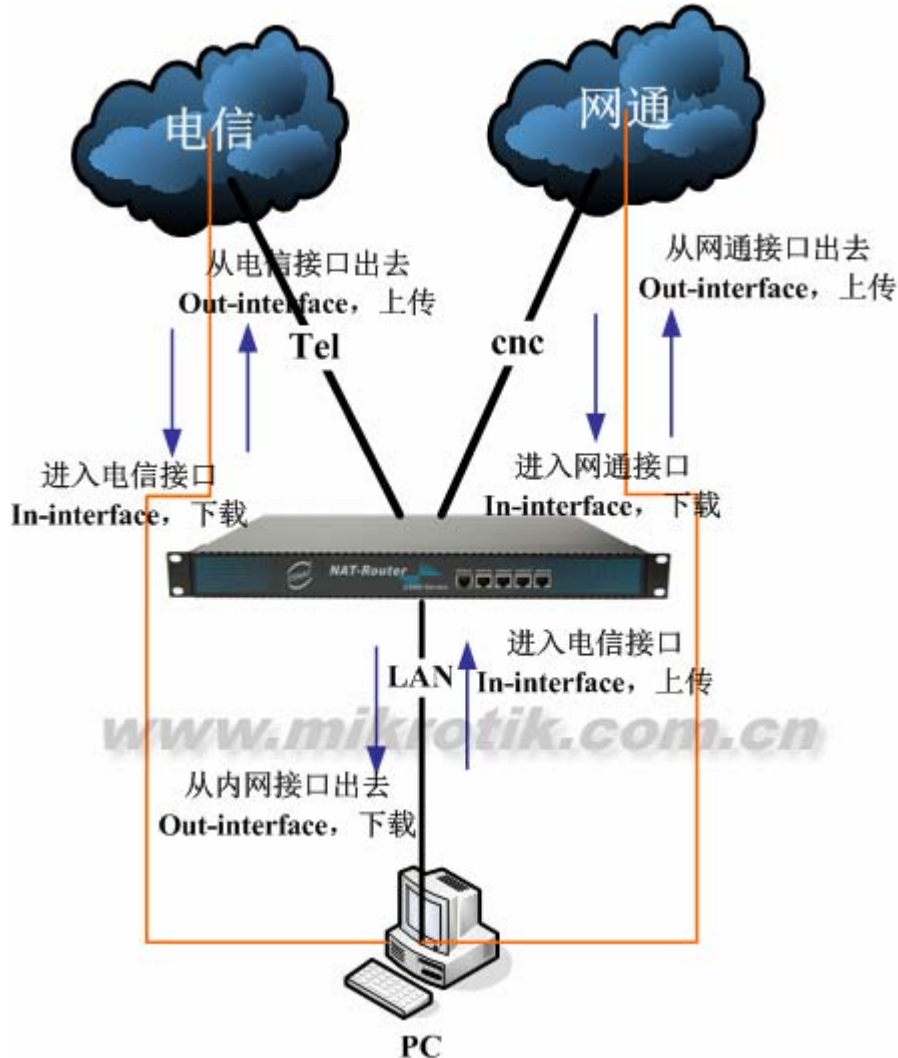


双线 HTB 操作手册

这里我们介绍下双线的 HTB 的操作方法，这里以电信和联通线路为例，双线的 HTB 里我们可以加入对游戏端口的优先控制，即但个用户在下载时，玩游戏同样不会卡，我们这里重点讲解 HTB 流控做法，双线的路由规则被忽略。如果想很好理解标记流量的原理，请理解下面这张图：



我们的两条线路的 IP 地址如下：

Address List					
<div>+ - ✓ ✗ 📄 🔍 Find</div>					
Address	/	Network	Broadcast	Interface	
118.6.6.2/24		118.6.6.0	118.6.6.255	ether1-tel	
192.168.0.1/24		192.168.0.0	192.168.0.255	ether3-lan	
212.2.2.2/24		212.2.2.0	212.2.2.255	ether2-cnc	

我们进入 ip firewall mangle 中标记数据规则，这里我们以 forward 链表为例，标记双线数据的上行和下行

我们首先标记 tel 和 cnc 线路的下行，选择规则的 in-interface=ether1-tel 和 in-interface=ether2-cnc 标记下行数据

New Mangle Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface: ☐ ether1-tel

Out. Interface:

New Mangle Rule

General Advanced Extra Action Statistics

Action: mark packet

New Packet Mark: tel_down

☐ Passthrough

标记 cnc 的数据流量

New Mangle Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface: ☐ ether2-cnc

Out. Interface:

New Mangle Rule	
General	Advanced
Extra	Action
Statistics	
Action:	mark packet
New Packet Mark:	cnc_down
<input type="checkbox"/> Passthrough	

