



MikroTik RouterOS™

<http://www.mikrotik.md>

	WinBOX	c . 3
FTP		. 8
		. 10
	Firewall	. 20
	Firewall	. 39
Mangle		. 50
NAT		. 60
		. 70
		. 73
SOCKS proxy		. 77
OSPF		. 82
	.1	. 100
	.2	. 125

WinBox

Winbox

(GUI).

Winbox

Winbox
(

Winbox).

Wnbox.

Winbox winbox.exe

MikrotikRouterOS,

http://router_address/winbox/winbox.exe.

winbox.exe

http://router_address.

Mikrotik RouterOS

Winbox

http (TCP 80

),

Winbox

winbox.exe.

winbox.exe

winbox.exe



... -
Discovery Protocol)

MNNDP(MikroTik Neighbor Discovery Protocol)

CDP (Cisco

Connect -

IP(

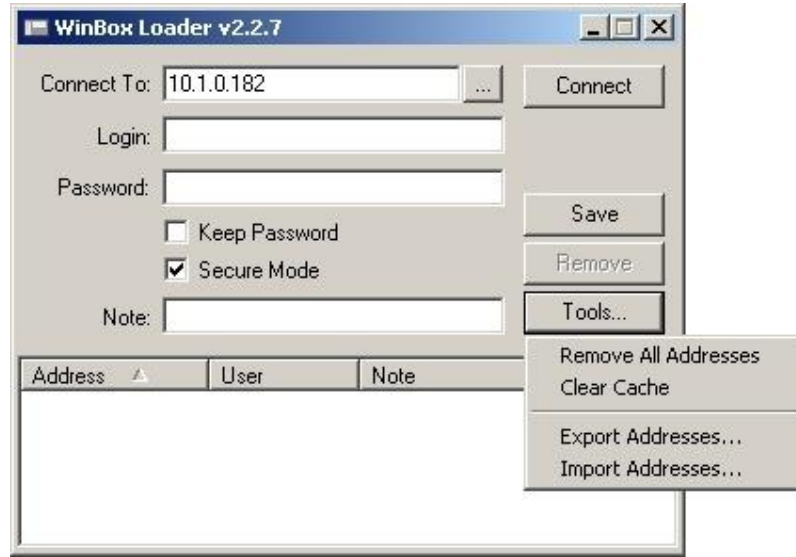
80)

MAC (

),

- Save
- Remove
- Tools...

wbx
wbx



- Secure Mode

WinBox RouterOS

TLS(Transport Layer Security)

- Keep Password

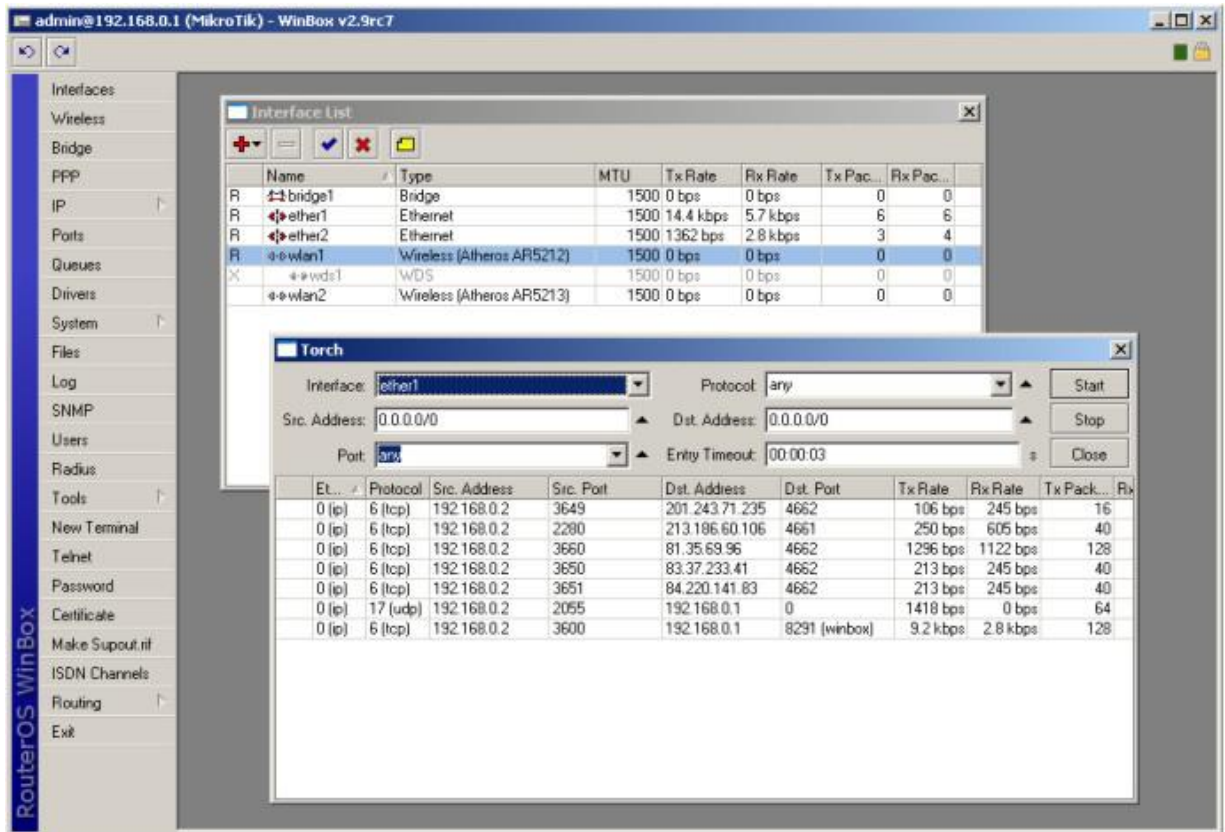
Winbox

WinBox

TCP

8291.

WinBox



() . ,

WinBox.

- 
- 
- 
- 
-  C
- 
- 

- 

- 

WinBox

WinBox Linux ?

WinBox

Router OS

Wine

WinBox ?

www

/ip service print.

address=0.0.0.0/0

WinBox.

/ip service set www port=80

WinBox

TCP

8291.

,

FTP

: system

: Level1

: FTP(RFC 959)

:

File Transfer Protocol

:/file

MikroTik RouterOS

20 21 .

FTP .

file.

FTP

(

).

creation-time (read-only: time) -

name (read-only: name) -

size (read-only: integer) -

type (read-only:file | directory | unknown | script | package | backup) -

print -

print

detail -

4kb

edit [item] contents -

**set [item] contents=[content]-
[content]**

contents

Unix shell,

/ip route print:

```
[admin@MikroTik] > /ip route print
Flags: A - active, X - disabled, I - invalid, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, d - dynamic
#      DST-ADDRESS      G GATEWAY      DISTANCE      INTERFACE
0 ADC 1.1.1.0/24
1 A S 2.2.2.0/24      r 1.1.1.2      0      isp2
2 ADC 3.3.3.0/24
3 ADC 10.1.0.0/24
4 A S 0.0.0.0/0      r 10.1.0.1      0      isp1
```

[admin@MikroTik] >

ip route

:

```
[admin@MikroTik] > ip route
[admin@MikroTik] ip route> print
Flags: A - active, X - disabled, I - invalid, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, d - dynamic
#      DST-ADDRESS      G GATEWAY      DISTANCE      INTERFACE
0 ADC 1.1.1.0/24
1 A S 2.2.2.0/24      r 1.1.1.2      0      isp2
2 ADC 3.3.3.0/24
3 ADC 10.1.0.0/24
4 A S 0.0.0.0/0      r 10.1.0.1      0      isp1
```

[admin@MikroTik] ip route>

() /

```
[admin@MikroTik] > /ip route
[admin@MikroTik] ip route> /
[admin@MikroTik] >
```

..

/ .

```
[admin@MikroTik] ip route> /ping 10.0.0.1
10.0.0.1 ping timeout
2 packets transmitted, 0 packets received, 100% packet loss
```

```
[admin@MikroTik] ip firewall nat> .. service-port print
Flags: X - disabled, I - invalid
```

```
# NAME
```

```
PORTS
```

0	ftp	21
1	tftp	69
2	irc	
6667		
3 X	h323	
4	quake3	
5	mms	
6	gre	
7	pptp	

```
[admin@MikroTik] ip firewall nat>
```

: interfaces, routes, users . . .

interface **user.**

print

```

    print
    ,
    add, remove move(
    ).
    ,
    ,
    ,
    print.
    ,
    ip address print
    .

```

```

[admin@MikroTik] interface> set 0 mtu=1200
ERROR: item number must be assigned by a print command
use print command before using an item number in a command
[admin@MikroTik] interface> print
Flags: X - disabled, D - dynamic, R - running
#   NAME                TYPE             RX-RATE  TX-RATE  MTU
0   R Public             ether            0         0
1500
1   R Local              ether            0         0
1500
2   R wlan1              wlan             0         0
1500
[admin@MikroTik] interface> set 0
disabled mtu name rx-rate tx-rate
[admin@MikroTik] interface> set 0 mtu=1200
[admin@MikroTik] interface> set wlan1 mtu=1300
[admin@MikroTik] interface> print
Flags: X - disabled, D - dynamic, R - running
#   NAME                TYPE             RX-RATE  TX-RATE  MTU
0   R Public             ether            0         0
1200
1   R Local              ether            0         0
1500
2   R wlan1              wlan             0         0
1300
[admin@MikroTik] interface>

```

```

    ,
    [Tab]
    bash shell UNIX.
    ,
    [Tab]
    ,
    :
    /inte[Tab]_    /interface _
    ,
    ,
    :
    /interface set e[Tab]_    /interface set ether_
    [Tab]

```

```
[admin@MikroTik] > interface set e[Tab]_
[admin@MikroTik] > interface set ether[Tab]_
[admin@MikroTik] > interface set ether[Tab]_
ether1 ether5
[admin@MikroTik] > interface set ether_
```

[Tab]

```
firewall NAT ). ( , , , IP
```

```
[admin@MikroTik] > pi 10.1 c 3 si 100
```

```
[admin@MikroTik] > ping 10.0.0.1 count 3 size 100
```

[Tab] IP DNS

```
, IP , DNS ( IP ),
, DNS ( IP ).
```

DNS , [Tab]

```
[admin@MikroTik] > interface x[TAB]_
```

```
[admin@MikroTik] > interface export _
```

```
[admin@MikroTik] > interface mt[TAB]_
```

```
[admin@MikroTik] > interface monitor-traffic _
```

-
?([Tab],
).

```
[admin@MikroTik] > interface print
Flags: X - disabled, D - dynamic, R - running
#   NAME           TYPE           MTU
0   R ether1       ether          1500
1   R ether2       ether          1500
2   R ether3       ether          1500
3   R ether4       ether          1500
[admin@MikroTik] > interface set 0,1,2 mtu=1460
[admin@MikroTik] > interface print
Flags: X - disabled, D - dynamic, R - running
#   NAME           TYPE           MTU
0   R ether1       ether          1460
1   R ether2       ether          1460
2   R ether3       ether          1460
3   R ether4       ether          1500
[admin@MikroTik] >
```

print, set, remove, add, find, get, export, enable, disable, comment, move .

print -
, /system clock print , **ip route print**
...
read-only / (
/system history
) , **print**

print

• **from -**

• **brief - print**

• **detail - print property=value**

• **count-only -**

- **file** -
ftp

- **interval** - print

- **oid** - oid, SNMP

- **without-paging** -
[Shift]+[Tab]

print

```
[admin@MikroTik] interface> print type=ether
Flags: X - disabled, D - dynamic, R - running
#  NAME          TYPE      RX-RATE  TX-RATE  MTU
0  R isp1        ether     0        0
1500
1  R isp2        ether     0        0
1500
[admin@MikroTik] interface>
```

set -

```
set
? [Tab]
set
( )
( )
```

add -

set,

set

- **copy-from** -

```
( - )
```

- **place-before** -

move

• **disabled** - () () / ()

• **comment** -

add

add

remove - ()

remove

() () () .

move -

move ;

print

move.

move

• ()

• ,

find - find

set,

print.

find

flag

,

yes no

print.

find

edit -

set,

:

```
[admin@MikroTik] ip route> print
Flags: A - active, X - disabled, I - invalid, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, d - dynamic
#   DST-ADDRESS      G GATEWAY      DISTANCE  INTERFACE
0 ADC 1.1.1.0/24
1 A S 2.2.2.0/24      r 1.1.1.2      0         isp2
```



```
2 ADC 3.3.3.0/24 bonding1
3 ADC 10.1.0.0/24 ispl
4 A S 0.0.0.0/0 r 10.1.0.1 0 ispl
[admin@MikroTik] ip route> edit 1 gateway
```

[Ctrl]+[X].

