

9 Bandwidth Limit



Bandwidth Limit

Simple Queue

- Самый просто способ ограничить скорость:
 - client download
 - client upload
 - client aggregate, download+upload

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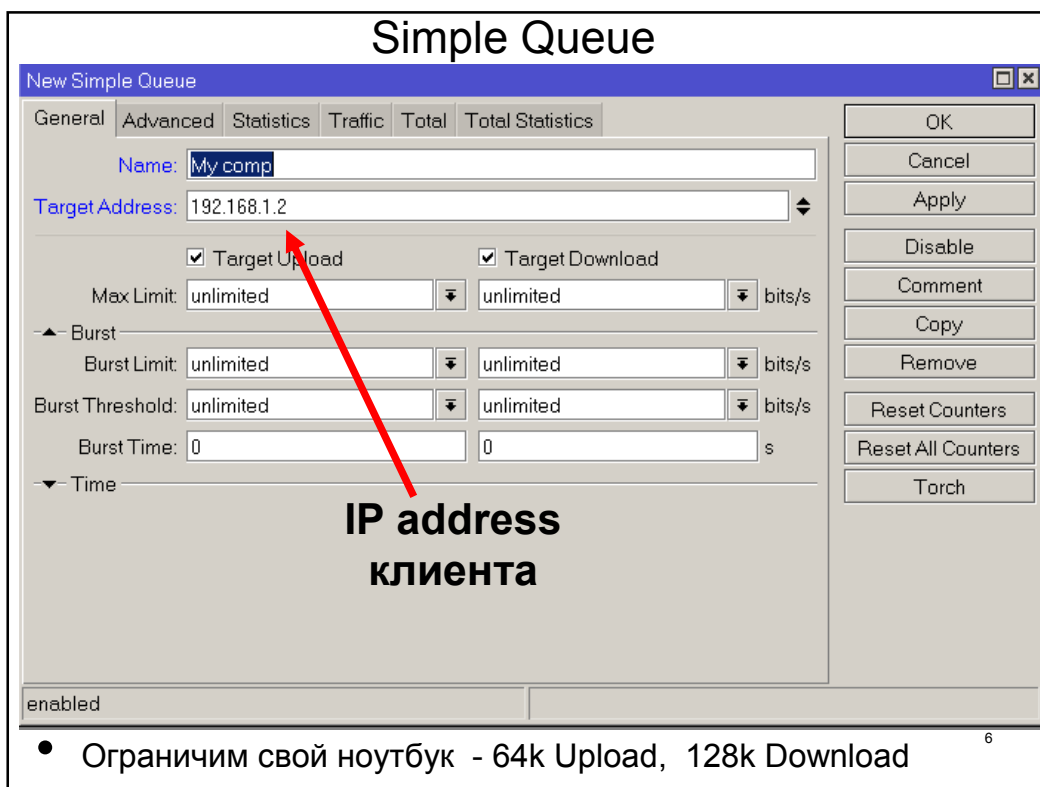
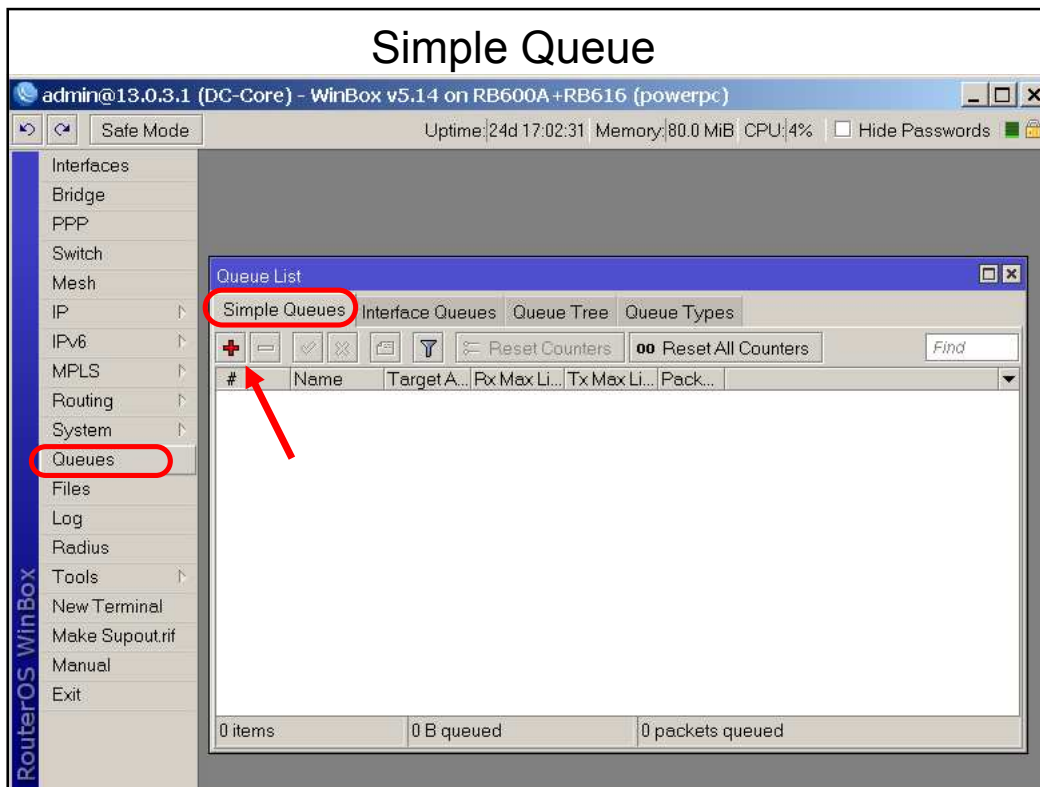
3

Simple Queue

- В Simple Queue вы должны использовать **Target-Address**
- Важен порядок правил.