标记电信和联通的上行数据流量

电信上行数据流量

New Mangle Rule	
General	Advanced
Extra	Action
Statistics	
Chain:	forward
Src. Address:	
Dst. Address:	
Protocol:	
Src. Port:	
Dst. Port:	
Any. Port:	
P2P:	
In. Interface:	
Out. Interface:	<input type="checkbox"/> ether1-tel

New Mangle Rule	
General	Advanced
Extra	Action
Statistics	
Action:	mark packet
New Packet Mark:	tel_up
<input type="checkbox"/> Passthrough	

联通上行流量标记

New Mangle Rule

General Advanced Extra Action Statistics

Chain: ▼

Src. Address: ▼

Dst. Address: ▼

Protocol: ▼

Src. Port: ▼

Dst. Port: ▼

Any. Port: ▼

P2P: ▼

In. Interface: ▼

Out. Interface: ☐ ▼

New Mangle Rule

General Advanced Extra Action Statistics

Action: mark packet

New Packet Mark: cnc_up

☐ Passthrough

标记完成后

The screenshot shows the Mikrotik WinBox Firewall rule configuration window. The 'Filter Rules' tab is selected. The rule is named '电信下载' (Telecom Download). The action is 'mark packet'. The chain is 'forward'. The in-interface is 'ether1-tel'. The new packet mark is 'tel_down'. The bytes and packets are both 0. The rule is enabled (checkbox checked).

以上完成了对电信和联通数据标记，我们接下来要做的是，游戏数据的标记，现在要做的是导入游戏脚本，因为是电信和联通双线，我们就要做两条线路的游戏策略，导入两组游戏策略规则。我们先把游戏脚本拖放到 Files 列表中

The screenshot shows a 'File List' window with a blue title bar. Below the title bar is a toolbar with icons for a minus sign, a funnel, a document, a folder, and buttons for 'Backup' and 'Restore'. A 'Find' button is on the right. The main area contains a table with the following data:

	File Name	Type	Size	Creation Time
	games510cnc.rsc	script	8.9 KiB	Jan/04/1970 18:49:11
	games510tel.rsc	script	8.9 KiB	Jan/04/1970 18:49:11

我们进入 CLI 下，通过 import 命令导入脚本

```

MMM      MMM      KKK                      TTTTTTTTTT      KKK
MMMM     MMMM     KKK                      TTTTTTTTTT      KKK
MMM MMMM MMM III  KKK KKK RRRRRR      OOOOOO      TTT      III KKK KKK
MMM MM  MMM III  KKKKK RRR RRR OOO OOO      TTT      III KKKKK
MMM     MMM III  KKK KKK RRRRRR      OOO OOO      TTT      III KKK KKK
MMM      MM III  KKK KKK RRR RRR      OOOOOO      TTT      III KKK KKK

MikroTik RouterOS 5.0rc1 (c) 1999-2010      http://www.mikrotik.com/

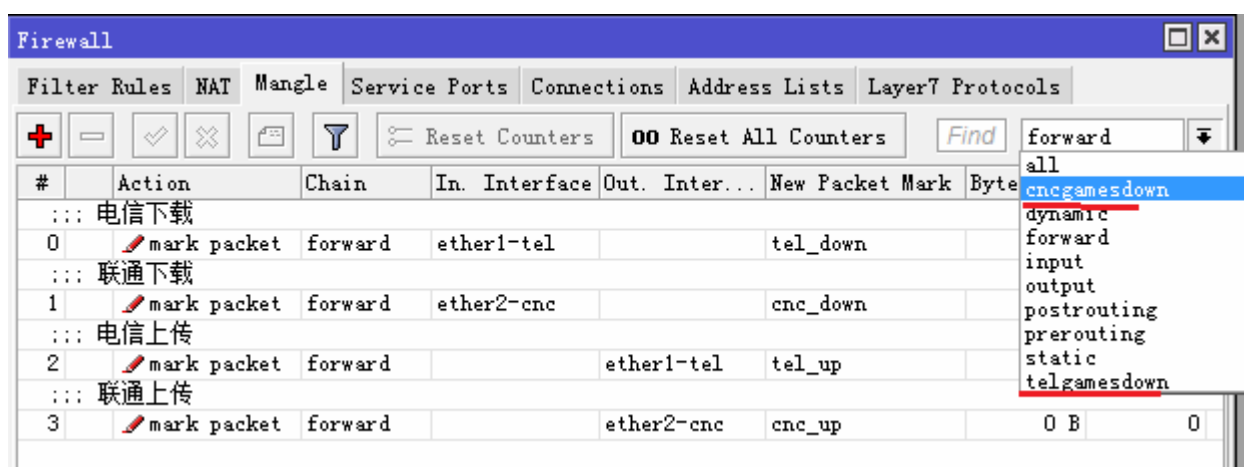
[admin@MikroTik] > import games510tel.rsc
Opening script file games510tel.rsc

Script file loaded and executed successfully
[admin@MikroTik] > import games510cnc.rsc
Opening script file games510cnc.rsc

Script file loaded and executed successfully
[admin@MikroTik] >