[Ctrl]+[X].

```
[admin@MikroTik] ip route>[Ctrl]+[X]
[Safe Mode taken]
```

```
[admin@MikroTik] ip route
```

F /system history:

```
[admin@MikroTik] ip route>
[Safe Mode taken]
```

```
[admin@MikroTik] ip route add
[admin@MikroTik] ip route /system history print
Flags: U - undoable, R - redoable, F - floating-undo
ACTION BY POLICY
F route added admin write
```

```
telnet , (TCP 9 )
```

[Ctrl]+[D]

```
[admin@MikroTik] >
Hijacking Safe Mode from someone - unroll/release/don't take it [u/r/d]:
[u] -
```

[r] -

```
[admin@MikroTik] ip firewall rule input
[Safe mode released by another user]
```

[d] -

(
[Ctrl]+[X]),

Firewall

- 135 TCP :

```
/ip firewall rule forward add dst-port=135 protocol=tcp action=drop
```

- Telnet(TCP, 23),

```
/ip firewall rule input add protocol=tcp dst-port=23 action=drop
```

: system

: Level1(P2P 1), Level3

: /ip firewall

: [IP](#)

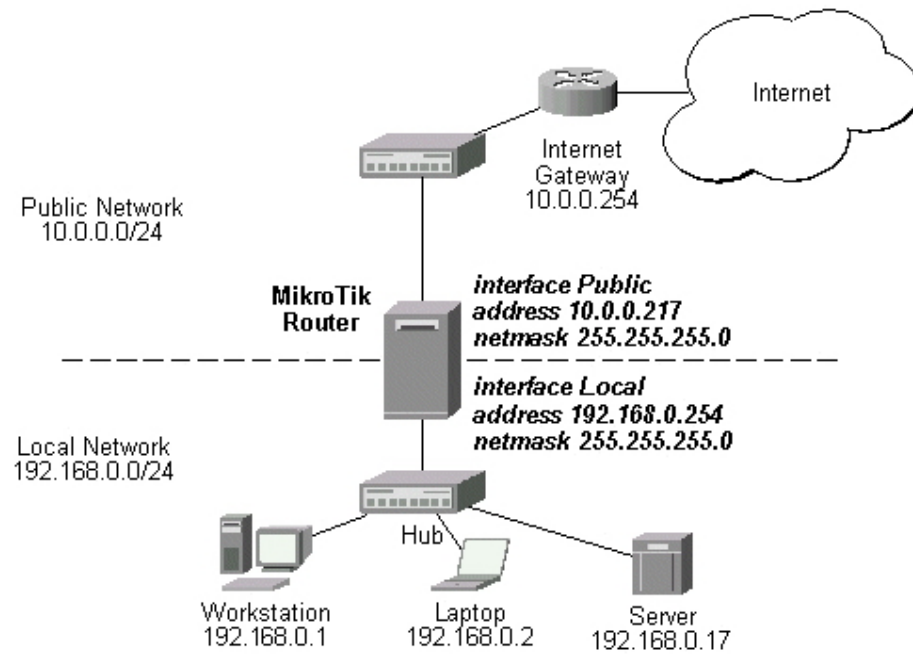
:

- Package Management
- IP Addresses and ARP
- Routes, Equal Cost Multipath Routing, Policy Routing
- Network Address Translation

- Packet Marking(Mangle)

• Mikrotik RouterOS

MikroTik RouterOS



- NAT. input
- NAT.

- NAT forward. (forward),

- NAT . output,

(IPsec / ,)

: /ip firewall rule

,

.

:

·
·

WinBox,

().

Peer-to-Peer Traffic Filtering

MikroTik RouterOS

P2P.

ICMP TYPE:CODE values

,

ICMP

ICMP

ICMP TYPE:CODE

ICMP

Ping

- 8:0 - echo request()
- 0:0 - echo reply()

Trace

- 11:0 - TTL exceeded()
- 3:3 - Port unreachable()

Path MTU discovery

- 3:4 - Fragmentation-DF-Set()

ICMP .

- ping ICMP Echo -Request Echo -
reply

- traceroute TTL -Exceeded Port-Unrechable

- path MTU-ICMP Fragmentation-DF-Set

-

- , , .
" " .

, IP ,
- . Type of Service ().

, ToS .

TCP

MikroTik RouterOS

(ToS . ,
) .

DiffServ(Differentiated Services Codepoint, DSCP
ECN codepoints (Explicit Congestion Notification
DiffServ IP ECN,

RFC2474)
RFC3168),
RouterOS

RFC1349

- normal - (ToS=0)
- low-cost - (ToS=2)
- max-reliability - (ToS=4)
- max-throughput - (ToS=8)
- low-delay - (ToS=16)

action(accept | drop | jump | passthrough | reject | return;

accept) -
:

- accept - mangle.
- drop - ICMP reject
- jump -

• **passthrough** - **mangle**

• **reject** - **ICMP**

• **return - jump.**

comment(; : "") -

connection(; "") -
(related) **MANGLE**

connection-limit(; "") -
IP

connection-state(any | established | invalid | new | related; any) -

content(text; : "") -

disabled(yes | no; no) -

dst-address(IP : ; 0.0.0.0/0:0-65535) -

dst-netmask(IP) - **x.x.x.x**

dst-port(: 0..65535) -

flow() -
MANGLE

icmp-options(; any:any) - **ICMP Type:Code**

in-interface(; : all) -

- all - ,

jump-target() - , **=jump**
limit-burst(; : 0) - limit -
count/limit-time, bits/s
limit-count(; : 0) -
limit-time
limit-time(; : 0) - ,
limit-count

- 0 -

log(yes | no; : no) -
out-interface(; :name) -

- all

p2p(ane | all-p2p | bit-torrent | direct-connect | fasttrack | soulseek | blubster | edonkey | gnutella | warez; any) - Peer-to-Peer(P2P) :

- all-p2p - P2P

- any - ()

protocol(ah | egp | ggp | icmp | ipencap | ospf | rspf | udp | xtp | all | encap | gre | idpr -cmtip | ipip | pup | st | vmtp | ddp | esp | hmp | igmp | iso-tp4 | rdp | tcp | xns-idp; all) -

- all ,

src-address(ip : ; : 0.0.0.0/0:0 -65535) -

src-mac-address(MAC ; 00:00:00:00:00:00) - MAC

src-netmask(IP) -

src-port(: 0..65535) - (0..65535)

- 0 - 1-65535

tcp-port(any | syn-only | non-syn-only; : any) - TCP

tos(< >| dont-change | low-cost | low-delay | max-reliability | max-throughput | normal | anyinteger;

any) - Type of Service(ToS)
IP

- any - (. .)

, protocol , port

dst-port=8080

```
/ip firewall rule input add dst-port=8080 protocol=tcp action=reject
[admin@MikroTik] ip firewall rule input> print
Flags: X - disabled, I - invalid
0 src-address=0.0.0.0/0:0-65535 in-interface=all
dst-address=0.0.0.0/0:8080 out-interface=all protocol=tcp
icmp-options=any:any tcp-options=any connection-state=any flow=""
sconnection="" content="" src-mac-address=00:00:00:00:00:00 limit-count=0
limit-burst=0 limit-time=0s action=reject log=no
```

4

IP

```
/ip firewall rule forward add protocol=tcp tcp-options=syn-only connection-limit=5
action=drop
```

: /ip firewall

IP

IP

IP

. , :

• **input** input .

• **forward** .

• **output** . **output**

() . .
:

- **accept -**
- **drop -** (**ICMP**)
- **none -**

jump
none,
NAT
NAT
input
output.
input
output!

```
[admin@MikroTik] ip firewall> print
# NAME POLICY
0 input accept
1 forward accept
2 output accept

[admin@MikroTik] ip firewall> add name=router

[admin@MikroTik] ip firewall> print
# NAME POLICY
0 input accept
1 forward accept
2 output accept
3 router none
```

input

IP

forward

SRC-NAT(masquerading)

masquerade.

forward, /

non-syn-only.

1. MikroTik

10.5.8.0/24.

2.

192.168.0.0/24

3.

http smtp

192.168.0.17

4.

ICMP ping

192.168.0.17

:

```
[admin@MikroTik] ip address> print
```

```
Flags: X - disabled, I - invalid, D - dynamic
```

```
# ADDRESS NETWORK BROADCAST INTERFACE
```

```
0 10.0.0.217/24 10.0.0.0 10.0.0.255 Public
```

```
1 192.168.0.254/24 192.168.0.0 192.168.0.255 Local
```

```
[admin@MikroTik] ip route> print
```

```
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
```

```
C - connect, S - static, R - rip, O - ospf, B - bgp
```

```
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 S 0.0.0.0/0 r 10.0.0.254 1 Public
1 DC 192.168.0.0/24 r 0.0.0.0 0 Local
2 DC 10.0.0.0/24 r 0.0.0.0 0 Public
```

input,

```
/ip firewall rule input
add connection-state=invalid action=drop
    comment="Drop invalid connection packets"
add connection-state=established
    comment="Allow established connections"
add connection-state=related
    comment="Allow related connections"
add protocol=udp comment="Allow UDP connections"
add protocol=icmp comment="Allow ICMP messages"
add src-address=10.5.8.0/24
    comment="Allow access from 'trusted' network 10.5.8.0/24"
add action=drop log=yes
    comment="Reject and log everything else"
```

input

forward.

```
/ip firewall rule forward
add out-interface=Local action=jump
    jump-target=customer
```

192.168.0.17

forward.

```
/ip firewall rule forward
add connection-state=invalid action=drop
    comment="Drop invalid connection packets"
add connection-state=established
    comment="Allow established connections"
add connection-state=related
    comment="Allow related connections"
add protocol=icmp out-interface=Public
    comment="Allow ICMP ping packets"
add src-address=192.168.0.17/32 out-interface=Public
    comment="Allow outgoing connections from the server at 192.168.0.17"
add action=drop out-interface=Public log=yes
    comment="Drop and log everything else"
```

source NAT(Masquerading)

10.0.0.217, 192.168.0.0/24
192.168.0.0/24 10.0.0.217

```
/ip firewall src-nat action=masquerade out-interface=Public
```

destination NAT.

destination NAT

,
web 80 192.168.0.4
10.0.0.217:80
192.168.0.4:80
:

```
/ip firewall dst-nat add action=nat protocol=tcp  
dst-address=10.0.0.217/32:80 to-dst-address=192.168.0.4
```


135

TCP

:

```
/ip firewall filter add chain=forward dst-port=135 protocol=tcp action=drop
```

Telnet(TCP, 23)

:

```
/ip firewall filter add chain=input protocol=tcp dst-port=23 action=drop
```

: system

: Level1(P2P)

: /ip firewall filter

: IP,

:

(

)

MikroTik RouterOS

:

-
-
-

peer-to-peer

:

- MAC
- IP () (broadcast, local, multicast, unicast)
- IP
- (ICMP , TCP, IP MSS)
-
- ToS(DSCP)
-
- , ()

- o
- o
- o

IP

: input, forward output

action=jump jump-target

IP address:port.