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Simple Queue

Указываем скорости

- Ограничим свой ноутбук - 64k Upload, 128k Download

Simple Queue

#	Name	Target Addr...	Rx Max Limit	Tx Max Limit	Pack...
0	My comp	192.168.1.2	64k	128k	

1 item 0 B queued 0 packets queued

- Ограничим свой ноутбук - 64k Upload, 128k Download

Simple Queue

LAB

- Ограничьте свой ноутбук 128k / 256k
- Проверьте свое ограничение
- Torch

9

9

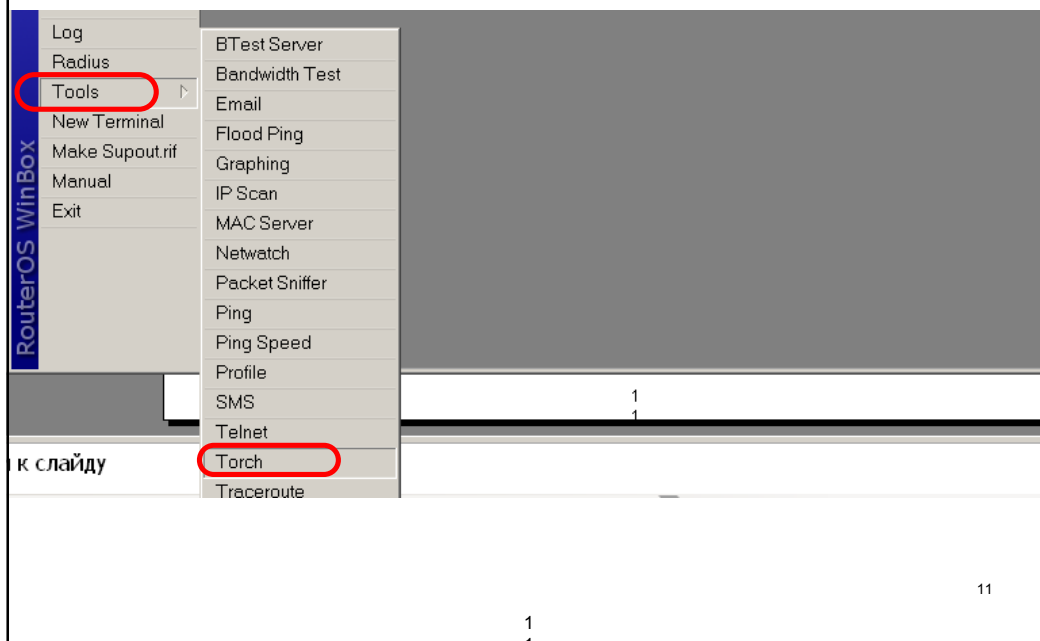
Torch

- Диагностическая утилита
- Показывает в реальном времени трафик проходящий через указанный интерфейс

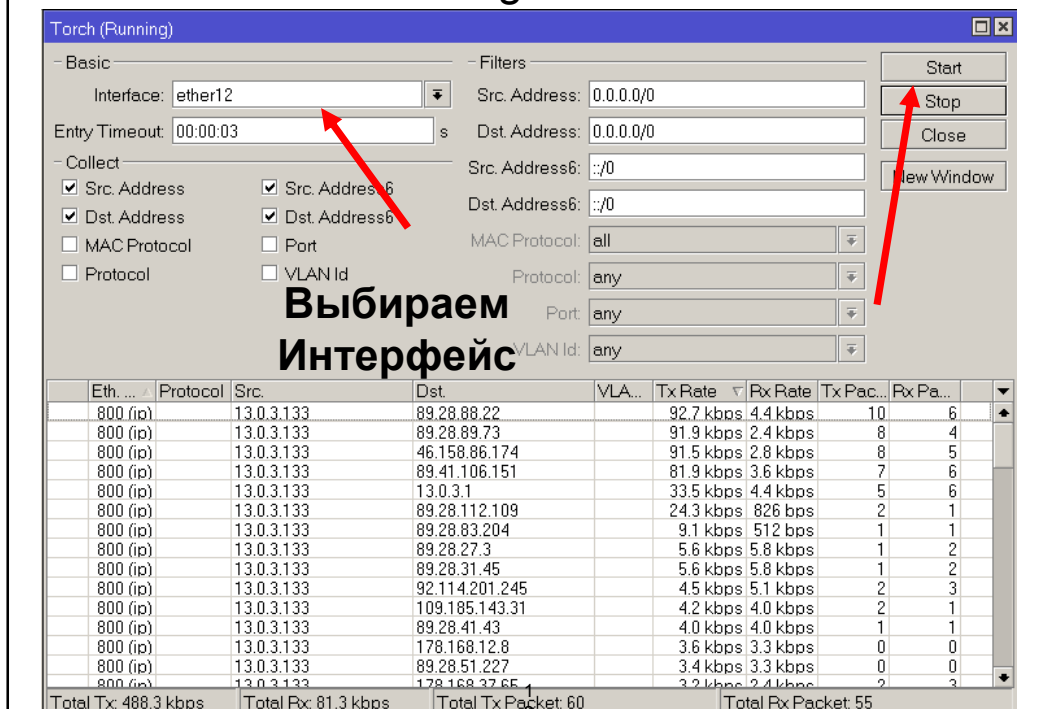
10

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Torch



Using Torch



Using Torch

Torch (Running)

- Basic
 Interface: ether12
 Entry Timeout: 00:00:03 s

- Collect
☒ Src. Address
☐ Dst. Address
☐ MAC Protocol
☐ Protocol
☒ Src. Address6
☐ Dst. Address6
☐ Port
☐ VLAN Id

- Filters
 Src. Address: 0.0.0.0/0
 Dst. Address: 0.0.0.0/0
 Src. Address6: ::/0
 Dst. Address6: ::/0
 MAC Protocol: all
 Protocol: any
 Port: any
 VLAN Id: any

Start
Stop
Close
New Window

Eth...	Protocol	Src.	Dst.	VLA...	Tx Rate	Rx Rate	Tx Pac...	Rx Pa...
800 (ip)		13.0.3.133	0.0.0.0		6.2 Mbps	214.4 k...	559	296
800 (ip)		13.0.3.118	0.0.0.0		288 bps	1456 b...	0	2
800 (ip)		15.0.0.239	0.0.0.0		0 bps	264 bps	0	0

Total Tx: 6.2 Mbps Total Rx: 216.1 kbps Total Tx Packet: 559 Total Rx Packet: 298

Using Torch

Torch (Running)

- Basic
 Interface: ether12
 Entry Timeout: 00:00:03 s

- Collect
☒ Src. Address
☐ Dst. Address
☐ MAC Protocol
☐ Protocol
☒ Src. Address6
☐ Dst. Address6
☐ Port
☐ VLAN Id

- Filters
 Src. Address: 13.0.3.133
 Dst. Address: 0.0.0.0/0
 Src. Address6: ::/0
 Dst. Address6: ::/0
 MAC Protocol: all
 Protocol: any
 Port: any
 VLAN Id: any

Start
Stop
Close
New Window

Eth...	Protocol	Src.	Dst.	VLA...	Tx Rate	Rx Rate	Tx Pac...	Rx Pa...
800 (ip)		13.0.3.133	0.0.0.0		3.2 Mbps	115.7 k...	335	179

Total Tx: 3.2 Mbps Total Rx: 115.7 kbps Total Tx Packet: 335 Total Rx Packet: 179

Using Torch

The screenshot shows the Mikrotik WinBox interface. On the left, the 'Interface List' pane displays a list of network interfaces. A right-click context menu is open over the 'ether12' interface, with the 'Torch' option highlighted by a red arrow. The main pane shows a table of interface statistics.