```

导入脚本后，我们可以在 mangler 中找到自定义的 2 个电信和联通的游戏链表



我们定义数据跳转到游戏规则中，并进行相应游戏端口数据处理，首先定义电信游戏链表

New Mangle Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface: ☐ ether1-tel

New Mangle Rule

General Advanced Extra Action Statistics

Action: jump

Jump Target: telgamesdown

定义联通游戏数据的调整

New Mangle Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface: ☐ ether2-cnc

New Mangle Rule

General Advanced Extra Action Statistics

Action: jump

Jump Target: cncgamesdown

定义完成后，我们把两条游戏跳转规则拖动到最上面

Firewall							
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols							
<div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📄</div> <div>🔍</div> <div>00 Reset Counters</div> <div>00 Reset All Counters</div> <div>Find</div> <div>forward</div> <div>⌵</div> </div>							
#	Action	Chain	In. Interface	Out. Inter...	New Packet Mark	Bytes	Packets
::: 电信下载							
0	🔪 mark packet	forward	ether1-tel		tel_down	0 B	0
::: 联通下载							
1	🔪 mark packet	forward	ether2-cnc		cnc_down	0 B	0
::: 电信上传							
2	🔪 mark packet	forward		ether1-tel	tel_up	0 B	0
::: 联通上传							
3	🔪 mark packet	forward		ether2-cnc	cnc_up	0 B	0
100	🔗 jump	forward	ether1-tel			0 B	0
101	🔗 jump	forward	ether2-cnc			0 B	0

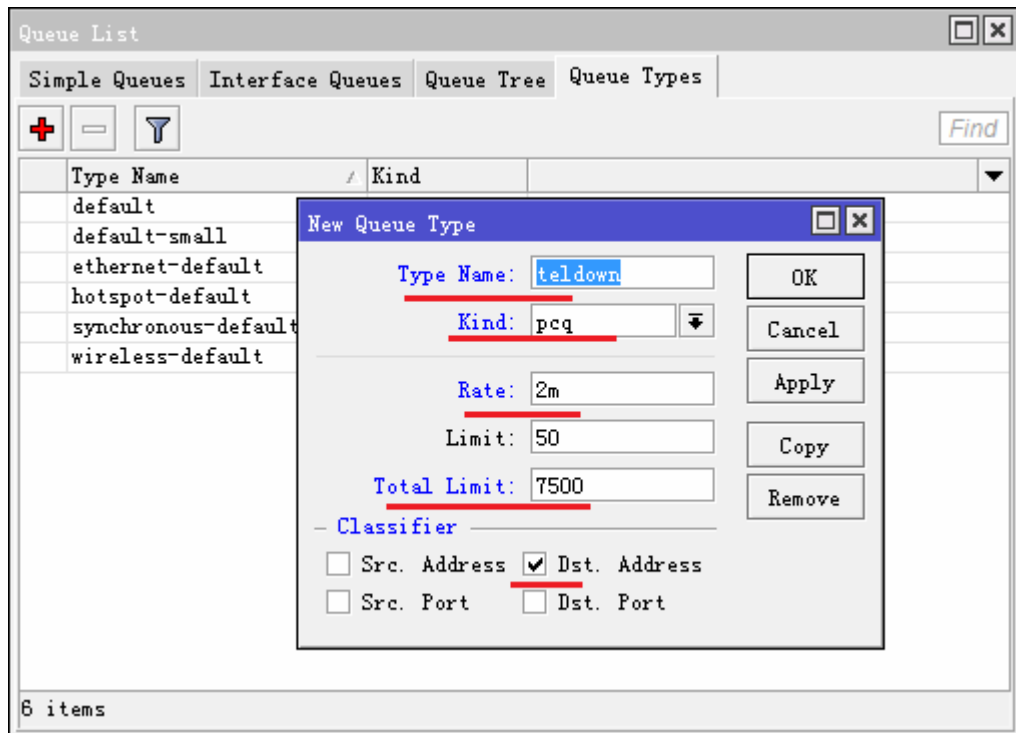
Firewall							
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols							
<div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📄</div> <div>🔍</div> <div>00 Reset Counters</div> <div>00 Reset All Counters</div> <div>Find</div> <div>forward</div> <div>⌵</div> </div>							
#	Action	Chain	In. Interface	Out. Inter...	New Packet Mark	Bytes	Packets
0	🔗 jump	forward	ether1-tel			0 B	0
1	🔗 jump	forward	ether2-cnc			0 B	0
::: 电信下载							
2	🔪 mark packet	forward	ether1-tel		tel_down	0 B	0
::: 联通下载							
3	🔪 mark packet	forward	ether2-cnc		cnc_down	0 B	0
::: 电信上传							
4	🔪 mark packet	forward		ether1-tel	tel_up	0 B	0
::: 联通上传							
5	🔪 mark packet	forward		ether2-cnc	cnc_up	0 B	0