IP address:port

forward,

src-address=1.1.1.2/32 jump-target=mychain

IP , . : /ip firewall filter add

IP

mychain

mychain

IP

1. input -

IP

input

2. forward

3. output -

output

(passthrough).

action(accept | add-dst-to-address-list | add-src-to-address-list | drop | jump | log | passthrough | reject | return | tarpit; : **accept**) -

accept -

add-dst-to-address-list - **address-list** IP

add-src-to-address-list - **address-list** IP

drop - (ICMP)

jump - **jump-target**

log -

passthrough -

reject - ICMP

return -

tarpit - TCP SYN) TCP (SYN/ACK

address-list(name) - **action=add-dst-address-liyst** IP **action=add-src-address-**
list.

address-list-timeout(time; : **00:00:00**) - **address-list.**
add-dst-to-address-list **add-src-to-address-**
list

00:00:00 -

chain (forward | input | output | name) -

comment(text) -

connections-bytes(integer-integer) -
: **connection-bytes=2000000-0** , 2Mb

connection-limit(integer,netmask) -

connection-mark(name) - mangle

connection-state(established | invalid | new | related) -

established - ,

invalid -
ICMP

new -

related - , ICMP
FTP data (/ip firewall service-port) FTP

connection-type(ftp | gre | h323 | irc | mms | pptp | quake3 | tftp) -
/ip firewall service-

port content(text) -

dst-address(IP address/netmask | IP address-IP address) - IP
: **1.1.1.1/24** **address/netmask**
1.1.1.0/24

dst-address-list(name) -

dst-address-type (unicast | local | broadcast | multicast) -
IP :

unicast - IP

local -

broadcast - IP

multicast - IP

dst-limit - (integer/time{0,1},integer,dst-address | dst-port | src-address{+},time{0,1}) -
IP /

Count - ,
(pps), () **Time**

Time - ,

Burst -

Mode -

Expire - , IP /

dst-port (integer: 0..65535-integer: 0..65535{*}) -

hotspot (from-client | auth | local-dst | http) -
HotSpot.

from-client - , HotSpot

auth - ,

local-dst - , IP

hotspot - TCP : 80
IP

icmp-options (integer:integer) - ICMP Type:Code

in-interface (name) -

ipv4-options (any | loose-source-routing | no-record-route | no-router-alert | no-source-routing |
no-timestamp | none | record-route | router-alert | strict-source-routing | timestamp) -
ipv4

any - ipv4

loose-source-routing - ,

no-record-route - ,

no-router-alert - (alert)

no-source-routing

Min -

Max -

phys-in-interface (name) - (input)
bridge .
bridge.

phys-out-interface (name) - (output)
bridge ,
bridge.

protocol (ddp | egp | encap | ggp | gre | hmp | icmp | idrp -cmt | igmp | ipencap | ipip | ipsec-ah | ipsec-esp | iso-tp4 | ospf | pup | rdp | rspf | st | tcp | udp | vmt | xns -idp | xtp | integer) -
IP .

psd (integer,time,integer,integer) - TCP UDP .
() 1024
, F TP

WeightThreshold - TCP/UDP c (1024)
,

DelayThreshold - (1024) ,

LowPortWeight - (<=1024)

HighPortWeight -

random(integer 1..99) -

reject-with (icmp-admin-prohibited | icmp-echo-reply | icmp-host-prohibited | icmp-host-unreachable | icmp-net-prohibited | icmp-network-unreachable | icmp-port-unreachable | icmp-protocol-unreachable | tcp-reset | integer) **reject**

routing-mark(name) - mangle

src-address (IP address/netmask | IP address-IP address) - IP
address/netmask
. : 1.1.1.1/24 1.1.1.0/24

src-address-list(name) -

src-address-type (unicast | local | broadcast | multicast) -
:

IP

local -

broadcast -

multicast -

src-mac-address (MAC address) - MAC (MAC)

src-port (integer: 0..65535-integer: 0..65535{*}) - .

tcp-flags (ack | cwr | ece | fin | psh | rst | syn | urg) - tcp :

ack -

cwr -

ece - ECN-echo ()

fin -

psh -

rst -

syn -

urg -

tcp-mss(integer: 0..65535) - IP TCP MSS

time(time-time,sat | fri | thu | wed | tue | mon | sun{+}) - ,

tos(max-reliability | max-throughput | min-cost | min-delay | normal) -
(T oS)

max-reliability - (ToS=4)

max-throughput - (ToS=8)

min-cost - (ToS=2)

min-delay - (ToS=16)

normal - (ToS=0)

NAT ,

NAT

RouterOS

```
input. :  
input.
```

```
/ip firewall filter  
add chain=input connection-state=invalid action=drop  
comment=Drop Invalid connections  
add chain=input connection-state=established action=accept  
comment=Allow Established connections  
add chain=input protocol=udp action=accept  
comment=Allow UDP  
add chain=input protocol=icmp action=accept  
comment=Allow ICMP  
add chain=input src-address=192.168.0.0/24 action=accept  
comment=Allow access to router from known network  
add chain=input action=drop comment=Drop anything else
```

```
. icmp, udp tcp
```

```
/ip firewall filter  
add chain=forward protocol=tcp connection-state=invalid  
action=drop comment=drop invalid connections  
add chain=forward connection-state=established action=accept  
comment=allow already established connections  
add chain=forward connection-state=related action=accept  
comment=allow related connections
```

IP bogons

```
add chain=forward src-address=0.0.0.0/8 action=drop  
add chain=forward dst-address=0.0.0.0/8 action=drop  
add chain=forward src-address=127.0.0.0/8 action=drop  
add chain=forward dst-address=127.0.0.0/8 action=drop  
add chain=forward src-address=224.0.0.0/3 action=drop  
add chain=forward dst-address=224.0.0.0/3 action=drop
```

```
add chain=forward protocol=tcp action=jump jump-target=tcp  
add chain=forward protocol=udp action=jump jump-target=udp  
add chain=forward protocol=icmp action=jump jump-target=icmp
```

tcp tcp tcp

```
add chain=tcp protocol=tcp dst-port=69 action=drop  
comment=deny TFTP
```

```
add chain=tcp protocol=tcp dst-port=111 action=drop
    comment=deny RPC portmapper
add chain=tcp protocol=tcp dst-port=135 action=drop
    comment=deny RPC portmapper
add chain=tcp protocol=tcp dst-port=137-139 action=drop
    comment=deny NBT
add chain=tcp protocol=tcp dst-port=445 action=drop
    comment=deny cifs
add chain=tcp protocol=tcp dst-port=2049 action=drop comment=deny NFS
add chain=tcp protocol=tcp dst-port=12345-12346 action=drop comment=deny
NetBus
add chain=tcp protocol=tcp dst-port=20034 action=drop comment=deny NetBus
add chain=tcp protocol=tcp dst-port=3133 action=drop comment=deny
BackOriffice
add chain=tcp protocol=tcp dst-port=67-68 action=drop comment=deny DHCP
```

udp

udp

```
add chain=udp protocol=udp dst-port=69 action=drop comment=deny TFTP
add chain=udp protocol=udp dst-port=111 action=drop comment=deny PRC
portmapper
add chain=udp protocol=udp dst-port=135 action=drop comment=deny PRC
portmapper
add chain=udp protocol=udp dst-port=137-139 action=drop comment=deny NBT
add chain=udp protocol=udp dst-port=2049 action=drop comment=deny NFS
add chain=udp protocol=udp dst-port=3133 action=drop comment=deny
BackOriffice
```

icmp

icmp

```
add chain=icmp protocol=icmp icmp-options=0:0 action=accept
    comment=drop invalid connections
add chain=icmp protocol=icmp icmp-options=3:0 action=accept
    comment=allow established connections
add chain=icmp protocol=icmp icmp-options=3:1 action=accept
    comment=allow already established connections
add chain=icmp protocol=icmp icmp-options=4:0 action=accept
    comment=allow source quench
add chain=icmp protocol=icmp icmp-options=8:0 action=accept
    comment=allow echo request
add chain=icmp protocol=icmp icmp-options=11:0 action=accept
    comment=allow time exceed
add chain=icmp protocol=icmp icmp-options=12:0 action=accept
    comment=allow parameter bad
add chain=icmp action=drop comment=deny all other types
```


Mangle

```
: system
: Level1
: /ip firewall mangle
: IP
: mangle
```

Mangle

```
: /ip firewall mangle
```

Mangle " " RouterOS ,
NAT.
mangle ,

action (accept | add-dst-to-address-list | add-src-to-address-list | change-dscp | change-mss | change-ttl | jump | log | mark-connection | mark-packet | mark-routing | passthrough | return | set-priority | strip-ipv4-options; : **accept**) - ,

- **accept** - , . . .
- **add-dst-to-address-list** - IP
address-list
- **add-src-to-address-list** - IP
address-list
- **change-dscp** - **new-dscp** (DSCP)
- **change-mss** - **new-mss**
- **change-ttl** - **new-ttl**
- **jump** - **jump-target**
- **log** -
- **mark-connection** - , **new-connection**
- **mark-packet** , **new-packet-mark** ,

- **mark-routing** **new-routing-mark.**
- **passthrough** -
- **return** -
- **set-priority** - **new-priority**
- **strip-ipv4-options** - (VLAN WMM-enabled IPv4 IP)

address-list(name) - IP
action=add-dst-to-address **action=add-src-to-address-list.**

address-list-timeout(time; : 00:00:00) - **address-list.**
add-dst-to-address-list **add-src-to-address-**

list

- **00:00:00** -

chain (forward | input | output | postrouting | prerouting) -

comment(text)

connection-bytes(integer-integer) -

- **0** - : **connection-bytes=2000000-0**
2

connection-limit(integer, netmask) -

connection-mark(name) - mangle

connection-state (established | invalid | new | related) -

- **established** -
- **invalid** - ICMP
- **new** -

- **related** - , ICMP , FTP FTP
(
/ip firewall service-port)

connection-type (ftp | gre | h323 | irc | mms | pptp | quake3 | tftp) -

/ip firewall service-port

content(text) -

dscp (integer: 0..63) - DSCP (ex-ToS) - IP

dst-address (IP address/netmask | IP address -IP address) -

IP

address/netmask . 1.1.1.1/24

1.1.1.0/24

dst-address-list(name) -

dst-address-type (unicast | local | broadcast | multicast) -

IP

:

- **unicast** - IP
- **local** -
- **broadcast** - IP IP
- **multicast** - IP

dst-limit (integer/time{0,1},integer,dst-address | dst-port | src-address{+},time{0,1}) -
IP

):

- **count** - , time -
(pps), **time**
- **time** -
- **burst** - -
- **mode** -
- **expire** - IP /

dst-port - (integer: 0..65535-integer: 0..65535{*}) -

fragment (yes | no) - IP (.

hotspot (multiple choice: auth | from-client | http | local-dst | to-client) -
HotSpot.