Interface	Type	MTU	Tx	Rx	Tx Pa...	Rx Pa...	Tx
ether2	Ethernet	1600	13.1 kb...	174.5 kbps	18	25	
ether3	Ethernet	1600	1585.4 ...	315.9 kbps	232	147	
ether4	Ethernet	1526	321.7 k...	1596.7 kb...	148	225	
ether5	Ethernet	1526	0 bps	0 bps	0	0	
ether6	Ethernet	1526	0 bps	0 bps	0	0	
ether7	Ethernet	1526	3.5 kbps	6.5 kbps	5	7	
ether8	Ethernet	1526	0 bps	0 bps	0	0	
ether9	Ethernet	1526	0 bps	0 bps	0	0	
ether10	Ethernet	1526	0 bps	0 bps	0	0	
ether11	Ethernet	1526	0 bps	0 bps	0	0	
ether12	Ethernet	1526	4.5 Mbps	154.4 kbps	422	216	
ether13	Ethernet	1526	0 bps	0 bps	0	0	
ether14	Ethernet	1526	0 bps	0 bps	0	0	
ether15	Ethernet	1526	0 bps	0 bps	0	0	
ether16	Ethernet	1526	0 bps	0 bps	0	0	
ether17	Ethernet	1526	0 bps	0 bps	0	0	
ether18	Ethernet	1526	0 bps	0 bps	0	0	
ether19	Ethernet	1526	0 bps	0 bps	0	0	
l2tp-out1	L2TP Client		0 bps	0 bps	0	0	
tun-999.md	OVPN Client		0 bps	0 bps	0	0	

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Simple Queue Specific Server Limit

New Simple Queue

General | Advanced | Statistics | Traffic | Total | Total Statistics

Name: Local Comp to Aitec.md

Target Address: 192.168.1.2

☒ Target Upload ☒ Target Download

Max Limit: 1M 2M bits/s

Burst Limit: unlimited unlimited bits/s

Burst Threshold: unlimited unlimited bits/s

Burst Time: 0 0 s

Time

enabled

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

Simple Queue Specific Server Limit

New Simple Queue

General **Advanced** Statistics Traffic Total Total Statistics

P2P:

Packet Marks:

Dst. Address:

Interface:

Target Upload Limit At: bits/s

Target Download Limit At: bits/s

Queue Type:

Parent:

Priority:

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

enabled

Simple Queue Specific Server Limit

Queue List

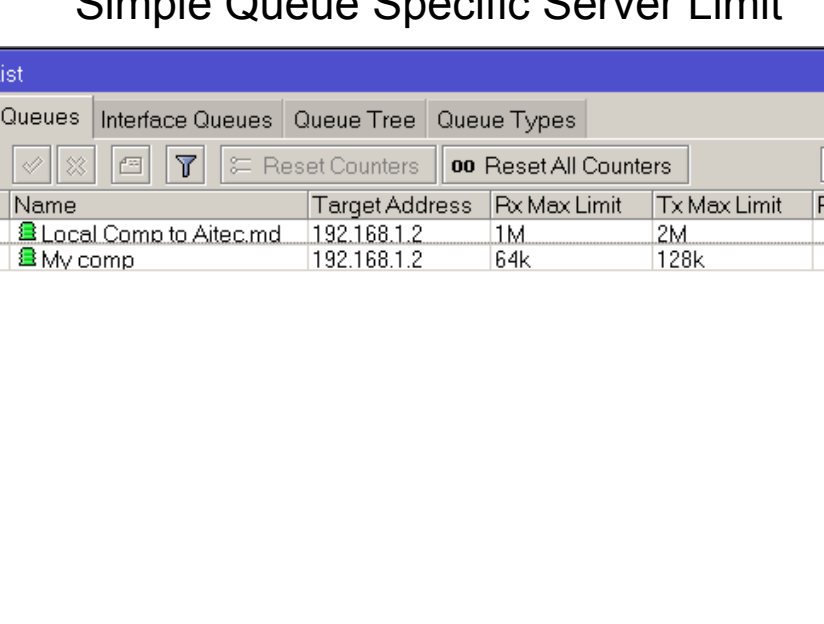
Simple Queues Interface Queues Queue Tree Queue Types

+ - ✓ ✗ Reset Counters ∞ Reset All Counters Find

#	Name	Target Address	Rx Max Limit	Tx Max Limit	Pack...	
0	Mv comp	192.168.1.2	64k	128k		
1	Local Comp to Aitec.md	192.168.1.2	1M	2M		

2 items 0 B queued 0 packets queued

Simple Queue Specific Server Limit



The screenshot displays the 'Queue List' window in Mikrotik WinBox. The window has a blue title bar and a menu bar with 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. Below the menu bar is a toolbar with various icons and buttons, including 'Reset Counters' and 'Reset All Counters'. A 'Find' text box is also present. The main area contains a table with the following data:

#	Name	Target Address	Px Max Limit	Tx Max Limit	Pack...	
0	Local Comp to Aitec.md	192.168.1.2	1M	2M		
1	My comp	192.168.1.2	64k	128k		

The status bar at the bottom of the window shows '2 items', '0 B queued', and '0 packets queued'.

Specific Server Limit

- Сделайте ограничение для сайта aitec.md
- Скорость для этого сайта должна быть выше чем основное ограничение