这样数据已经标记完成，剩下的就是在 Queue 里设置带宽控制规则了，进入 Queue 里，在 Queue type 里定义

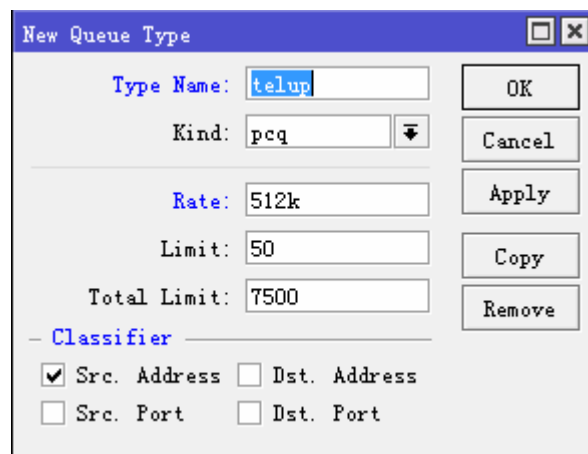
Queue 带宽控制

假设我们的双线出口的带宽分别是电信 12M，联通 10M，内网主机是 150 台，我们根据这个带宽来添加电信、联通两条线路的上行和下行 PCQ 规则。

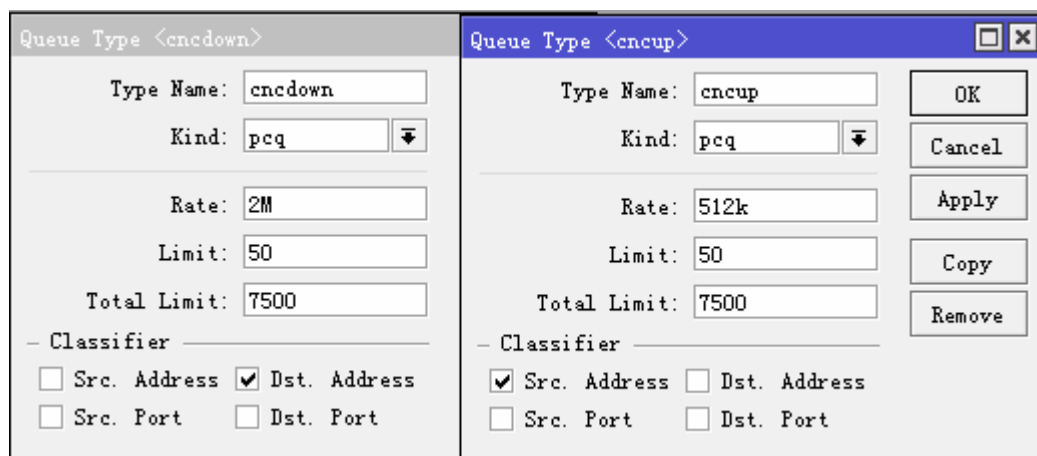
首先添加电信出口的下行带宽，通过 PCQ 设置每台电脑带宽为 2M，取名为 tel_down，记住要换算主机数，即 $\text{total-limit} = \text{limit} * 150 \text{ 台主机} = 7500$