- **auth** - , HotSpot
- **from-client** - , HotSpot
- **http** - , HotSpot
proxy (Universal Proxy technique) 80
- **local-dst** - , IP
- **to-client** - ,

icmp-options (integer.integer) - ICMP :

in-bridge-port (name) -

(, ,)

in-interface ()

in-interface (name) -

()

ingress-priority (integer: 0..63) - INGRESS() ,

(0)

VLAN

WMM

ipv4-options (any | loose-source-routing | no-record-route | no-router-alert | no-source-routing | no-timestamp | none | record-route | router-alert | strict-source-routing | timestamp) -
ipv4

- **any** - ipv4
- **loose-source-routing** -
- **no-record-route** -
- **no-router-alert** -
- **no-source-routing** -
- **no-timestamp** - timestamp
- **record-route** -
- **router-alert** -
- **strict-source-routing** -
- **timestamp** - timestamp

jump-target (forward | input | output | postrouting | prerouting name) -
, **action=jump**

layer7-protocol (name) - Layer 7
protocol :

/ip firewall layer7-

limit (integer/time{0,1},integer) -

- **count** (pps), **time** , -
- **time** - ,
- **burst** - -

log-prefix (text) -

new-dscp (integer: 0..63) - **action=mark-connection**

DSCP

new-mss (integer) - **action=change-dscp**

MSS

action=change-mss

new-packet-mark(name) -

action-mark-packet

new-priority (integer) -

action=set-priority

- **from-dscp** - DSCP
- **from-ingress** - INGRESS(VLAN
- WMM - ; 0)

new-routing-mark (name) -

action=mark-routing

new-ttl (decrement | increment | set:integer) -

TTL

action=change-ttl

- **decrement** - TTL
- **increment** - TTL
- **set:** TTL

nth (integer,integer: 0..15,integer{0,1}) -

Nth

16

- **every** - +1 , +1
- **counter** .
- **packet** (nth) .
0 every

, every+1
0 every

out-bridge-port(name) -

(
out-interface)

out-interface (name) -

(
)

p2p (all-p2p | bit-torrent | direct-connect | edonkey | fasttrack | gnutella | soulseek | warez | winmx) -

P2P

packet-mark (name) -

mangle

packet-mark

packet-size (integer: 0..65535-integer: 0..65535{0,1})-

min -

max -

passthrough (yes | no; : yes) -

(
)

port (port{0-16}) -

(
)

src-port

dst-port)

protocol (ddp | egp | encap | ggp | gre | hmp | icmp | idrp -cmtip | igmp | ipencap | ipip | ipsec-ah | ipsec-esp | iso-tp4 | ospf | pup | rdp | rspf | st | tcp | udp | vmtip | xns-idp | xtp | integer) -

psd (integer,time,integer,integer) -

TCP UDP

FTP

- **WeightThreshold** -

TCP/UDP

- **DelayThreshold** -

- **LowPortWeight** -

(1024)

- **HighPortWeight** -

random (integer: 1..99) -

routing-mark (name) -

src-address (IP address/netmask | IP address-IP address) -

IP

. 1.1.1.1/24

1.1.1.0/24

address/netmask

src-address-list (name) -

src-address-type (unicast | local | broadcast | multicast) -

IP

- **unicast** - IP

- **local** -

- **broadcast** - IP

- **multicast** - IP

IP

src-mac-address (MAC address) - MAC

src-port (integer: 0..65535-integer: 0..65535{*}) -

tcp-flags (multiple choice: ack | cwr | ece | fin | psh | rst | syn | urg)

tcp

- **ack** -

- **cwr** -

- **ece** - ECH-echo ()

- **fin** -

- **psh** -

- **rst** -

- **syn** -

- **urg** -

tcp-mss (integer: 0..65535) -

IP

TCP MSS

time (time-time,sat | fri | thu | wed | tue | mon | sun{+}) -

mangle

(
passthrough
),
P2P,
P2P

mangle

Peer-to-Peer Traffic Marking

VoIP HTTP
, peer-to-peer. RouterOS QOS

P2P
1 Mbps
:

```
[admin@MikroTik] > /ip firewall mangle add chain=forward
... p2p=all-p2p action=mark-connection new-connection-mark=p2p_conn
[admin@MikroTik] > /ip firewall mangle add chain=forward
... connection-mark=p2p_conn action=mark-packet new-packet-mark=p2p
[admin@MikroTik] > /ip firewall mangle add chain=forward
... connection-mark=!p2p_conn action=mark-packet new-packet-mark=other
[admin@MikroTik] > /ip firewall mangle print
Flags: X - disabled, I - invalid, D - dynamic
 0 chain=forward p2p=all-p2p action=mark-connection new-connection-
mark=p2p_conn
 1 chain=forward connection-mark=p2p_conn action=mark-packet new-packet-
mark=p2p
 2 chain=forward packet-mark=!p2p_conn action=mark-packet new-packet-
mark=other
[admin@MikroTik] >
[admin@MikroTik] > /queue tree add parent=Public packet-mark=p2p limit-
at=1000000
... max-limit=100000000 priority=8
[admin@MikroTik] > /queue tree add parent=Local packet-mark=p2p limit-
at=1000000
... max-limit=100000000 priority=8
[admin@MikroTik] > /queue tree add parent=Public packet-mark=other limit-
at=1000000
... max-limit=100000000 priority=1
[admin@MikroTik] > /queue tree add parent=Local packet-mark=other limit-
at=1000000
... max-limit=100000000 priority=1
```

MAC

:

/

```
[admin@MikroTik] > / ip firewall mangle add chain=prerouting
... src-mac-address=00:01:29:60:36:E7 action=mark-connection new-connection-
mark=known_mac_conn
[admin@MikroTik] > / ip firewall mangle add chain=prerouting
... connection-mark=known_mac_conn action=mark-packet new-packet-
mark=known_mac
```

MSS

VPN
MSS

MSS VPN

DF,

MTU (PMTUD)

FTP HTTP

PTUMD,

MSS

VPN

MSS

mangle

```
[admin@MikroTik] > /ip firewall mangle add out-interface=pppoe-out
... protocol=tcp tcp-flags=syn action=change-mss new-mss=1300 chain=forward
[admin@MikroTik] > /ip firewall mangle print
Flags: X - disabled, I - invalid, D - dynamic
0 chain=forward out-interface=pppoe-out protocol=tcp tcp-flags=syn
action=change-mss new-mss=1300
[admin@MikroTik] >
```


NAT

: system
: Level1(- 1), Level3
: /ip firewall nat
: IP, RFC1631, RFC2663

NAT

IP
natted . NAT (NAT NAT) NAT
/ .

NAT:

- natted NAT srcnat. NAT
 - natted NAT dstnat. NAT , ,
natted . , ,
. NAT dstnat
- IP IP .

NAT

NAT
NAT, NAT AH , IPsec. RouterOS

dstnat srcnat, . srcnat
masquerade masquerade srcnat **to-address IP**
IP
to-ports,
(
web proxy).
action=redirect), dstnat (
() **action=nat**
(web

```

dstnat web IP , ( ). Starting from HTTP/1.1 IP
HTTP , IP , web , (
HTTP ) , web (
HTTP
" "
( web ) " " ;

```

action (accept | add-dst-to-address-list | add-src-to-address-list | dst-nat | jump | log | masquerade | netmap | passthrough | redirect | return | same | src -nat; default: **accept**)

- **accept** -
- **add-dst-to-address-list** - IP address-list
- **add-src-to-address-list** - IP address-list
- **dst-nat** - IP to-address to-ports.
- **jump** - " " jump-target
- **log** -

- **masquerade** - IP
- **netmap** - 1:1 IP
().
- **passthrough** - () .
- **redirect** - IP .
- **return** - " " **jump**
- **same** - IP /
- **src-nat** - IP
to-address
to-ports.

address-list(name) - IP

action=adddst-to-address-list **action=add-src-to-address-tist.**

address-list-timeout(time; default: **00:00:00**) – ,
address-list.
add-dst-to-address-list **add-src-to-address-list. 00:00:00** -

chain(dstnat | srcnat | name) - .

. **dstnat** -

IP . srcnat -

comment(text) -

connection-bytes(integerinteger) -

0 - : : **connection-bytes=2000000-0**
2

connection-limit(integer, netmask) - ()

connection-mark(name) -

mangle.

connection-type(ftp | gre | h323 | irc | mms | pptp | quake3 | tftp) -

()

/ip firewall service-port

content(text) -

dst-address(IP address/netmask | IP address-IP address) -

IP

address/netmask . . : **1.1.1./24**

1.1.1.0/24

dst-address-list(name) -

dst-address-type(unicast | local | broadcast | multicast) -

IP :

- **unicast** - IP ,
- **local** - ,
- **broadcast** - IP
- **multicast** - IP

dst-limit(integer/time{0,1},integer,dst-address | dst-port | src-address{+},time{0,1}) -

((pps))

limit

/

():

- **Count** - (pps), (Time)
- **Time** -
- **Burst** - ()
- **Mode** -
- **Expire** - IP /

dst-port(integer: 0..65535-integer: 0..65535{*}) -

hotspot(multiple choice: from-client | auth | local-dst) -
Hot-Spot.

- **from-client** - HotSpot
- **auth** -
- **local-dst** -

icmp-options(integer:integer) - ,

ip4-options(any | loose-source-routing | no-record-route | no-route-alert | no-source-routing) -
ipv4

- **any** - ipv4
- **loose-source-routing** -
- **no-record-route** -
- **no-route-alert** - ,
- **no-source-routing** - ,
- **record-route** - ,
- **strict-source-routing** -
- **timestamp** - timestamp
- **route-alert** -

jump-target(dstnat | srcnat name) - " ",
action=jump

limit(integer/time{0,1}, integer) -
c ().

- **Count** - (pps), **Time**
- **Time** -
- **Burst** - ()

log-prefix(text) -
action=log

nth(integer, integer: 0..15, integer{0,1}) - Nth
16

- **Every** - **Every+1th** , **Every=1**
2-
- **Counter** -
nth
- **Packet** -
0 Every
0 Every+1th
0 Every

out-interface (name) -

packet-mark (name) - mangle

packet-size (integer: 0..65535-integer: 0..65535{0,1}) -

- **Min** - ,
- **Max** - ,

phys-in-interface (name) -
(input)

phys-out-interface (name) -
(output).

protocol (ddp | egp | encap | ggp | gre | hmp | icmp | idrp -cmt | igmp | ipencap | ipip | ipsec -ah | ipsec -esp | iso -tp4 | ospf | pup | rdp | rspf | st | tcp | udp | vmtp | xns -idp | xtp | integer) -
IP

psd(integer,time,integer,integer) - TCP UDP

FTP

- **WeightThreshold** - TCP/UDP
(
- **DelayThreshold** -
- **LowPortWeight** - (<=1024)
- **HighPortWeight** -

random(integer) -

routing-mark(name) - mangle,

same-not-by-dst(yes | no) -
action=same

src-address(IP address/netmask | IP address -IP address) - IP
address/netmask , . . . : **1.1.1.1/24**
1.1.1.0/24

src-address-list(name) -

src-address-type (unicast | local | broadcast | multicast) -
IP , :

- **unicast** - IP
- **local** -
- **broadcast** - IP
()

- **multicast** - IP

src-mac-address(MAC address) - MAC

src-port(integer: 0..65535-integer: 0..65535{*}) -

tcp-mss(integer: 0..65535) - TCP MSS IP

time (IP address-IP address{0,1}; : **0.0.0.0**) - IP

to-ports (integer: 0..65535-integer: 0..65535{0,1}) - IP

tos (max-reliability | max-throughput | min-cost | min-delay | normal) - IP (tos). ToS - Type of Service.

- **max-reliability** - (ToS=4)
- **max-throughput** - (ToS=8)
- **min-delay** - (ToS=16)
- **normal** - (ToS=16)

NAT

NAT

- " " (Public) IP
- 1:1

NAT(Masquerading)

" " 192.168.0.0/24 10.5.8.109
(masquerading) MikroTik
. Masquerading IP 10.5.8.109
192.168.0.0/24


```
: system
: Level 1
: IP
:
```

firewall address list
filter, mangle, NAT

IP .
.

address-list **action=add-dst-to-address-list** **action=add-src-to-**
NAT mangle filter.

list(name) - IP
address(IP address/netmask | IP address-IP address) - IP

address/netmask , **1.1.1.1/24**
1.1.1.0/24

23 (telnet)

address=192.0.34.166/32 (www.example.com).

```
[admin@MikroTik] > /ip firewall address-list add list=drop_traffic  
address=192.0.34.166/32
```

```
[admin@MikroTik] > /ip firewall address-list print
```

Flags: X - disabled, D - dynamic

```
#    LIST            ADDRESS  
0    drop_traffic 192.0.34.166
```

```
[admin@MikroTik] > /ip firewall mangle add chain=prerouting protocol=tcp dst-  
port=23
```

```
... action=add-src-to-address-list address-list=drop_traffic
```

```
[admin@MikroTik] > /ip firewall filter add action=drop chain=input src-  
address-list=drop_traffic
```

```
[admin@MikroTik] > /ip firewall address-list print
```

```
Flags: X - disabled, D - dynamic
```

```
#  LIST          ADDRESS
0  drop_traffic  192.0.34.166
1  D drop_traffic 1.1.1.1
2  D drop_traffic 10.5.11.8
```

```
[admin@MikroTik] >
```

print

IP

telnet

,

- Firewall Filters
- Packet Marking(Mangle)
- Certificate Management

: /ip service

name -

port(integer: 1..65535) -

address(IP address/mask; default: **0.0.0.0/0**) - IP ()

certificate (name | none; : **none**) -

www

8081

10.10.10.0/24

```
[admin@MikroTik] ip service> print
```

```
Flags: X - disabled, I - invalid
```

```
# NAME PORT ADDRESS CERTIFICATE
```

```
0 telnet 23 0.0.0.0/0
```

```
1 ftp 21 0.0.0.0/0
```

```
2 www 80 0.0.0.0/0
```

```
3 ssh 22 0.0.0.0/0
```

```
4 www-ssl 443 0.0.0.0/0 none
```

```
[admin@MikroTik] ip service> set www port=8081 address=10.10.10.0/24
```

```
[admin@MikroTik] ip service> print
```

```
Flags: X - disabled, I - invalid
```

```
# NAME PORT ADDRESS CERTIFICATE
```

```
0 telnet 23 0.0.0.0/0
```

```

1 ftp 21 0.0.0.0/0
2 www 8081 10.10.10.0/24
3 ssh 22 0.0.0.0/0
4 www-ssl 443 0.0.0.0/0 none

[admin@MikroTik] ip service>

```

Mikrotik

RouterOS.