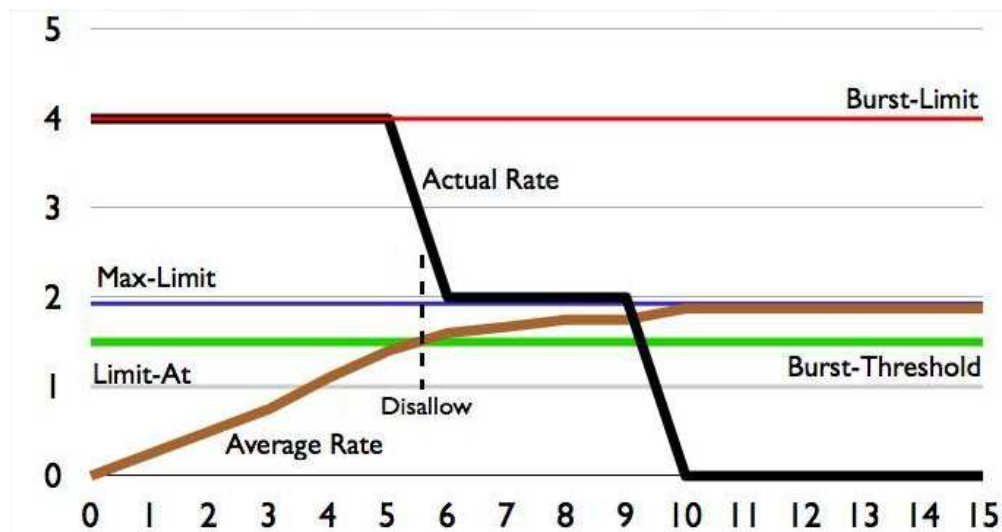
20

Simple Queue Burst

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2
4

Simple Queue Burst



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2
2

Simple Queue Burst

New Simple Queue

General | Advanced | Statistics | Traffic | Total | Total Statistics

Name: Local Comp to Aitec.md

Target Address: 192.168.1.2

☒ Target Upload ☒ Target Download

Max Limit: 1M 2M bits/s

Burst

Burst Limit: unlimited unlimited bits/s

Burst Threshold: unlimited unlimited bits/s

Burst Time: 0 0 s

Time

enabled

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

Simple Queue Burst

Simple Queue <Local Comp to Aitec.md>

General | Advanced | Statistics | Traffic | Total | Total Statistics

Name: Local Comp to Aitec.md

Target Address: 192.168.1.2

☒ Target Upload ☒ Target Download

Max Limit: 1M 2M bits/s

Burst

Burst Limit: unlimited 5M bits/s

Burst Threshold: unlimited 1M bits/s

Burst Time: 0 10 s

Time

enabled

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

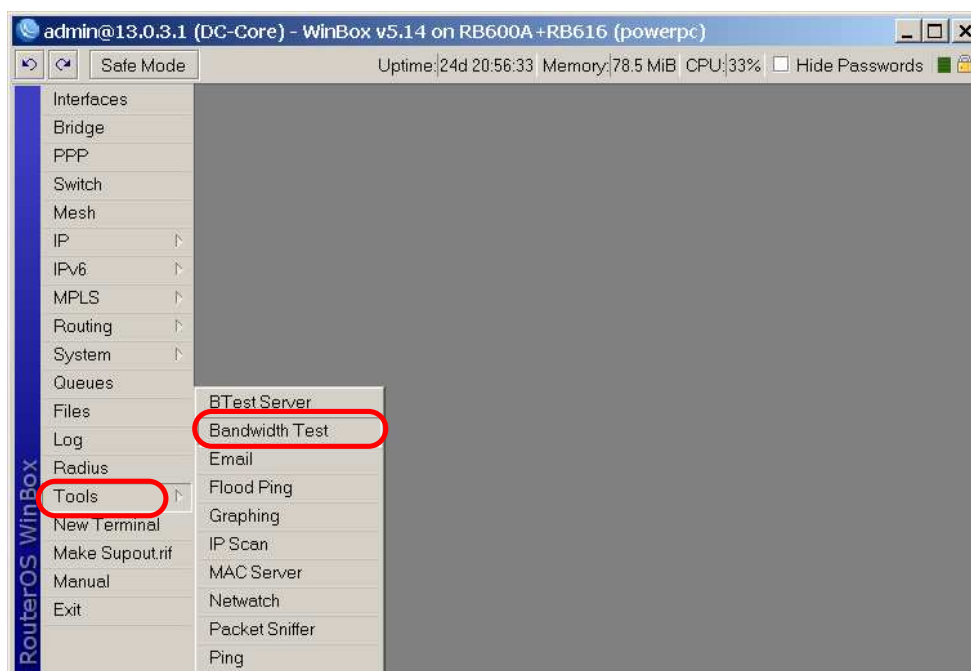
Bandwidth Test Utility

- Bandwidth test может использоваться для мониторинга пропускной способности канала (до удаленного устройства).
- Bandwidth test работает между 2 роутерами MikroTik
- Bandwidth test utility есть и для Windows
- Bandwidth test доступна на сайте MikroTik.com

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Bandwidth Test on Router



Bandwidth Test on Router

- Пишем IP address удал.р
- Выбираем protocol
- TCP count connections
- Authentication

The screenshot shows the 'Bandwidth Test' window with the following settings:

- Test To:** 0.0.0.0
- Protocol:** udp (selected)
- Local UDP Tx Size:** 1500
- Remote UDP Tx Size:** 1500
- Direction:** receive
- TCP Connection Count:** 20
- Local Tx Speed:** 0 bps
- Remote Tx Speed:** 0 bps
- Random Data:** unchecked
- User:** (empty)
- Password:** (empty)
- Lost Packets:** 0
- Tx/Rx Current:** 0 bps/0 bps
- Tx/Rx 10s Average:** 0 bps/0 bps
- Tx/Rx Total Average:** 0 bps/0 bps

A legend at the bottom left indicates Tx (blue) and Rx (red).

Bandwidth Test on Router

- Пишем IP address удал.р
- Выбираем protocol
- TCP count connections
- Authentication

The screenshot shows the 'Bandwidth Test' window with the following settings and results:

- Test To:** 15.0.0.1
- Protocol:** udp (selected)
- Local UDP Tx Size:** 1500
- Remote UDP Tx Size:** 1500
- Direction:** send
- TCP Connection Count:** 20
- Local Tx Speed:** 73.4 Mbps
- Remote Tx Speed:** 0 bps
- Random Data:** unchecked
- User:** admin
- Password:** (masked with asterisks)
- Lost Packets:** 0
- Tx/Rx Current:** 73.4 Mbps/0 bps
- Tx/Rx 10s Average:** 55.3 Mbps/0 bps
- Tx/Rx Total Average:** 47.7 Mbps/0 bps

A legend at the bottom left indicates Tx (blue) and Rx (red). A graph at the bottom right shows the test results over time, with Tx reaching 75.0 Mbps.

Bandwidth Test on Router

- Пишем IP address удал.р
- Выбираем protocol
- TCP count connections
- Authentication

Uptime: 24d 21:06:10 | Memory: 78.2 MiB | CPU: 100%

Bandwidth Test (Running)

Test To: 15.0.0.1 [Start] [Stop] [Close]

Protocol: ☐ udp ☒ tcp

Local UDP Tx Size: 1500

Remote UDP Tx Size: 1500

Direction: send

TCP Connection Count: 1

Local Tx Speed: [] bps

Remote Tx Speed: [] bps

☐ Random Data

User: admin

Password: []

Lost Packets: 0

Tx/Rx Current: 16.0 Mbps/0 bps

Tx/Rx 10s Average: 18.4 Mbps/0 bps

Tx/Rx Total Average: 18.4 Mbps/0 bps

Tx: 16.0 Mbps
Rx: []

Bandwidth Test Server

System ▸

Queues

Files

Log

Radius

Tools ▸

New Terminal

Make Supout.rif

Manual

Exit

BTest Server

Bandwidth Test

Email

Flood Ping

Graphing

IP Scan

MAC Server

Netwatch

Packet Sniffer

BTest Server

BTest Server Settings [Find]

Address Protocol Direction User

BTest Server Settings

☒ Enabled [OK]

☒ Authenticate [Cancel]

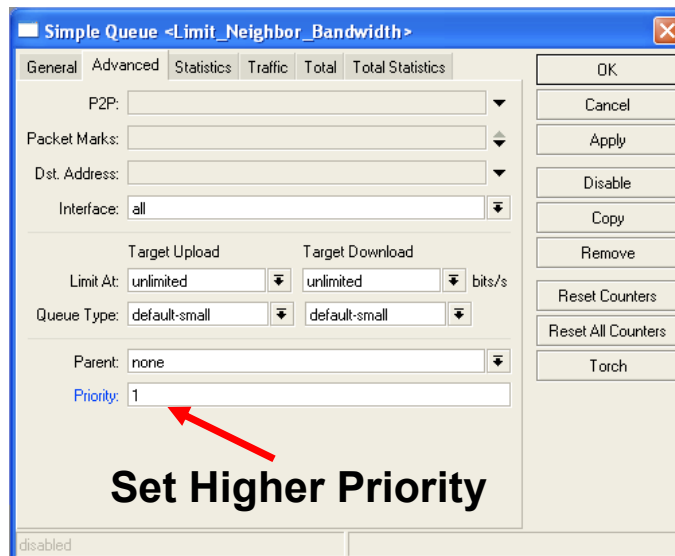
Allocate UDP Ports From: 2000 [Apply]

Max Sessions: 100

0 items

Traffic Priority

- Можно выставить наивысший приоритет
- Priority 1 is higher than 8
- Должно быть хотя бы 2 приоритета