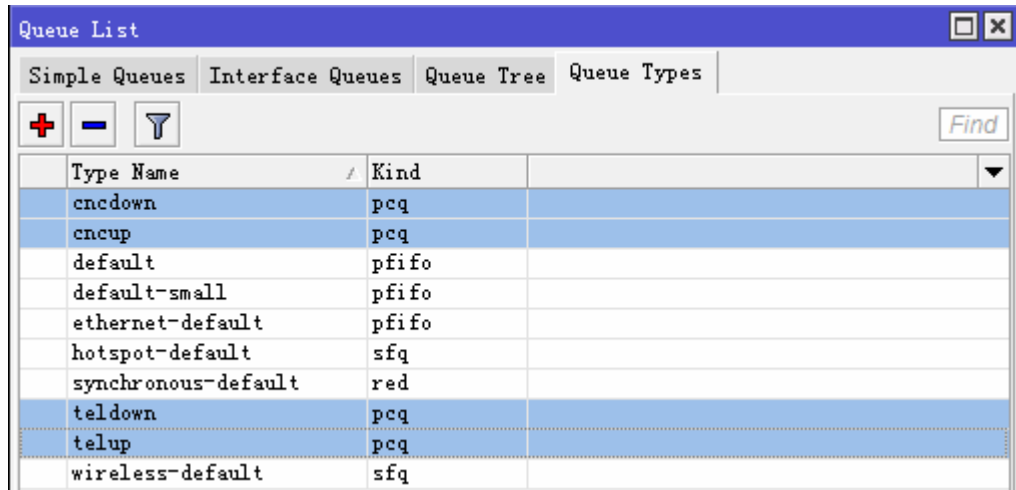
添加电信出口的上行带宽控制，上行分配为 512k



接下来是联通的下行和上行带宽 PCQ 规则



配置 PCQ 规则如下：

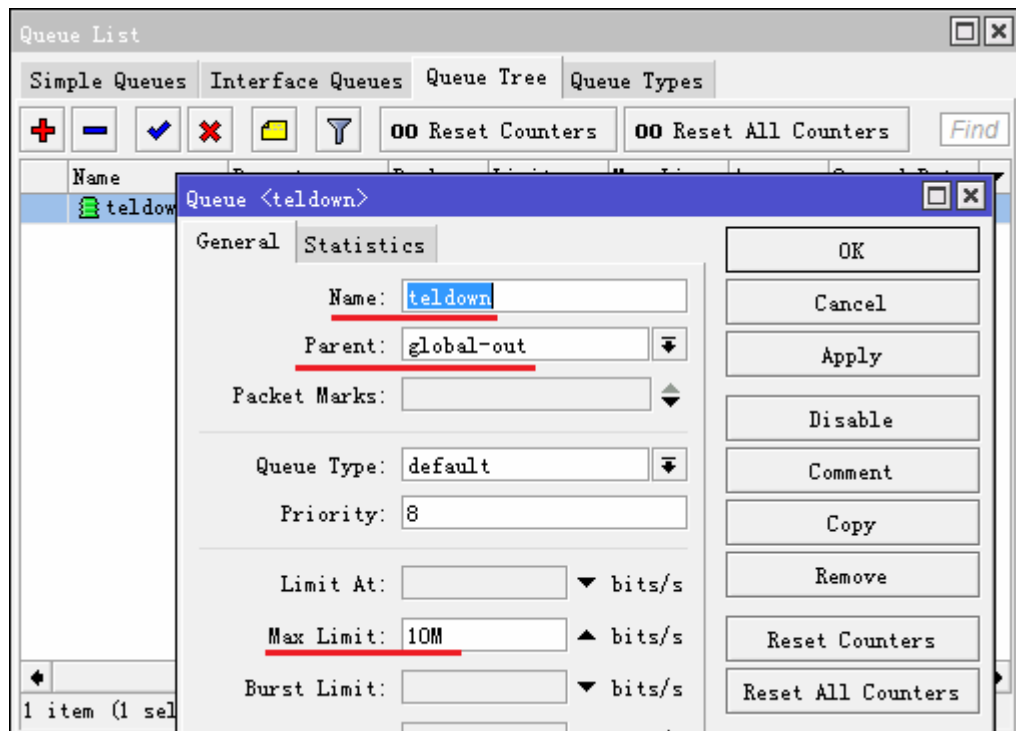


Type Name	Kind
cncdown	pcq
cncup	pcq
default	pfifo
default-small	pfifo
ethernet-default	pfifo
hotspot-default	sfq
synchronous-default	red
teldown	pcq
telup	pcq
wireless-default	sfq

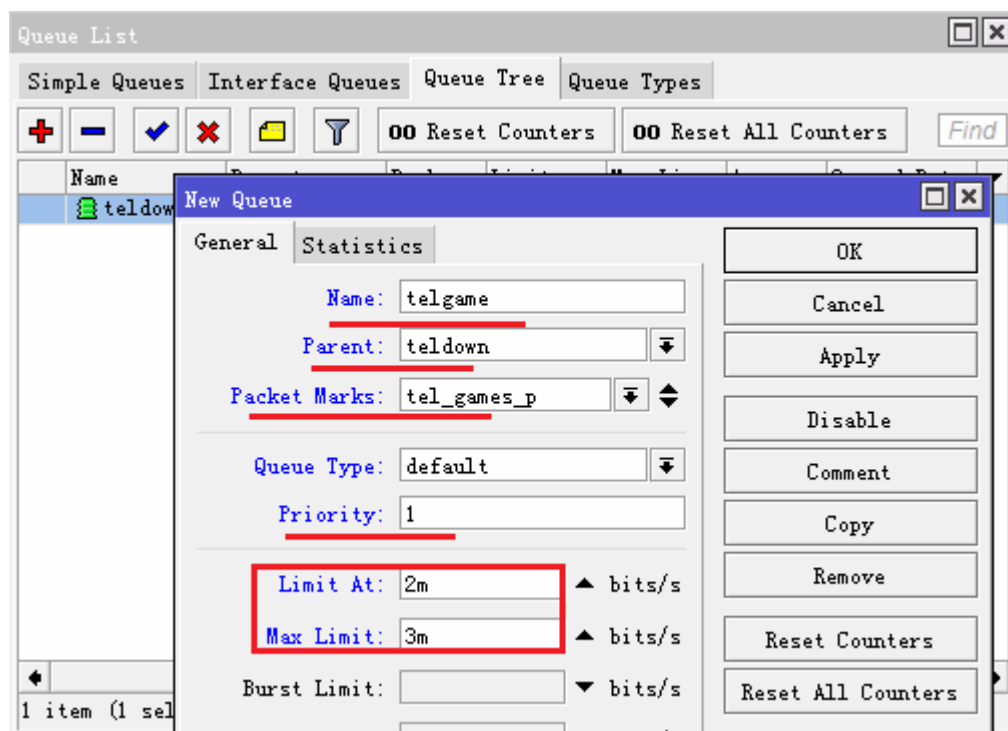
以上 PCQ 规则配置完成后，最后一步就是配置 Queue Tree 的流控，HTB 需要考虑一个父级带宽，每个子队列从父级获得一个可用的带宽，每个子队列都有优先级，父级根据子队列的优先级不同来对其区别处理，优先级高的先获得带宽，低的则最后获得。