/	
20/tcp	File Transfer Protocol FTP [Data Connection]
21/tcp	File Transfer Protocol FTP [Control Connection]
22/tcp	Secure Shell SSH remote Login Protocol (Only with security package)
23/tcp	Telnet protocol
53/tcp	Domain Name Server DNS
53/udp	Domain Name Server DNS
67/udp	Bootstrap Protocol or DHCP Server (only with dhcp package)
68/udp	Bootstrap Protocol or DHCP Client (only with dhcp package)
80/tcp	World Wide Web HTTP
123/udp	Network Time Protocol NTP (Only with ntp package)
161/udp	Simple Network Management Protocol SNMP (Only with snmp package)
443/tcp	Secure Socket Layer SSL encrypted HTTP(Only with hotspot package)
500/udp	Internet Key Exchange IKE protocol (Only with ipsec package)
521/udp	Routing Information Protocol RIP (Only with routing package)
179/tcp	Border Gateway Protocol BGP (Only with routing package)
1080/tcp	SOCKS proxy protocol
1701/udp	Layer 2 Tunnel Protocol L2TP (Only with ppp package)
1718/udp	H.323 Gatekeeper Discovery (Only with telephony package)
1719/tcp	H.323 Gatekeeper RAS (Only with telephony package)
1720/tcp	H.323 Call Setup (Only with telephony package)
1723/tcp	Point-to-Point Tunneling Protocol PPTP (Only with ppp package)
1731/tcp	H.323 Audio Call Control (Only with telephony package)
1900/udp	Universal Plug and Play uPnP
2828/tcp	Universal Plug and Play uPnP
2000/tcp	Bandwidth-test server
3986/tcp	Proxy for winbox

3987/tcp	SSL proxy for secure winbox (Only with security package)
5678/udp	MikroTik Neighbor Discovery Protocol
8080/tcp	HTTP Web proxy (Only with web-proxy package)
8291/tcp	Winbox
20561/udp	MAC winbox
5000+/udp	H.323 RTP Audio Stream (Only with telephony package)
/1	ICMP - Internet Control Message Protocol
/4	IP - IP in IP (encapsulation)
/47	GRE - General Routing Encapsulation (Only for PPTP and EoIP)
/50	ESP - Encapsulating Security Payload for IPv4 (Only with security package)
/51	AH - Authentication Header for IPv4 (Only with security package)
/89	OSPFIGP - OSPF Interior Gateway Protoco

SOCKS proxy

C

```
: system  
      : Level1  
: /ip socks  
      : SOCKS version 4  
      :
```

- Web Proxy
- NAT

SOCKS -

TCP
. SOCKS

WWW, FTP, TELET
SOKS

4.

SOCKS

SOCKS
/

SOCKS

SOCKS

connection-idle-timeout (time; default: **2m**) -
idle

enabled (yes | no; default: **no**) - SOCKS

max-connections (integer: 1..500; default: **200**) -

port (integer: 1..65535; default: **1080**) - TCP

SOCKS

SOCKS

:

```
[admin@MikroTik] ip socks> set enabled=yes
[admin@MikroTik] ip socks> print
    enabled: yes
    port: 1080
    connection-idle-timeout: 2m
    max-connections: 200
[admin@MikroTik] ip socks>
```

: **/ip socks access**

SOCKS

SOCKS

C

action (allow | deny; default: **allow**) -

allow -

deny -

- **dst-address** (IP address/netmask:port) -
- **src-address** (IP address/netmask:port) -

: **/ip socks connections**

SOCKS

TCP

SOCKS :

```
[admin@MikroTik] ip socks> set enabled=yes
[admin@MikroTik] ip socks> print
enabled: yes
port: 1080
connection-idle-timeout: 2m
max-connections: 200
[admin@MikroTik] ip socks>
```

```
65535          FTP          IP          192.168.0.2/32,
                IP          )          (          .          1024
```

```
[admin@MikroTik] ip socks access> add src-address=192.168.0.2/32 dst-
address=:21 action=allow
[admin@MikroTik] ip socks access> add dst-address=:1024-65535 action=allow
[admin@MikroTik] ip socks access> add action=deny
[admin@MikroTik] ip socks access> print
Flags: X - disabled
0 src-address=192.168.0.2/32 dst-address=:21 action=allow
1 dst-address=:1024-65535 action=allow
2 action=deny
[admin@MikroTik] ip socks access>
```

SOCKS

.
:

```
[admin@MikroTik] ip socks connections> print
# SRC-ADDRESS          DST-ADDRESS          TX          RX
0 192.168.0.2:1238     10.5.8.8:21         1163       4625
1 192.168.0.2:1258     10.5.8.8:3423       0          3231744
[admin@MikroTik] ip socks connections>
```

```
!          SOCKS
IP          192.168.0.1 (          FTP          .          /SOCK)          1080.
```


OSPF

```
: routing
: Level 3
:/routing ospf
: OSPF
:
C
```

- Software Package Management
- IP Addresses and ARP
- Routes, Equal Cost Multipath Routing, Policy Routing
- Log Management

Open Shortest Path First () -
. OSPF

().
OSPF
(MTU), OSPF
OSPF OSPF
OSPF OSPF
110.

```
:/routing ospf
```

distribute-default (never | if-installed-as-type-1 | if-installed-as-type-2
| always-as-type-1 | always-as-type-2; default: **never**) -
ABR(

) ASBR()

- **never** -
- **if-installed-as-type-1** - 1
(DHCP PPP . .)
- **if-installed-as-type-2** - 2
(DHCP PPP . .)
- **always-as-type-1** - 1.
- **always-as-type-2** - 2.

metric-bgp (integer; : 20) -
BGP .

metric-connected (integer; : 20) -
().

metric-default (integer; : 1) -

metric-rip (integer; : 20) -
RIP.

metric-static(integer; : 20) -

redistribute-bgp (as-type-1 | as-type-2 | no; : no) -

redistribute-connected(as-type-1 | as-type-2 | no; : no) -

redistribute-rip (as-type-1 | as-type-2 | no; : no) -
RIP.

redistribute-static (as-type-1 | as-type-2 | no; : no) -

/ip route add.

router-id(IP address; : 0.0.0.0) - OSPF
, OSPF IP

```
( . ( ), AS( . ) )
```

```
OSPF ( )  
OSPF :
```

- **type1** - , OSPF
AS
- **type2** - ; **type2**
AS. **type2** AS

```
/ip route , Type1 Type2 AS  
Io.
```

10e+8/
:

ethernet 10

T1 64

64Kb/s 1562

type1 OSPF
1

```
[admin@MikroTik] routing ospf> set redistribute-connected=as-type-1  
... metric-connected=1  
[admin@MikroTik] routing ospf> print  
router-id: 0.0.0.0  
distribute-default: never  
redistribute-connected: as-type-1  
redistribute-static: no  
redistribute-rip: no  
redistribute-bgp: no  
metric-default: 1
```

```
metric-connected: 1
metric-static: 20
metric-rip: 20
metric-bgp: 20
[admin@MikroTik] routing ospf>
```

: /routing ospf area

OSPF

)

60-80

area-id(IP address;
area-id=0.0.0.0 -

: 0.0.0.0) -

OSPF

OSPF

().

authentication(none | simple | md5;

: none) -

OSPF

- none -
- simple -
- md5 -

md5

default-cost(integer;

: 1) -

name(name;

"" -

OSPF

stub(yes | no; : **no**) - ()

CPU

OSPF **local_10 area-id=0.0.0.15**

```
[admin@WiFi] routing ospf area> add area-id=0.0.10.5 name=local_10
[admin@WiFi] routing ospf area> print
Flags: X - disabled, I - invalid
# NAME          AREA-ID     STUB DEFAULT-COST AUTHENTICATION
0  backbone      0.0.0.0    no      1          none
1  local_10      0.0.10.5   no      1          none
[admin@WiFi] routing ospf area>
```

:/routing ospf network

(.
OSPF ,

C

area(name; : **backbone**) - OSPF

network(IP ; : **20**) -
networks multiple ,
OSPF.

OSPF 10.10.1.0/24,

:

```
[admin@MikroTik] routing ospf network> add area=backbone network=10.10.1.0/24
[admin@MikroTik] routing ospf network> print
Flags: X - disabled
# NETWORK      AREA
0 10.10.1.0/24 backbone
[admin@MikroTik] routing ospf>
```

:/routing ospf interface

OSPF

authentication-key (text; : "") -

cost(integer: 1..65535; : 1) -

dead-interval(time; :40s) -

hello.

hello-interval (time; 10s) - hello

interface(name; : all) - OSPF

• all -

priority(integer: 0..255; :1) -
()

retransmit-interval(time; : 5s) -

(LSA) , LSA
LSA. : 5
- 10 .

transmit-delay(time; : 1s) -

ether2

Hello 5 , :

```
[admin@MikroTik] routing ospf> interface add interface=ether2 hello-  
interval=5s  
[admin@MikroTik] routing ospf> interface print  
0 interface=ether2 cost=1 priority=1 authentication-key=""  
  retransmit-interval=5s transmit-delay=1s hello-interval=5s  
  dead-interval=40s  
[admin@MikroTik] routing ospf>
```

:/routing ospf virtual-link

RFC OSPF

neighbor-id(IP address; : 0.0.0.0) **router-id**

transit-area(name; : (unknown)) -

() .

10.0.0.201 ex,

:

```
[admin@MikroTik] routing ospf virtual-link> add neighbor-id=10.0.0.201
... transit-area=ex
[admin@MikroTik] routing ospf virtual-link> print
Flags: X - disabled, I - invalid
# NEIGHBOR-ID TRANSIT-AREA
0 10.0.0.201 ex
[admin@MikroTik] routing ospf virtual-link>
```

: /routing ospf neighbor

OSPF ,

address(read-only: IP) - IP

backup-dr-id(read-only: IP) -

db-summaries(read-only: integer) -

dr-id(read-only: IP) -

ls-request(read-only: integer) -

ls-retransmits(read-only: integer) -

priority(read-only: integer) -
Hello

router-id(read-only: IP) - **router-id**

state(read-only: Down | Attempt | Init | 2-Way | ExStart | Exchange | Loading | Full) - co

:

- **Down** -
- **Attempt** - Hello
- **Init** - Hello
- **2-Way** - ,
- **ExStart** - DR () BDR() ,
- **Exchange** -
- **Loading** -
- **Full** - .