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Bandwidth Test

LAB

- Проверьте скорость до роутера 192.168.111.1 (TCP / UDP)
- Можете проверить скорость между вашими внешними роутерами
- Создайте правило Burst и проверьте его работу
- Используя утилиту Torch посмотрите по какому порту работает программа Bandwidth Test

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Advanced Queuing

- Заменить сотни правил simple queues всего несколькими
- Установить одно ограничение для всех пользователей
- Поделить поровну полосу между пользователями

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PCQ

- PCQ is advanced Queue type
- PCQ uses classifier to divide traffic (from client point of view; src-address is upload, dst-address is download)

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PCQ, one limit to all

- PCQ позволяет установить одно лимитирующее правило для всех пользователей
- ЗАДАЧА – одним правилом дать ограничение каждому пользователю в локальной сети (ограничить всех пользователей)

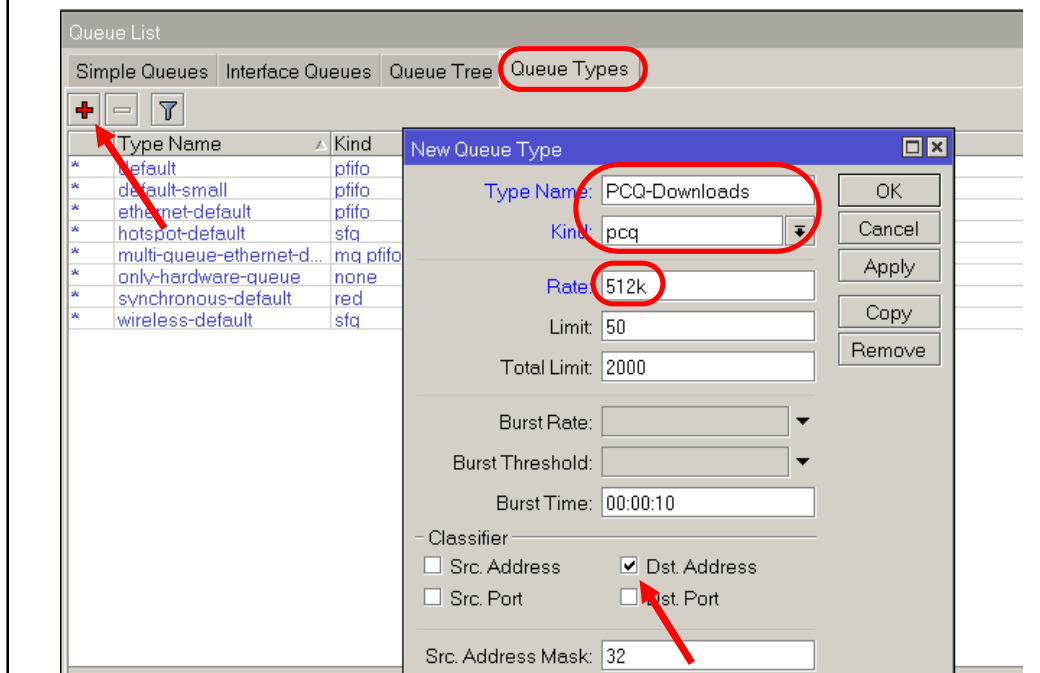
35

3
5

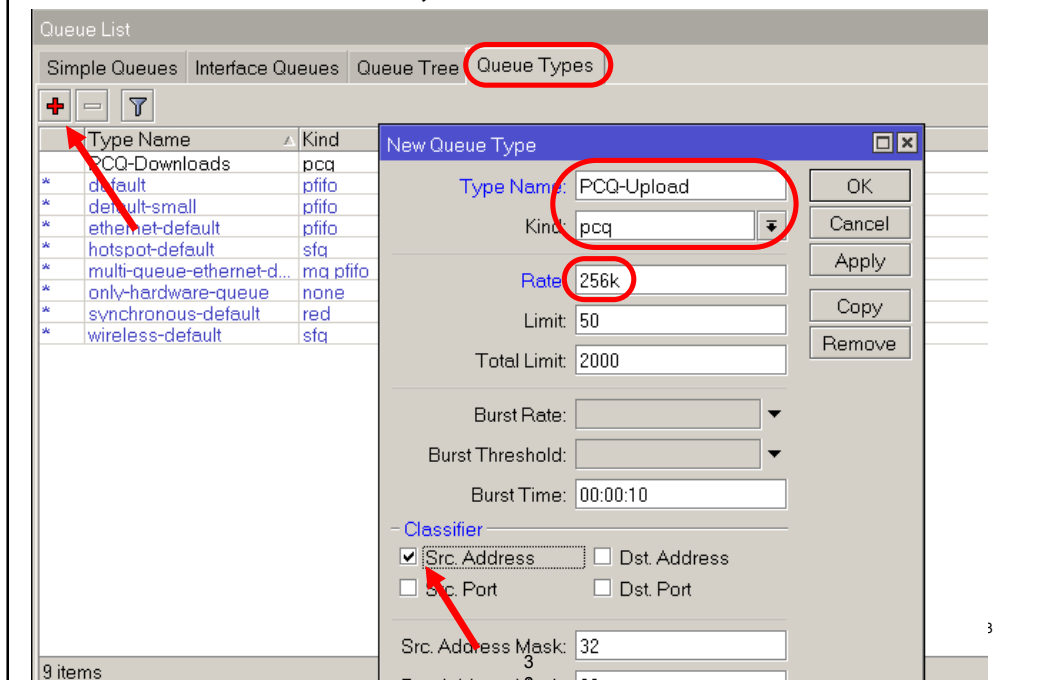
PCQ, one limit to all

The screenshot shows the 'New Simple Queue' dialog box in Mikrotik WinBox. The 'General' tab is active. The 'Name' field is set to 'All-512k' and the 'Target Address' is '192.168.1.0/24'. Both 'Target Upload' and 'Target Download' checkboxes are checked. The 'Max Limit' for both is set to 'unlimited' bits/s. Under the 'Burst' section, 'Burst Limit' is also 'unlimited' bits/s, and 'Burst Threshold' is 'unlimited' bits/s. The 'Burst Time' is set to '0' seconds. The 'Time' section is collapsed. On the right side of the dialog, there are buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', 'Reset Counters', 'Reset All Counters', and 'Torch'. The 'Queue List' window in the background shows a list with 0 items.