电信和联通分成两组 HTB，每组的下行包含两个队列，一个是游戏数据，一个是除游戏外的其他数据，这样让游戏的队列优先级为 1（最高），其他数据优先级为 8（最低），达到优先处理游戏带宽的作用

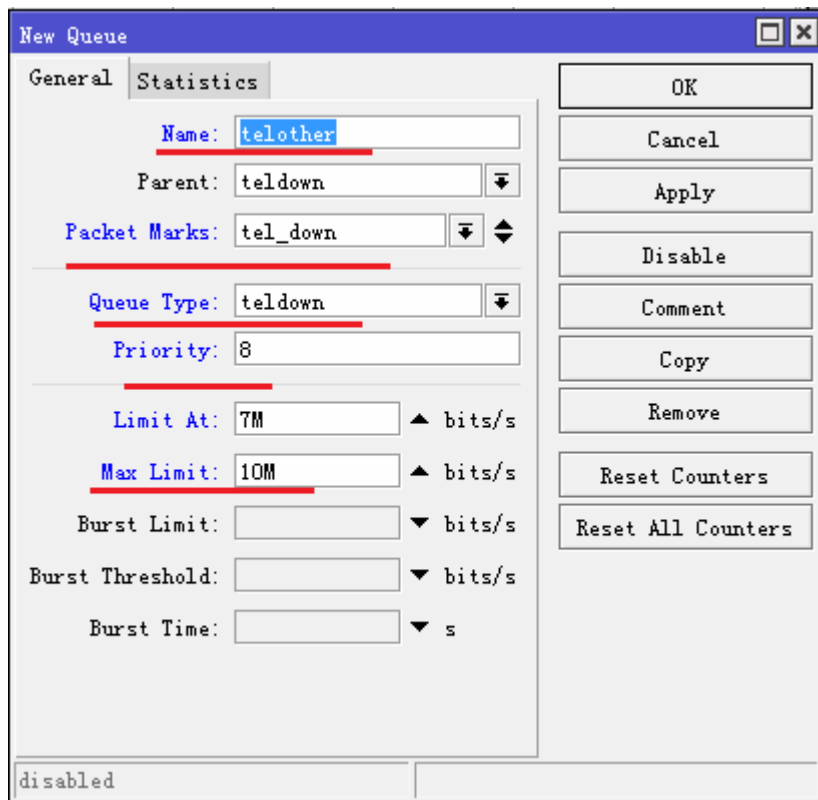
我们先定义 HTB 的下行父级，电信下行父级取名 teldown，选择 global-out，因为我们标记使用的是 forward，max-limit=10M，这里我们保留 2M 为电信的缓冲



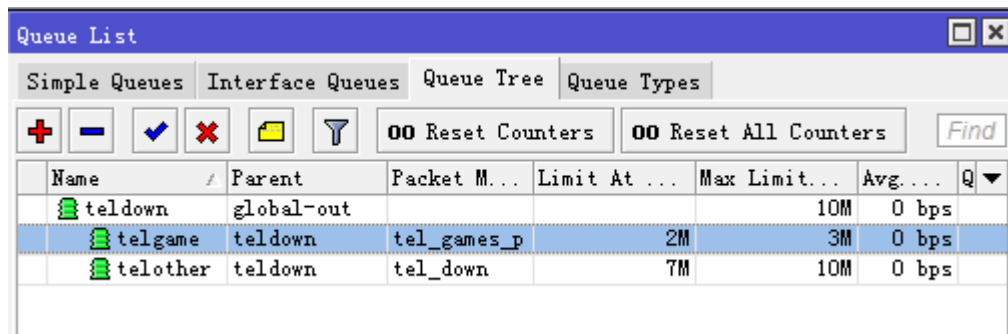
添加一个电信游戏的流控规则，这里我们取名为 telgame，parent 父级设置为刚才的 teldown，选择 packet-mark 为之前我们标记的 tel_games_p，设置 max-limit=3M，即游戏可以获得的最大带宽，最低保证 2M 带宽，即 Limit=2M，游戏带宽不大，所以 2M 可以满足 150 台机器的带宽