Hello,

state-changes(read-only: integer) -

OSPF :

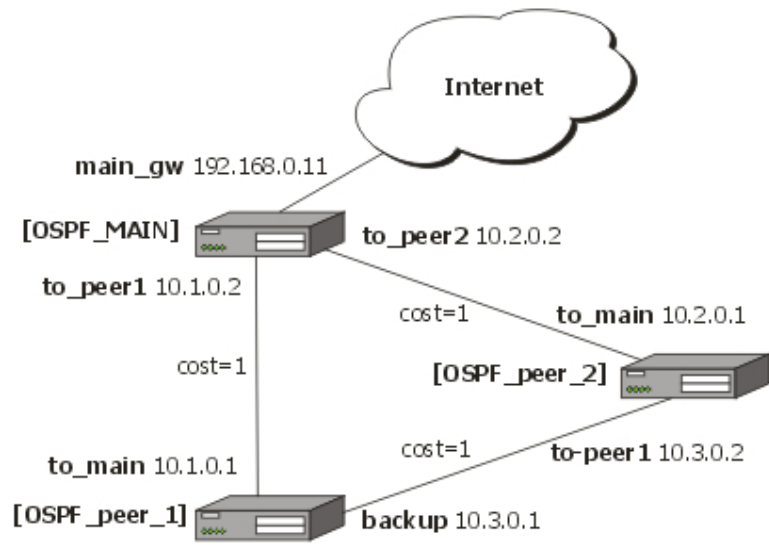
```
admin@MikroTik] routing ospf> neighbor print
router-id=10.0.0.204 address=10.0.0.204 priority=1 state="2-Way"
state-changes=0 ls-retransmits=0 ls-requests=0 db-summaries=0
dr-id=0.0.0.0 backup-dr-id=0.0.0.0

[admin@MikroTik] routing ospf>
```

OSPF

```
peer-1 . OSPF -Main OSPF-
peer-2. , OSPF-
OSPF ,
OSPF .
:
```

1. OSPF ID=0.0.0.1,



2. OSPF
 - peer1 peer2
 - main_gw OSPF OSPF
3. OSPF-peer-1 OSPF-peer-2
 - OSPF.

```
[admin@OSPF_MAIN] interface> print
Flags: X - disabled, D - dynamic, R - running
#  NAME                TYPE          RX-RATE  TX-RATE  MTU
0  R main_gw            ether         0         0         0
   0                    1500
1  R to_peer_1         ether         0         0         0
   0                    1500
2  R to_peer_2         ether         0         0         0
   0                    1500
```

ip ,

```
[admin@OSPF_MAIN] ip address> print
Flags: X - disabled, I - invalid, D - dynamic
#  ADDRESS             NETWORK      BROADCAST  INTERFACE
0  192.168.0.11/24     192.168.0.0  192.168.0.255  main_gw
1  10.1.0.2/24         10.1.0.0    10.1.0.255
to_peer_1
2  10.2.0.2/24         10.2.0.0    10.2.0.255
to_peer_2
```

distribute-default if-installed-as-type-2,

redistribute-connected as-type-1 redistribute-static as-type-2.
Metric-connected, metric-static, metric-rip, metric-bgp

```
[admin@OSPF_MAIN] routing ospf> print
      router-id: 0.0.0.0
      distribute-default: if-installed-as-type-2
redistribute-connected: as-type-1
redistribute-static: as-type-2
redistribute-rip: no
redistribute-bgp: no
metric-default: 1
metric-connected: 0
metric-static: 0
metric-rip: 0
metric-bgp: 0
```

OSPF local_10 area-id 0.0.0.1:

```
[admin@OSPF_MAIN] routing ospf area> print
Flags: X - disabled, I - invalid
# NAME AREA-ID STUB DEFAULT-COST
AUTHENTICATION
0 backbone 0.0.0.0
none
1 local_10 0.0.0.1 no 1
none
```

area local_10 OSPF :

```
[admin@OSPF_MAIN] routing ospf network> print
Flags: X - disabled, I - invalid
# NETWORK AREA
0 10.1.0.0/24 local_10
1 10.2.0.0/24 local_10
```

OSPF_peer_1.

OSPF_peer_1:

```
[admin@OSPF_peer_1] interface> print
Flags: X - disabled, D - dynamic, R - running
# NAME TYPE RX-RATE TX-RATE MTU
0 R backup ether 0
0 1500
1 R to_main ether 0
0 1500
```

IP :

```
[admin@OSPF_peer_1] ip address> print
Flags: X - disabled, I - invalid, D - dynamic
# ADDRESS NETWORK BROADCAST INTERFACE
0 10.1.0.1/24 10.1.0.0 10.1.0.255
to_main
1 10.3.0.1/24 10.3.0.0 10.3.0.255 backup
```

redistribute-connected as-type-1. Metric-connected, metric-static, metric-rip, metric-bgp

```
[admin@OSPF_peer_1] routing ospf> print
router-id: 0.0.0.0
distribute-default: never
redistribute-connected: as-type-1
redistribute-static: no
redistribute-rip: no
redistribute-bgp: no
metric-default: 1
metric-connected: 0
metric-static: 0
metric-rip: 0
metric-bgp: 0
```

```
[admin@OSPF_peer_1] routing ospf area> print
Flags: X - disabled, I - invalid
# NAME AREA-ID STUB DEFAULT-COST
AUTHENTICATION
0 backbone 0.0.0.0
none
1 local_10 0.0.0.1 no 1
none
```

local_10:

```
[admin@OSPF_peer_1] routing ospf network> print
Flags: X - disabled, I - invalid
# NETWORK AREA
0 10.3.0.0/24 local_10
1 10.1.0.0/24 local_10
```

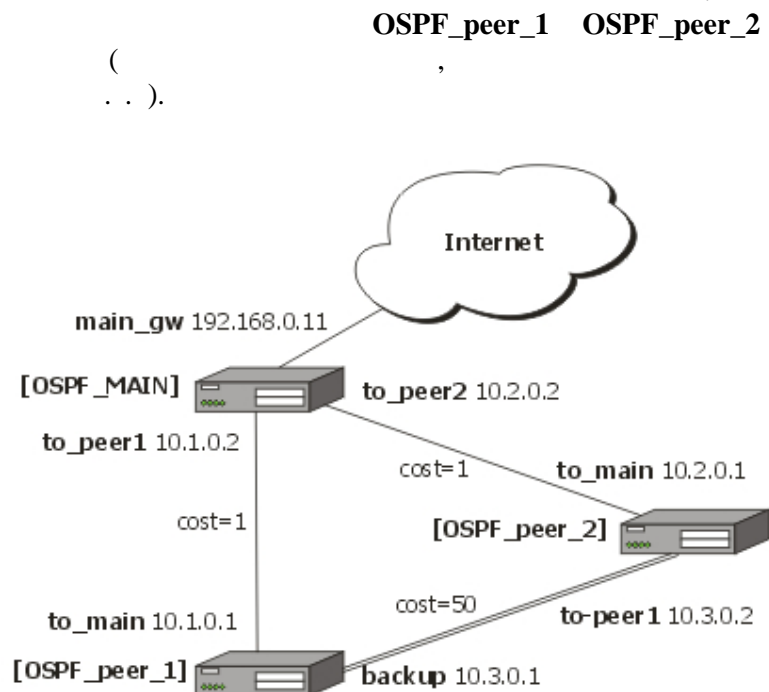
OSPF_peer2.

```
[admin@OSPF_peer_2] interface> print
Flags: X - disabled, D - dynamic, R - running
# NAME TYPE RX-RATE TX-RATE MTU
```



```
[admin@OSPF_peer_1] ip route> print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 Do 192.168.0.0/24 r 10.1.0.2 110 to_main
1 Io 10.3.0.0/24 110
2 DC 10.3.0.0/24 r 0.0.0.0 0 backup
3 Do 10.2.0.0/24 r 10.1.0.2 110 to_main
r 10.3.0.2 backup
4 Io 10.1.0.0/24 110
5 DC 10.1.0.0/24 r 0.0.0.0 0 to_main
```

```
[admin@OSPF_peer_2] ip route> print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 Do 192.168.0.0/24 r 10.2.0.2 110 to_main
1 Io 10.3.0.0/24 110
2 DC 10.3.0.0/24 r 0.0.0.0 0 to_peer_1
3 Io 10.2.0.0/24 110
4 DC 10.2.0.0/24 r 0.0.0.0 0 to_main
5 Do 10.1.0.0/24 r 10.3.0.1 110 to_peer_1
r 10.2.0.2 to_main
```



: OSPF_peer_1

OSPF_peer_2 50.
:

```
[admin@OSPF_peer_1] routing ospf interface> add interface=backup cost=50
[admin@OSPF_peer_1] routing ospf interface> print
 0 interface=backup cost=50 priority=1 authentication-key=""
 retransmit-interval=5s transmit-delay=1s hello-interval=10s
 dead-interval=40s
```

```
[admin@OSPF_peer_2] routing ospf interface> add interface=to_peer_1 cost=50
[admin@OSPF_peer_2] routing ospf interface> print
 0 interface=to_peer_1 cost=50 priority=1 authentication-key=""
 retransmit-interval=5s transmit-delay=1s hello-interval=10s
 dead-interval=40s
```

10.3.0.0/24 , multi
OSPF_MAIN

OSPF_MAIN

```
[admin@OSPF_MAIN] ip route> print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 Io 192.168.0.0/24 110
1 DC 192.168.0.0/24 r 0.0.0.0 0 main_gw
2 Do 10.3.0.0/24 r 10.2.0.1 110 to_peer_2
 r 10.1.0.1 to_peer_1
3 Io 10.2.0.0/24 110
4 DC 10.2.0.0/24 r 0.0.0.0 0 to_peer_2
5 Io 10.1.0.0/24 110
6 DC 10.1.0.0/24 r 0.0.0.0 0 to_peer_1
```

OSPF_peer_1

```
[admin@OSPF_peer_1] > ip route pr
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 Do 192.168.0.0/24 r 10.1.0.2 110 to_main
1 Io 10.3.0.0/24 110
2 DC 10.3.0.0/24 r 0.0.0.0 0 backup
3 Do 10.2.0.0/24 r 10.1.0.2 110 to_main
4 Io 10.1.0.0/24 110
5 DC 10.1.0.0/24 r 0.0.0.0 0 to_main
```

OSPF_peer_2

```
[admin@OSPF_peer_2] > ip route print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
# DST-ADDRESS G GATEWAY DISTANCE INTERFACE
0 Do 192.168.0.0/24 r 10.2.0.2 110 to_main
```

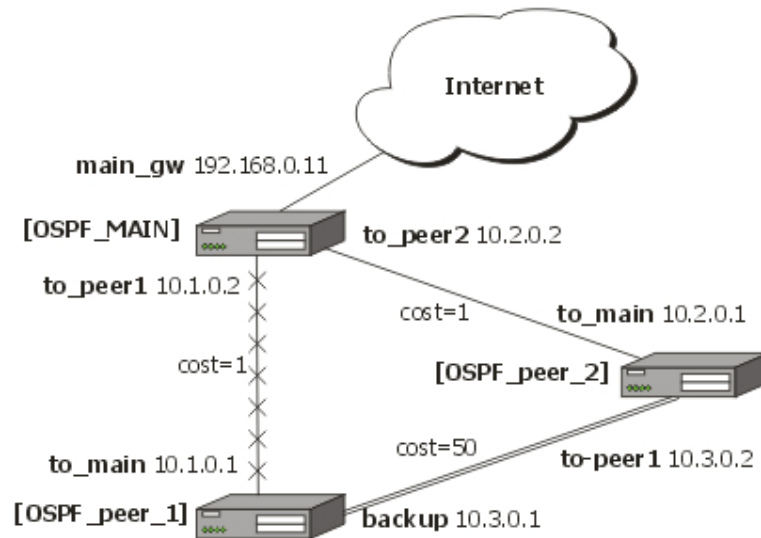


```

1 Io 10.3.0.0/24          110
2 DC 10.3.0.0/24          r 0.0.0.0          0          to_peer_1
3 Io 10.2.0.0/24          110
4 DC 10.2.0.0/24          r 0.0.0.0          0          to_main
5 Do 10.1.0.0/24          r 10.2.0.2          110        to_main