PCQ, one limit to all



PCQ, one limit to all



PCQ, one limit to all

Queue List

Simple Queues Interface Queues Queue Tree Queue Types

Reset Counters Reset All Counters

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Name: All-512k

Target Address: 192.168.1.0/24

☒ Target Upload ☒ Target Download

Max Limit: unlimited unlimited bits/s

Burst

Burst Limit: unlimited unlimited bits/s

Burst Threshold: unlimited unlimited bits/s

Burst Time: 0 0 s

Time

0 items

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

PCQ, one limit to all

Queue List

Simple Queues Interface Queues Queue Tree Queue Types

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

P2P:

Packet Marks:

Dst. Address:

Interface: all

Target Upload Target Download

Limit At: unlimited unlimited bits/s

Queue Type: default-small PCQ-Downloads

Parent: PCQ-Upload

Priority: default-small ethernet-default hotspot-default multi-queue-ethernet-default only-hardware-queue synchronous-default wireless-default

0 items

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

PCQ, one limit to all

Queue List						
<div> <div>Simple Queues</div> <div>Interface Queues</div> <div>Queue Tree</div> <div>Queue Types</div> </div> <div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📄</div> <div>🔍</div> <div>🔄 Reset Counters</div> <div>🔄 Reset All Counters</div> </div>						
#	Name	Target Address	Rx Max Limit	Tx Max Limit	Pack...	
0	All-512k	192.168.1.0/24	unlimited	unlimited		

4

PCQ, one limit to all

Queue List

Simple Queues

Interface Queues

Queue Tree

Queue Types

+

-

✓

✗

📄

🔍

🔄 Reset Counters

🔄 Reset All Counters

#

New Simple Queue

General

Advanced

Statistics

Traffic

Total

Total Statistics

Name:

All-512k

Target Address:

192.168.1.0/24

☒ Target Upload

☒ Target Download

Max Limit:

unlimited

bits/s

unlimited

bits/s

Burst

Burst Limit:

unlimited

bits/s

Burst Threshold:

unlimited

bits/s

Burst Time:

0

s

Time

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

Torch

0 items

PCQ, one limit to all

Simple Queue <All-512k>

General Advanced Statistics Traffic Total Total Statistics

Name: All-512k

Target Address: 192.168.1.0/24

☒ Target Upload ☒ Target Download

Max Limit: 10M 10M bits/s

Burst Limit: unlimited unlimited bits/s

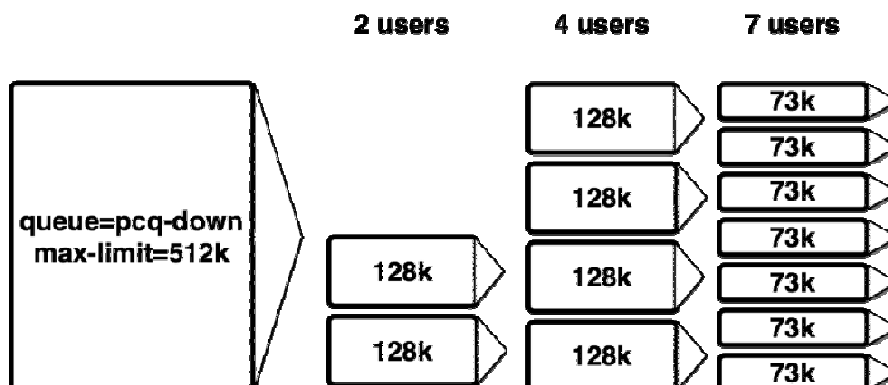
Burst Threshold: unlimited unlimited bits/s

Burst Time: 0 0 s

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

PCQ, one limit to all

pcq-rate=128000



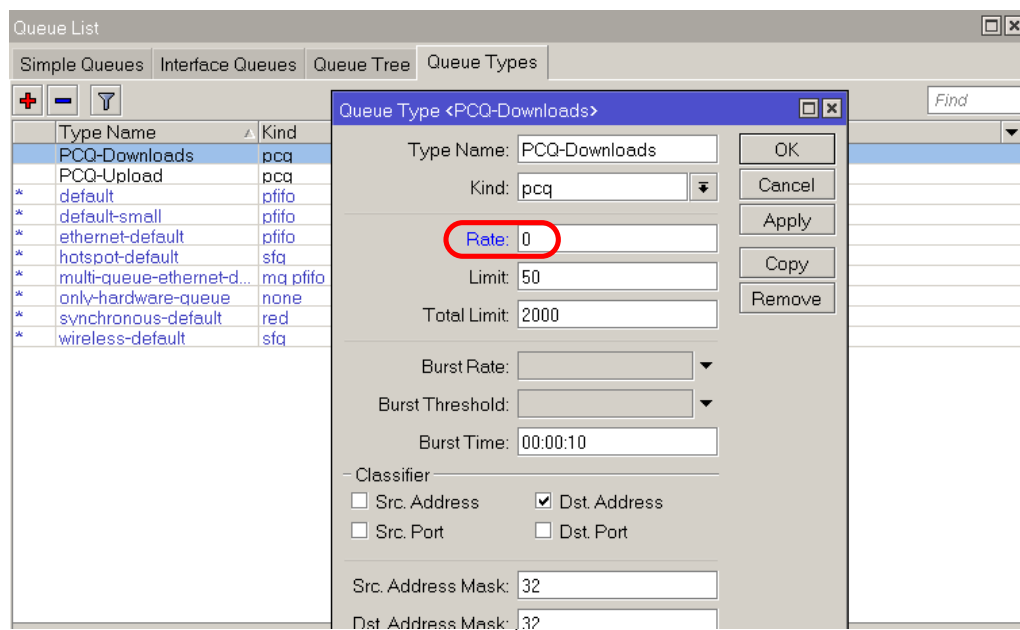
PCQ, equalize bandwidth

- PCQ так же позволяет поделить поровну весь канал между всеми пользователями
- ЗАДАЧА – одним правилом дать не ограничивать никого, но делить канал между всеми пользователями поровну

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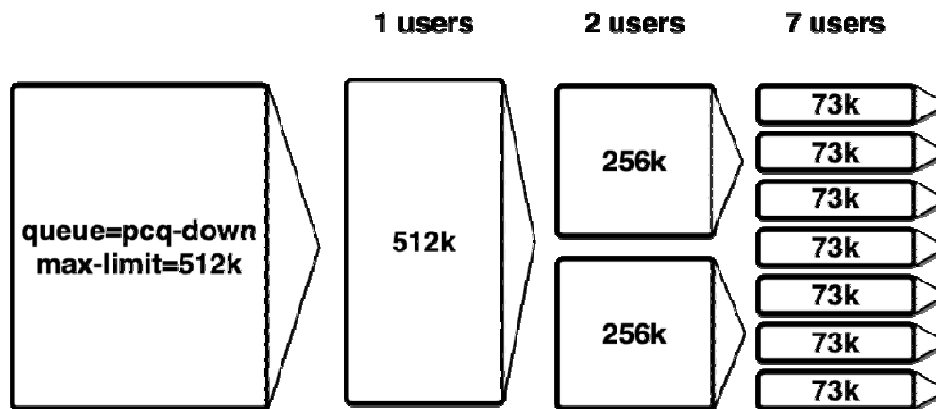
4

PCQ, equalize bandwidth



PCQ, equalize bandwidth

pcq-rate=0



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PCQ Lab

- Создайте 1 правило которое будет все компьютеры в вашей локальной сети ограничивать скоростью 128k Upload и 256k Download
- Но 1 компьютеру (администратору) нужно дать скорость 512k/512k
- Можете усложнить себе задачу используя Burst (его так же можно использовать в PCQ)

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graph

49

4

0

graph

- График представляет собой инструмент для мониторинга различных параметров RouterOS во временном промежутки собирает их и строит графики

Утилита Graphing может строить графики для:

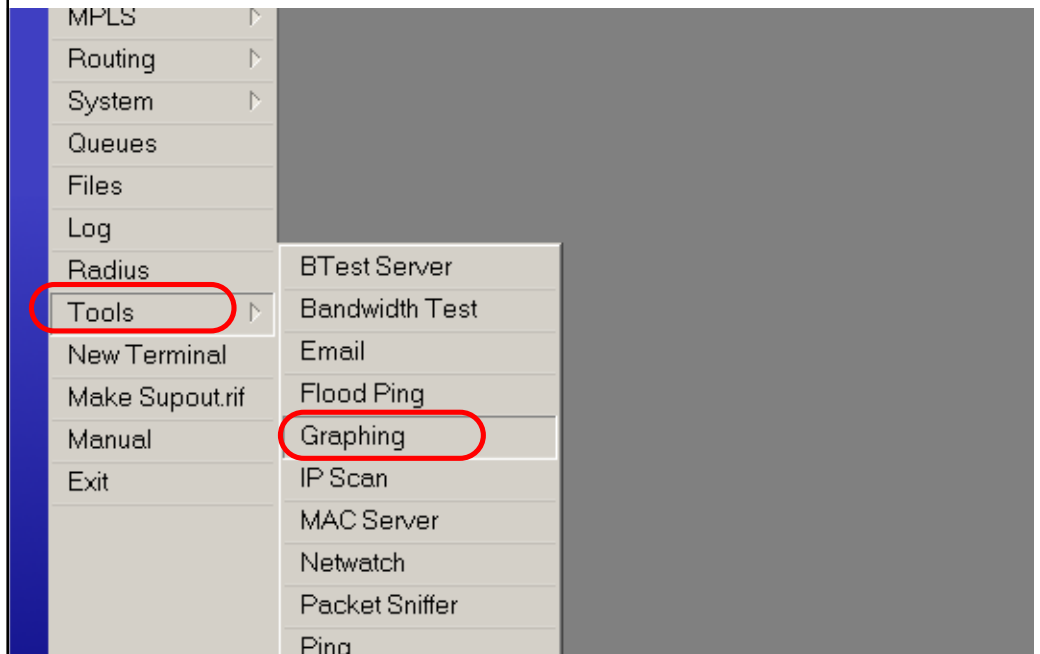
- Routerboard health (voltage and temperature)
- Использование ресурсов (CPU, Memory and Disk usage)
- Traffic проходящий через interfaces
- Traffic проходящий по правилам simple queues

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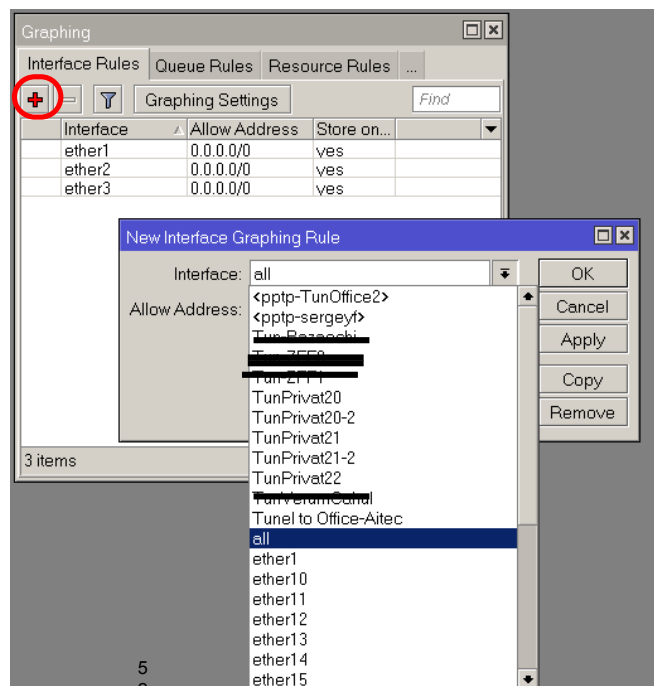
5

0

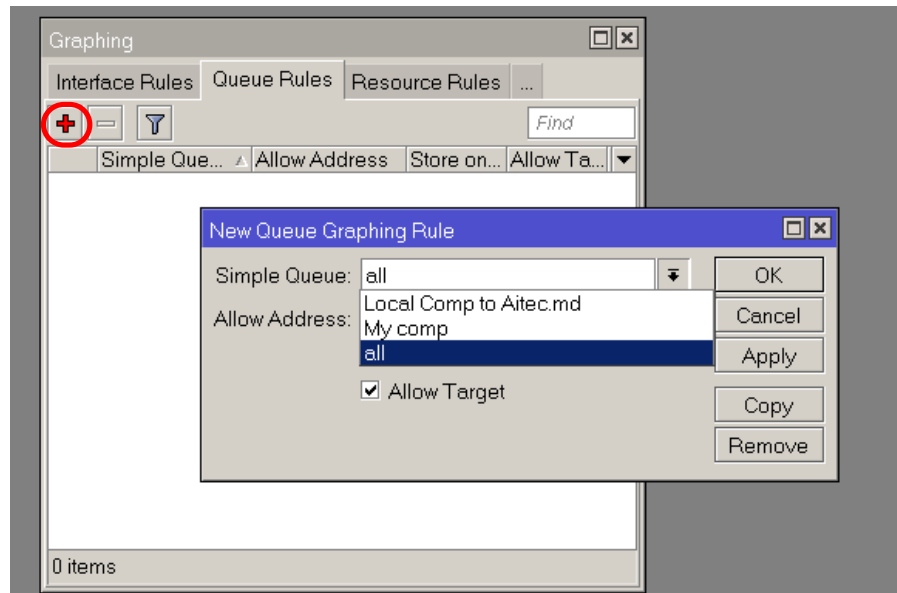
Graph - настройка



Graph - настройка



Graph - настройка

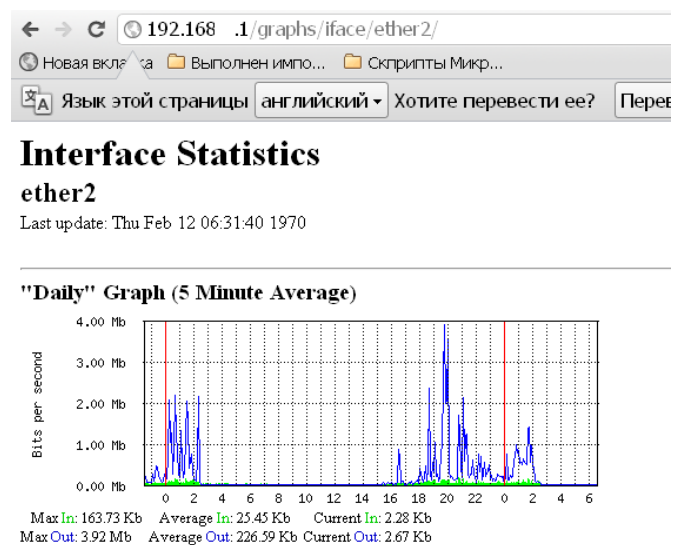


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2

Graph - просмотр

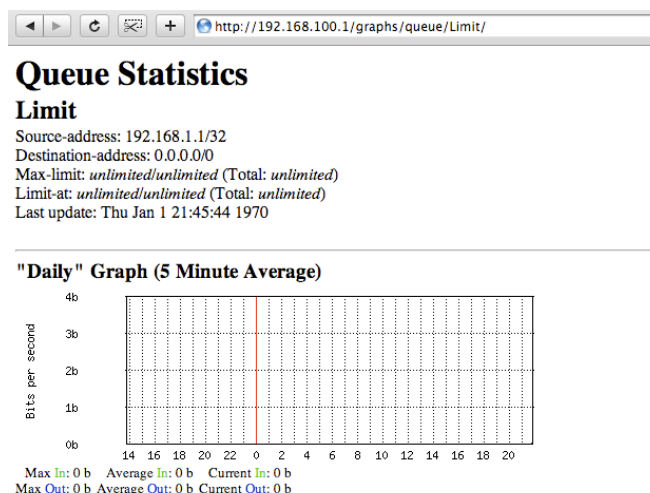
Для доступа к просмотру графиков напишите
[http://\[Router_IP_address\]/graphs/](http://[Router_IP_address]/graphs/)