剩下就是配置其他数据的流控，我们取名为 telother，同样是设置 teltdown 为父级，packet-mark 为 tel_down，这里我们要选择 queue=teltdown，即我们刚才设置的电信 PCQ 规则，我们把 max-limit 设置为 10M，即能获得最大带宽，但 limit-at 只能有 7M，需要流出来保证给游戏的 2M 带宽使用，并预留 1M 为备用带宽， $7M + 2M + 1M = 10M$

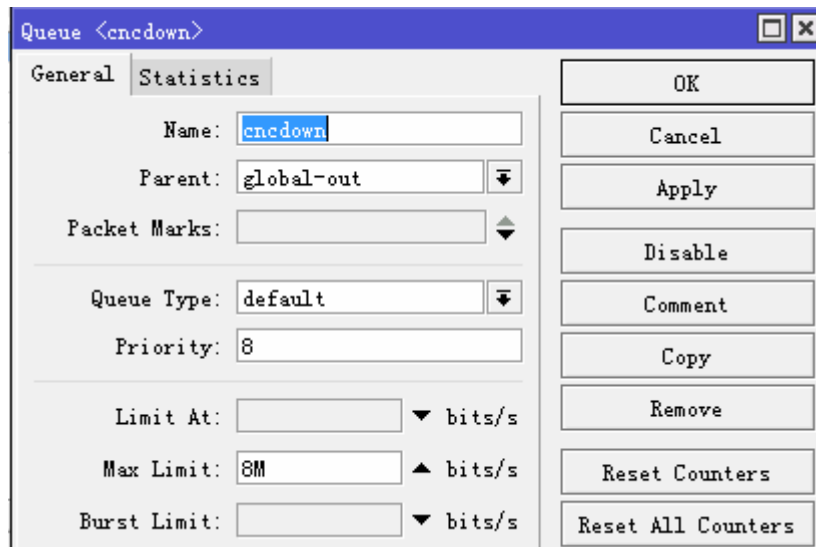


配置完成后如下显示



Name	Parent	Packet M...	Limit At ...	Max Limit...	Avg...	Q
teltdown	global-out			10M	0 bps	
telgame	teltdown	tel_games_p	2M	3M	0 bps	
telother	teltdown	tel_down	7M	10M	0 bps	

最后就是用同样的方法，添加联通的下行带宽控制：



Queue <cncdown>

General Statistics

Name: cncdown

Parent: global-out

Packet Marks:

Queue Type: default

Priority: 8

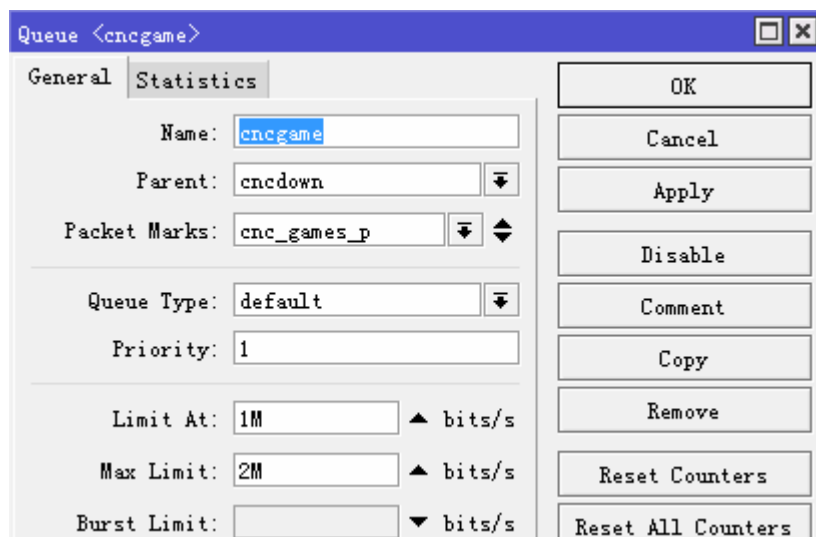
Limit At: bits/s

Max Limit: 8M bits/s

Burst Limit: bits/s

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Reset Counters
Reset All Counters