```

OSPF_MAIN OSPF_peer_1



OSPF

OSPF_MAIN

```

[admin@OSPF_MAIN] ip route> print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp
#  DST-ADDRESS      G GATEWAY      DISTANCE INTERFACE
0  Io 192.168.0.0/24  110
1  DC 192.168.0.0/24  r 0.0.0.0      0          main_gw
2  Do 10.3.0.0/24     r 10.2.0.1     110        to_peer_2
3  Io 10.2.0.0/24     110
4  DC 10.2.0.0/24     r 0.0.0.0      0          to_peer_2
5  Io 10.1.0.0/24     110
6  DC 10.1.0.0/24     r 0.0.0.0      0          to_peer_1

```

OSPF_peer_1

```

[admin@OSPF_peer_1] ip route> print
Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp

```

#	DST-ADDRESS	G GATEWAY	DISTANCE	INTERFACE
0	Do 192.168.0.0/24	r 10.3.0.2	110	backup
1	Io 192.168.0.0/24	110		
2	DC 10.3.0.0/24	r 0.0.0.0	0	backup
3	Do 10.2.0.0/24	r 10.3.0.2	110	backup
4	Io 10.1.0.0/24	110		
5	DC 10.1.0.0/24	r 0.0.0.0	0	to_main

OSPF_peer_2

[admin@OSPF_peer_2] ip route> print

Flags: X - disabled, I - invalid, D - dynamic, J - rejected,
C - connect, S - static, r - rip, o - ospf, b - bgp

#	DST-ADDRESS	G GATEWAY	DISTANCE	INTERFACE
0	Do 192.168.0.0/24	r 10.2.0.2	110	to_main
1	Io 10.3.0.0/24	110		
2	DC 10.3.0.0/24	r 0.0.0.0	0	to_peer_1
3	Io 10.2.0.0/24	110		
4	DC 10.2.0.0/24	r 0.0.0.0	0	to_main
5	Do 10.1.0.0/24	r 10.2.0.2	110	to_main

interval). , 40 (hello-

.1

:system

:Level1

:/system script

:

:

•

:

- **prefix -** ICE;
:put **:path** **/ping 10.0.0.1**

- **path -**

- **path_args -**

/ip firewall rule < name >

- **action** -

- **action_args** -

/ping < ip address >

- **params[=values]** -

action_args, **prefix**, **path**, **action**, **params**, **path_args**
 :put (1 + 2), ":pu" . "t") 3

/ping 10.0.0.1 count=5

prefix	/
action	ping
action_args	10.0.0.1
params[=values]	count=5

..ip firewall rule input

path	..ip firewall rule
path_args	input

```
:for i from=1 to=10 do={:put $i}
```

prefix	:
action	for
action_args	i
params[=values]	from=1 to=10 do={:put \$i}

```
/interface monitor-traffic ether1,ether2,ipip1
```

prefix	/
path	interface
action	monitor-traffic
action_args	ether1,ether2,ipip1

'[]'.

[Tab].

'{}'

```
admin@MikroTik] ip address> /user {  
{... /ip route
```

```
{... print
{... }
Flags: X - disabled
0 ;;; system default user
name="admin" group=full address=0.0.0.0/0

1 name="x" group=write address=0.0.0.0/0

2 name="y" group=read address=0.0.0.0/0

[admin@MikroTik] ip route>
```

**/ip route
print**

/user print.

('\$') (.)
'-'

- **global** **global,**

- **local** **local,**

- **loop index variables** **for** **foreach,**
do

- **monitor action**
do.

action.

unset.

" " ().

```
[admin@MikroTik] ip route> /  
[admin@MikroTik] > :global g1  
[admin@MikroTik] > :set g1 "this is global variable"  
[admin@MikroTik] > :put $g1  
this is global variable
```



```
[admin@MikroTik] >
```

```
    , incr   decr      "    ", time -      , add -  
    : find, /ping -
```

find

```
[admin@MikroTik] > /interface  
[admin@MikroTik] interface> find type=ether  
[admin@MikroTik] interface>  
[admin@MikroTik] interface> :put [find type=ether]  
*1,*2  
[admin@MikroTik] interface>
```


&& - **AND.**
 + -
 < -
 ip
 << -
 ip
 ip
 ip
 <= -
 ip
 >> -
 ip
 ip
 ip
 | - **OR.**
 || - **OR.**

```

[admin@MikroTik] ip firewall rule forward> :put (10+1 -6*2=11-12=2+(-3)=-1)
false
[admin@MikroTik] ip firewall rule forward> :put (10+1 -6*2=11-12=(2+(-3)=-1))
true
[admin@MikroTik] ip firewall rule forward

```

(NOT)

```
[admin@MikroTik] interface> :put (!true)
false
[admin@MikroTik] interface> :put (!(2>3))
true
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (-1<0)
true
[admin@MikroTik] > :put (--1)
1
```

```
[admin@MikroTik] interface> :put (~255.255.0.0)
0.0.255.255
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (3s + 5s)
```

8s

```
[admin@MikroTik] interface> :put (10.0.0.15 + 0.0.10.0)
```

ERROR: cannot add ip address to ip address

```
[admin@MikroTik] interface> :put (10.0.0.15 + 10)
```

10.0.0.25

```
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (15 - 10)
```

5

```
[admin@MikroTik] interface> :put (10.0.0.15 - 10.0.0.3)
```

12

```
[admin@MikroTik] interface> :put (10.0.0.15 - 12)
```

10.0.0.3

```
[admin@MikroTik] interface> :put (15h - 2s)
```

14h59m58s

```
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (12s * 4)
```

48s

```
[admin@MikroTik] interface> :put (-5 * -2)
10
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (10s / 3)
3s333.333ms
[admin@MikroTik] interface> :put (5 / 2)
2
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (10.0.2.3<=2.0.3.10)
false
[admin@MikroTik] interface> :put (100000s>27h)
true
[admin@MikroTik] interface> :put (60s,1d!=1m,3600s)
false
[admin@MikroTik] interface> :put (bridge=routing)
false
[admin@MikroTik] interface> :put (yes=false)
false
```

```
[admin@MikroTik] interface> :put (true=aye)
ERROR: cannot compare if truth value is equal to string
[admin@MikroTik] interface>
```

AND, OR

```
[admin@MikroTik] interface> :put ((yes && yes) || (yes && no))
true
[admin@MikroTik] interface> :put ((no || no) && (no || yes))
false
[admin@MikroTik] interface>
```

AND, OR, XOR

```
[admin@MikroTik] interface> :put (10.16.0.134 & ~255.255.255.0)
0.0.0.134
[admin@MikroTik] interface>
```

c

```
[admin@MikroTik] interface> :put (~(0.0.0.1 << 7) - 1))
```

```
255.255.255.128
```

```
[admin@MikroTik] interface>
```

```
[admin@MikroTik] interface> :put (1 . 3)
```

```
13
```

```
[admin@MikroTik] interface> :put (1,2 . 3)
```

```
1,2,3
```

```
[admin@MikroTik] interface> :put (1 . 3,4)
```

```
13,4
```

```
[admin@MikroTik] interface> :put (1,2 . 3,4)
```

```
1,2,3,4
```

```
[admin@MikroTik] interface> :put ((1 . 3) + 1)
```

```
ERROR: cannot add string to integer number
```

```
[admin@MikroTik] interface>
```


- list
- internal number
- number
- IP address
- time
- boolean
- string

9223372036854775807.
 0x. 64 ,
 -9223372036854775808 ,

false. true false. *.
 yes true no

HH:MM:SS.

- d, day, days - , 24
- h, hour, hours-
- m, min -
- s -
- ms - , 0.001

, ICE

ICE

beep -

length() c frequency() .

```
[admin@MikroTik] > :beep length=2s frequency=10000  
[admin@MikroTik] >
```

delay() -

do -

```
while if. do  
while do  
do  
if  
else if false
```

```
[admin@MikroTik] > {:global i; :set i 10; :do{:put $i; :decr i;}  
... while (($i < 10) && ($i > 0)); :unset i;}  
10  
9  
8  
7  
6  
5  
4
```

```
3
2
1
[admin@MikroTik] >
```

environment print

Global Variables.

:for **:foreach** (

:local
:global, ,
)

Local Variables.

```
[admin@MikroTik] > :environment print
Global Variables
g1=this is global variable
Local Variables
g1=this is global variable
l1=this is local variable
counter=2
[admin@MikroTik] >
```

for

from, to, step do.

do

```
[admin@MikroTik] > :for i from=1 to=100 step=37 do={:put ($i . " - " . 1000/$i)}
1 - 1000
38 - 26
75 - 13
[admin@MikroTik] >
```

```
foreach -
    in do.
    in
    do
    in
    do
    in
    find,
    ip
```

```
[admin@MikroTik] > :foreach i in=[/interface find type=ether ] do={
{... :put [/interface get $i name]
{... :foreach j in=[/ip address find interface=$i] do={
{{... :put [/ip address get $j address]
{{... }
{... }
ether1
ether2
10.0.0.65/24
[admin@MikroTik] >
```

```
if
-
true
do else.
```


time -

time.

```
[admin@MikroTik] > :put [:time {:delay}]  
1s34.31ms  
[admin@MikroTik] >
```

while -

do.

do.

```
[admin@MikroTik] > {:global i; :set i=0; :while ($i < 10)  
... do={:put $i; :incr i;}; :unset i;}  
0  
1  
2  
3  
4  
5  
6  
7  
8  
9  
[admin@MikroTik] >
```

Monitor

```
monitor  
( . /system script) do monitor
```

Get

```
print. print, get  
. , get  
. ,  
. ,
```

```
monitor do  
. do  
. do  
( get print,  
get. [tab] ).
```

```
monitor  
,
```

```
[admin@MikroTik] interface> monitor-traffic ether2 once do={:environment print}

received-packets-per-second: 0
received-bits-per-second: 0bps
sent-packets-per-second: 0
sent-bits-per-second: 0bps

Global Variables
i=1
Local Variables
sent-bits-per-second=0
received-packets-per-second=0
received-bits-per-second=0
sent-packets-per-second=0
[admin@MikroTik] interface>
```

'#',

;',

"().

,

;',

{ } "\$,

"

.

a bell (alarm), character code 7()
b backspace, character code 8()
f form feed, character code 12()
n newline, character code 10()
r carriage return, character code 13
t tabulation, character code 9()
v vertical tabulation, character code 11()
_ space, character code 32()

" ,) (, , .

: /system script

RouterOS

-
- ping , (netwatch tool)
-

last-started(time).

run-count!=0

owner(; : admin) -

**policy(: ftp | local | policy | read | reboot | ssh | telnet | test | web | write;
: reboot,read,write,policy,test) :**

ftp - ftp

local -

policy - ,

read -

reboot -

ssh - secure shell

<::;b>telnet - telnet

test - ping, traceroute

web - http

write -

run-count(; 0) -

(; : "") -

run() -

/user group

ssh,local,telnet,read,write,policy,test,web

```
[admin@MikroTik] system script> add name=log -test source={:log
... message="Hello World!" }

[admin@MikroTik] system script> print

0 name="log-test" source=":log message="Hello World!"" owner="admin"
policy=reboot,read,write,policy,test last -started=dec/06/1999 20:07:37
run-count=1

[admin@MikroTik] system script>
```


: /system script job

name(- ;) -

owner() -

source(;) -

```
[admin@MikroTik] system script> job print
# SCRIPT OWNER STARTED
0 DelayeD admin dec/27/2003 11:17:33

[admin@MikroTik] system script>
```

```
[admin@MikroTik] system script> job remove 0
[admin@MikroTik] system script> job print
```

```
[admin@MikroTik] system script>
```

```
: /system script edit
```

```
RouterOS
```

- **Delete** -
- **Ctrl+h, bakspase** -
- **Tab** -
- **Ctrl+b,LeftArrow** -
- **Ctrl+f, RightArrow** -
- **Ctrl+n, DownArrow** -
- **Ctrl+p, UpArrow** -
- **Ctrl+a, Home** -

- **Ctrl+e, End** -

- **Ctrl+y** -

- **Ctrl+k** -

- **Ctrl+u** - 8

- **Ctrl+o** -

- **Ctrl+x** -

edit() - **name** -

backspace, delete **Ctrl+k**

(Ctrl+y **)**,

VT102 **(**

"vt102", "linux", "xterm", "rxvt"
VT102).

backspace delete

"kuku".