Simple Queue Monitor

LAB

- Graphs are available on WWW
- To view graphs http://router_IP
- Отобразите графики ваших системных ресурсов
- Ваших Simple Queue



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5

Mangle

Mangle это как бы "маркер" который маркирует пакеты специальными марками для дальнейшей обработки. Многие другие средства в RouterOS используют эти марки, например такие как деревья очередей и NAT. Они идентифицируют пакеты по их маркам и соответственно обрабатывая их. Марки mangle используются только маршрутизатором, они не передаются по сети

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Mangle

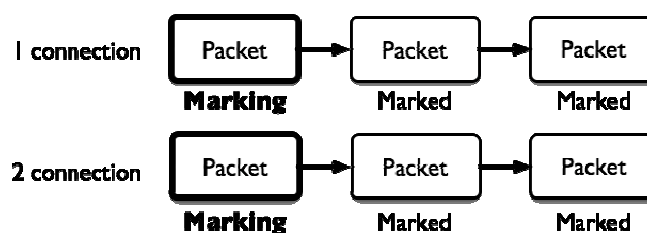
- Mangle используется для маркировки пакетов (mark packets)
- Позволяет отделить различные типы трафика
- Используется для ограничения различного трафика, приоритизацию.
- Mangle не меняет структуру пакета (исключение DSCP, TTL)

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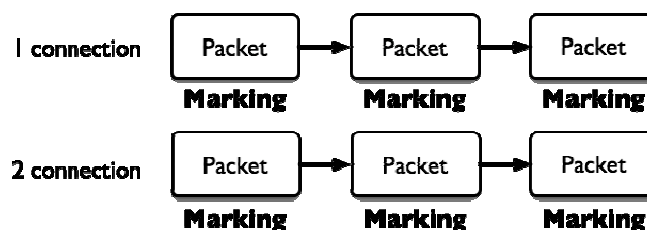
5
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Mangle Actions

Mark-Connection



Mark-Packet



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5
8

Mangle Actions

- **Mark-connection** использует connection tracking
- Информация о новом подключении добавляется в таблицу connection tracking
- Mark-packet работает непосредственно с пакетами

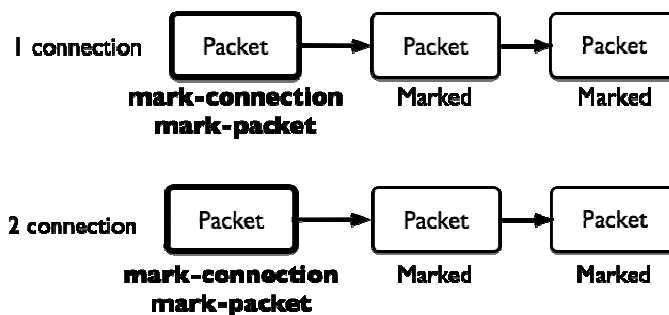
59

5
0

Optimal Mangle

- Queues имеют только опцию packet-mark

Combine Mark-Connection and Mark-Packet



60

6
0

Optimal Mangle

- Маркируйте новые соединения используя **mark-connection**
- Из промаркированных соединений промаркируйте пакеты - **mark-packet**

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4

Mangle Example

- Мы хотим ограничить только WEB трафик
- Imagine you have second client on the router network with 192.168.X.55 IP address
- Let's create two different marks (**Gold, Silver**), one for your computer and second for 192.168.X.55

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2

Mangle

Bridge

PPP

Switch

Mesh

IP

IPv6

MPLS

Routing

System

Queues

Files

Log

Radius

Tools

New Terminal

Make Supout.rtf

Manual

Exit

ARP

Accounting

Addresses

DHCP Client

DHCP Relay

DHCP Server

DNS

Firewall

IPsec

Neighbors

Packing

Pool

Routes

SMB

SNMP

Services

Socks

TFTP

Traffic Flow

Firewall

Filter Rules

NA

Mangle

Service Ports

Connections

Address Lists

Layer7 Protocols

Reset Counters

Reset All Counters

#	Action	Chain	Src. Address	Dst. Address	Prot...	Src. Port	Dst. Port	In. In
0	ma...	prerouting			6 (tc...		20-21.5...	
1	ma...	prerouting			17 (...)		50000-5...	
2	ma...	prerouting						
3	ma...	prerouting						
4	ma...	prerouting						
5	ma...	prerouting						
6	ma...	prerouting						
7	ma...	prerouting						
8	ma...	output						
9	ma...	prerouting						
10	ma...	prerouting						
11	ma...	forward						unk...
12	ma...	forward						unk...
13	ma...	forward						
14	ma...	prerouting			6 (tc...		7600	
15	ma...	prerouting						
16	ma...	prerouting						

63

6

2

Mark Connection

New Mangle Rule

General

Advanced

Extra

Action

Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol: 6 (tcp)

Src. Port:

Dst. Port: 80

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:

New Mangle Rule

General

Advanced

Extra

Action

Statistics

Action: mark connection

New Connection Mark: web-connection

Passthrough

64

6

4

Mark Packet

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:
Packet Mark:
Connection Mark: ☐ web-connection
Routing Mark:
Routing Table:

New Mangle Rule
General
Advanced
Extra
Action
Statistics

Action: mark packet
New Packet Mark: web-packet
☐ Passthrough

Simple queue

New Simple Queue
General
Advanced
Statistics
Traffic
Total
Total Statistics

Name: Web-limit
Target Address:
☒ Target Upload
☒ Target Download
Max Limit: 10M
Burst Limit: unlimited
Burst Threshold: unlimited
Burst Time: 0
Time
enabled

New Simple Queue
General
Advanced
Statistics
Traffic
Total
Total Statistics

P2P:
Packet Marks: web-packet
Dst. Address:
Interface: all
Target Upload
Limit At: unlimited
Queue Type: default-small
Parent: none
Priority: 8

Simple – PCQ – Mangle

LAB

- Сделайте туннель со своим соседом L2TP
- Ограничьте всех пользователей своей локальной сети по 128kbit
- Пользователям в группе BOSS скорость 256kbit
- Для Web сделайте своим пользователям локальной сети burst 512k – 256k
- Внимание! Эти скорости не должны распространяться на трафик между локальными сетями (туннель с соседом),
нам хватит 2Mbps

6
7