添加游戏的优先规则



Queue <cncgame>

General Statistics

Name: cncgame

Parent: cncdown

Packet Marks: cnc_games_p

Queue Type: default

Priority: 1

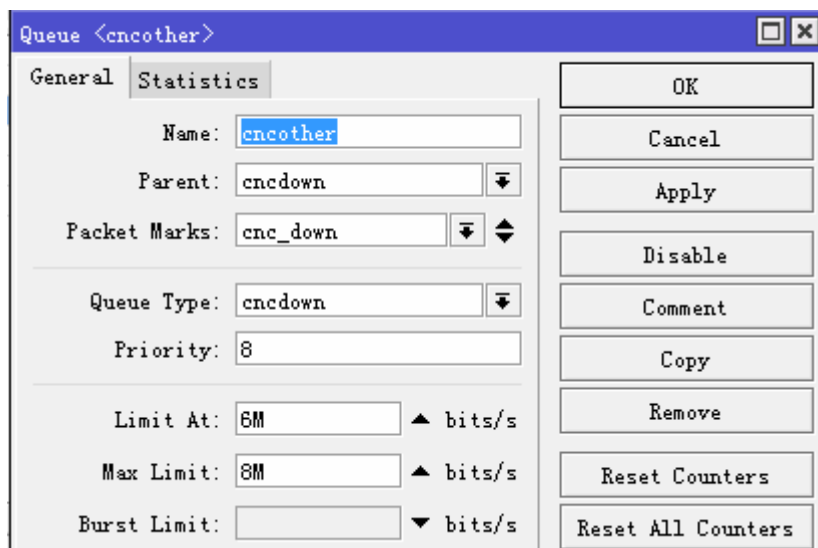
Limit At: 1M bits/s

Max Limit: 2M bits/s

Burst Limit: bits/s

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Reset Counters
Reset All Counters

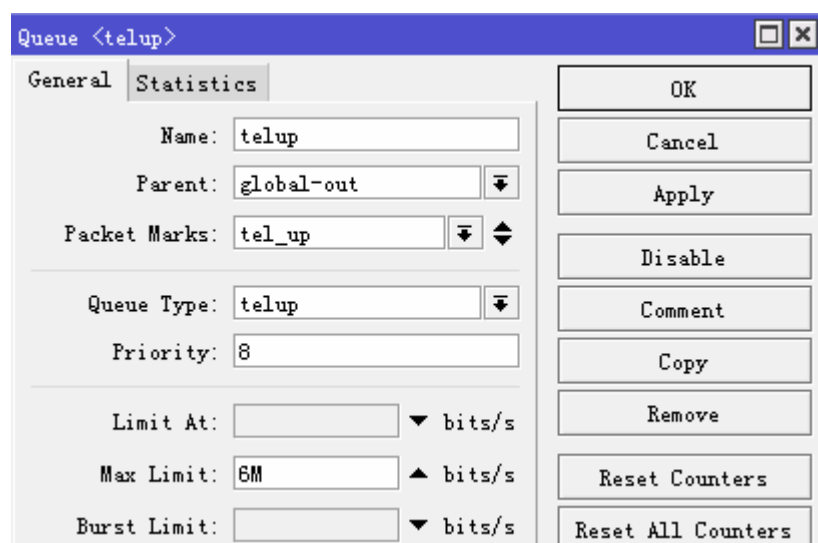
配置联通其他流量的流控



下行设置完成后如下:

Simple Queues Interface Queues Queue Tree Queue Types							
<input type="button" value="+"/> <input type="button" value="-"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="button" value="Filter"/> <input type="button" value="00 Reset Counters"/> <input type="button" value="00 Reset All Counters"/> <input type="button" value="Find"/>							
Name	Parent	Packet M...	Limit At ...	Max Limit...	Avg...	Q	
cncdown	global-out			8M	0 bps		
cncgame	cncdown	cnc_games_p	1M	2M	0 bps		
cncother	cncdown	cnc_down	6M	8M	0 bps		
teltdown	global-out			10M	0 bps		
telgame	teltdown	tel_games_p	2M	3M	0 bps		
telother	teltdown	tel_down	7M	10M	0 bps		

最后一步就是设置上行带宽，我们分别添加电信和联通的上行规则，一般上行流量较小，可又不用考虑游戏特别处理。



设置联通出口的带宽规则

Queue <cncup>

General Statistics

Name:

Parent:

Packet Marks:

Queue Type:

Priority:

Limit At: ▼ bits/s

Max Limit: ▲ bits/s

Burst Limit: ▼ bits/s

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

最后配置完成结果:

Queue List

Simple Queues Interface Queues Queue Tree Queue Types

+ - ✓ ✗ 📁 🔍 00 Reset Counters 00 Reset All Counters Find

Name	Parent	Packet M...	Limit At ...	Max Limit...	Avg...	Q ▼
cncdown	global-out			8M	0 bps	
cncgame	cncdown	cnc_games_p	1M	2M	0 bps	
cncother	cncdown	cnc_down	6M	8M	0 bps	
cncup	global-out	cnc_up		5M	0 bps	
teltdown	global-out			10M	0 bps	
telgame	teltdown	tel_games_p	2M	3M	0 bps	
telother	teltdown	tel_down	7M	10M	0 bps	
telup	global-out	tel_up		6M	0 bps	