"hello"

: system

: Level1

: system sheduler

:

:

interval(; 0)- ,
interval ,

name() -

run-count(;) - ,

start-date() -

start-time() -

run-count .

(),

move.


```

[admin@MikroTik] system script> add name=log-test source=:log message=test
[admin@MikroTik] system script> print

0 name="log-test" source=":log messgae=test" owner=admin run -count=0
[admin@MikroTik] system script> .. scheduler
[admin@MikroTik] system scheduler> add name=run -1h interval=1h
on-event=log-test
[admin@MikroTik] system scheduler> print

Flags: X - disabled

# NAME ON-EVENT START-DATE START-TIME INTERVAL RUN-COUNT
0 run-1h log-test mar/30/2004 06:11:35 1h 0
[admin@MikroTik] system scheduler>

```

```

64 Kb/s    5    "Cust0".    9    128 Kb/s.

```

```

[admin@MikroTik] queue simple> add name=Cust0 interface=ether1
... dst-address=192.168.0.0/24 limit-at=64000
[admin@MikroTik] queue simple> print

Flags: X - disabled, I - invalid

0 name="Cust0" target-address=0.0.0.0/0 dst-address=192.168.0.0/24

```

```
interface=ether1 limit-at=64000 queue=default priority=8 bounded=yes
```

```
[admin@MikroTik] queue simple> /system script
```

```
[admin@MikroTik] system script> add name=start_limit source={/queue simple set  
... Cust0 limit-at=64000}
```

```
[admin@MikroTik] system script> add name=stop_limit source={/queue simple set  
... Cust0 limit-at=128000}
```

```
[admin@MikroTik] system script> print
```

```
0 name="start_limit" source="/queue simple set Cust0 limit -at=64000"
```

```
owner=admin run-count=0
```

```
1 name="stop_limit" source="/queue simple set Cust0 limit -at=128000"
```

```
owner=admin run-count=0
```

```
[admin@MikroTik] system script> .. scheduler
```

```
[admin@MikroTik] system scheduler> add interval=24h name="set -64k"
```

```
... start-time=9:00:00 on-event=start_limit
```

```
[admin@MikroTik] system scheduler> add interval=24h name="set -128k"
```

```
... start-time=17:00:00 on-event=stop_limit
```

```
[admin@MikroTik] system scheduler> print
```

```
Flags: X - disabled
```

```
# NAME ON-EVENT START-DATE START-TIME INTERVAL RUN-COUNT
```

```
0 set-64k start... oct/30/2008 09:00:00 1d 0
```

```
1 set-128k stop_... oct/30/2008 17:00:00 1d 0
```

```
[admin@MikroTik] system scheduler>
```

e-mail.

```
[admin@MikroTik] system script> add name=e-backup source={/system backup
{... save name=email; /tool e-mail send to="root@host.com" subject=([/system
{... identity get name] . " Backup") file=email.backup}

[admin@MikroTik] system script> print

  0 name="e-backup" source="/system backup save name=ema... owner=admin<br /><br /> run-
count=0<br /><br /> <br /><br />[admin@MikroTik] system script> .. scheduler<br /><br
/>[admin@MikroTik] system scheduler> add interval=7d name="email -backup"

... on-event=e-backup

[admin@MikroTik] system scheduler> print

Flags: X - disabled

# NAME ON-EVENT START-DATE START-TIME INTERVAL RUN-COUNT

0 email-... e-backup oct/30/2008 15:19:28 7d 1

[admin@MikroTik] system scheduler>
```

FROM: e-mail, e-mail SMTP

```
[admin@MikroTik] tool e-mail> set server=159.148.147.198 from=SysAdmin@host.com

[admin@MikroTik] tool e-mail> print

server: 159.148.147.198

from: SysAdmin@host.com

[admin@MikroTik] tool e-mail>
```

'x'

```
[admin@MikroTik] system script> add name=enable -x source={/system scheduler
{... enable x}

[admin@MikroTik] system script> add name=disable -x source={/system scheduler
{... disable x}

[admin@MikroTik] system script> add name=log -x source={:log message=x}

[admin@MikroTik] system script> .. scheduler

[admin@MikroTik] system scheduler> add name=x -up start-time=00:00:00
... interval=24h on-event=enable-x

[admin@MikroTik] system scheduler> add name=x -down start-time=12:00:00
... interval=24h on-event=disable-x

[admin@MikroTik] system scheduler> add name=x start -time=00:00:00 interval=1h
... on-event=log-x

[admin@MikroTik] system scheduler> print

Flags: X - disabled

# NAME ON-EVENT START-DATE START-TIME INTERVAL RUN-COUNT
0 x-up enable-x oct/30/2008 00:00:00 1d 0
1 x-down disab... oct/30/2008 12:00:00 1d 0
2 x log-x oct/30/2008 00:00:00 1h 0

[admin@MikroTik] system scheduler>
```

: Level1

: /tool netwatch

: none

:

ICMP

IP

down-script() -

unknown up down

host(IP ; : 0.0.0.0) - IP

interval(; 1s) - ICMP

since(:) -

status(: up | down| unknown) -

- **up - ()**

- **down - ()**

- **unknown -**

/

timeout(; : **1s)** -
, (down)

up-script() -
unknown down up

gw_1 gw_2

:

```
[admin@MikroTik] system script> add name=gw_1 source={/ip route set
{... [/ip route find dst 0.0.0.0] gateway 10.0.0.1}
[admin@MikroTik] system script> add name=gw_2 source={/ip route set
{.. [/ip route find dst 0.0.0.0] gateway 10.0.0.217}
[admin@MikroTik] system script> /tool netwatch
[admin@MikroTik] tool netwatch> add host=10.0.0.217 interval=10s timeout=998ms
... up-script=gw_2 down-script=gw_1
[admin@MikroTik] tool netwatch> print
Flags: X - disabled
# HOST TIMEOUT INTERVAL STATUS
0 10.0.0.217 997ms 10s up
[admin@MikroTik] tool netwatch> print detail
Flags: X - disabled
0 host=10.0.0.217 timeout=997ms interval=10s since=feb/27/2003 14:01:03
status=up up-script=gw_2 down-script=gw_1
[admin@MikroTik] tool netwatch>
```

? "gw_2"
up

```
[admin@MikroTik] > /ip route set [/ip route find dst 0.0.0.0] gateway 10.0.0.217
```

```
/ip route find dst 0.0.0.0          dst-  
address          0.0.0.0.  
/ip route set  
10.0.0.217  
"gw_1"          down.
```

```
[admin@MikroTik] > /ip route set [/ip route find dst 0.0.0.0] gateway 10.0.0.1
```

```
10.0.0.217  
e-mail  
10.0.0.25
```

```
[admin@MikroTik] system script> add name=e-down source={/tool e-mail send  
{... from="rieks@mt.lv" server="159.148.147.198" body="Router down"  
{... subject="Router at second floor is down" to="rieks@latnet.lv"}  
[admin@MikroTik] system script> add name=e-up source={/tool e-mail send  
{... from="rieks@mt.lv" server="159.148.147.198" body="Router up"  
{.. subject="Router at second floor is up" to="rieks@latnet.lv"}  
[admin@MikroTik] system script>  
[admin@MikroTik] system script> /tool netwatch
```

```
[admin@MikroTik] system netwatch> add host=10.0.0.215 timeout=999ms
... interval=20s up-script=e-up down-script=e-down
[admin@MikroTik] tool netwatch> print detail
Flags: X - disabled
0 host=10.0.0.215 timeout=998ms interval=20s since=feb/2 7/2003 14:15:36
status=up up-script=e-up down-script=e-down
[admin@MikroTik] tool netwatch>
```

: **advanced-tools**

: Level1

: **/tool-traffic monitor**

C :

:

(),

C

interface() -

name() -

on-event() - . **/system script**

threshold(; :0) -

traffic(| ; :transmitted()) -

- **transmitted -**

- **received -**

trigger(| | ; :) -

- **above -** ,

- **always -** **above below**

- **below -** ,

15kbs ether1 ether2, 12kbs
ether1.

```
[admin@MikroTik] system script> add name=eth -up source={/interface enable ether2}
[admin@MikroTik] system script> add name=eth -down source={/interface disable
{... ether2}
[admin@MikroTik] system script> /tool traffic -monitor
```

```

[admin@MikroTik] tool traffic-monitor> add name=turn_on interface=ether1
... on-event=eth-up threshold=15000 trigger=above traffic=received

[admin@MikroTik] tool traffic-monitor> add name=turn_off interface=ether1
... on-event=eth-down threshold=12000 trigger=below traffic=received

[admin@MikroTik] tool traffic-monitor> print

Flags: X - disabled, I - invalid

# NAME INTERFACE TRAFFIC TRIGGER THRESHOLD ON -EVENT

0 turn_on ether1 received above 15000 eth -up

1 turn_off ether1 received below 12000 eth -down

[admin@MikroTik] tool traffic-monitor>

```

Sigwatch(`name` **)**

: advanced-tools

: Level1

: /tools sigwatch

:

:

Sigwatch

count(`name` **:** `item` **) -** `count`

log(`name` **|** `item` **;** `level` **no** **) -** `log` -of-sigwatch-item:

[`high` **|** `low` **]** `System-info` `sigwatch`

name(`name` **) -** `sigwatch`

on-condition(`on` **|** `off` **|** `change`; `level` **:** `on` **) -**

• **on** - high

• **off** - low

• - .
,

port() -

script() -

signal(dtr | rts | cts | dcd | ri | dsr; : **rts**) - ()

• **dtr** - (4)

• **rts** - (7)

• **cts** - (8)

• **dcd** - (1)

• **ri** - (9)

- dsr - (6)

state(;) -

/system script

sigwatch

serial1 cts .

```
[admin@10.179] tool sigwatch> pr
Flags: X - disabled
# NAME PORT SIGNAL ON-CONDITION LOG
0 test serial1 cts change no
[admin@MikroTik] tool sigwatch>
```

print detail interval=1s,
state
on,

off.

```
[admin@MikroTik] tool sigwatch> print detail
Flags: X - disabled
```

```
0 name="test" port=serial1 signal=cts on -condition=change log=no script=""  
count=1 state=on
```

```
[admin@MikroTik] tool sigwatch> print detail
```

```
Flags: X - disabled
```

```
0 name="test" port=serial1 signal=cts on -condition=change log=no script=""  
count=1 state=on
```

```
[admin@MikroTik] tool sigwatch> print detail
```

```
Flags: X - disabled
```

```
0 name="test" port=serial1 signal=cts on -condition=change log=no script=""  
count=2 state=off
```

```
[admin@MikroTik] tool sigwatch> print detail
```

```
Flags: X - disabled
```

```
0 name="test" port=serial1 signal=cts on -condition=change log=no script=""  
count=2 state=off
```

```
[admin@MikroTik] tool sigwatch>
```

port

.

```
[admin@MikroTik] port> print stats
```

```
0 name="serial0" line-state=dtr,rts
```

```
1 name="serial1" line-state=dtr,rts
[admin@MikroTik] port>
```

```
[admin@MikroTik] port> print stats
0 name="serial0" line-state=dtr,rts

1 name="serial1" line-state=dtr,rts,cts
[admin@MikroTik] port>
```

dtr,rts

cts

**condition
off**

on-

```
[admin@10.MikroTik] tool sigwatch ch> pr detail
Flags: X - disabled

0 name="cts_rest" port=serial1 signal=cts on -condition=off log=no
script=/system shutdown count=0 state=on
[admin@10.MikroTik] tool sigwatch>
```