MikroTik RouterOS™

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   .

... -   MNDP(MikroTik Neighbor Discovery Protocol)   CDP (Cisco
Discovery Protocol)   .

Connect -   IP(

.   **80**)

MAC   (   ),

.

Save - .

.

Remove -

Tools... - , ,
wbx
wbx .

- Secure Mode

  WinBox RouterOS
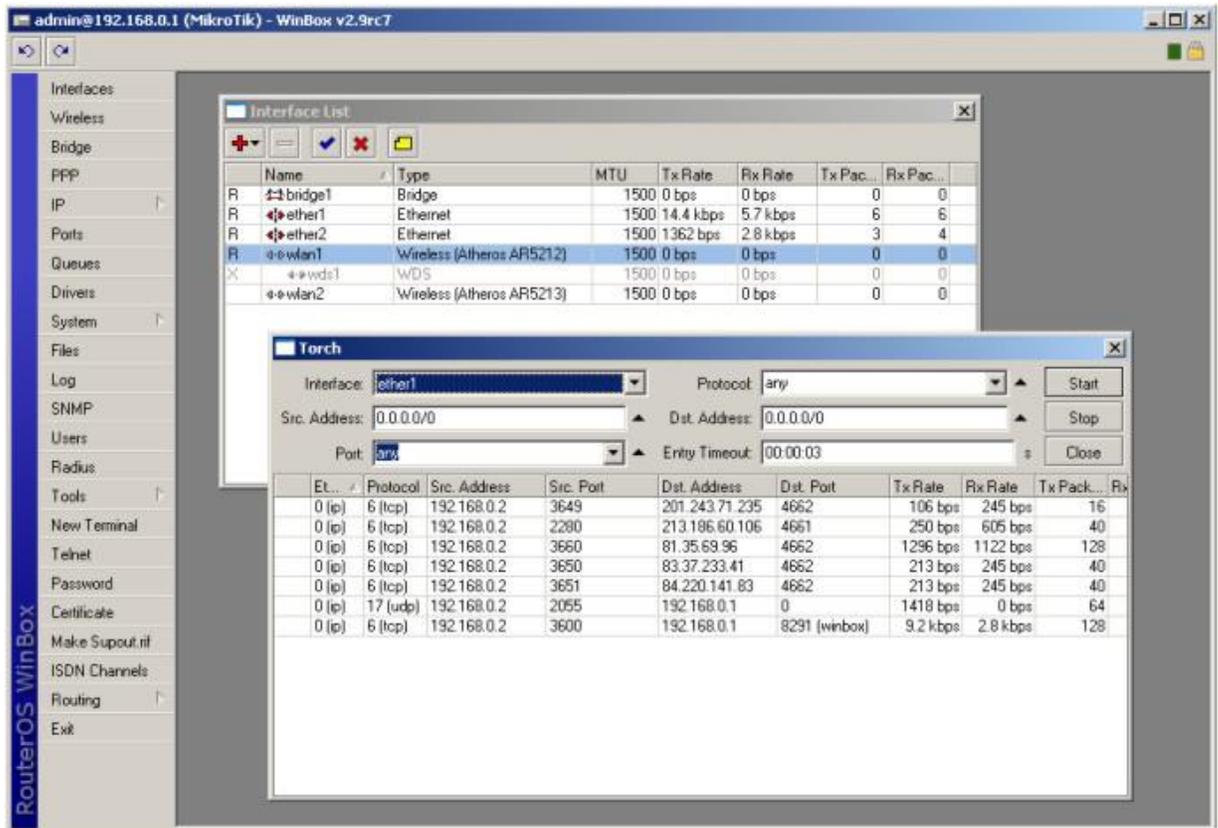 TLS(Transport Layer Security)
- Keep Password

  . **:**
  .

  Winbox

  WinBox TCP 8291.
  WinBox
  , .

(   ).   ,
.

                                             WinBox.

                      ,   .

- +   .

- -   .

-

-

- ![folder]C

- ![icon]

- ![undo]

-
-    WinBox

WinBox   Linux ?

WinBox   Router OS   Wine

WinBox ?

www   **/ip service print**.

WinBox.   **/ip service set www port=80 address=0.0.0.0/0**   .

WinBox   TCP   8291.   ,
.

FTP

: **system**

: Level1

: FTP(RFC 959)

:

File Transfer Protocol

: **/file**

MikroTik RouterOS   FTP   .
                        20   21   .

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] -   **contents**
            [content]

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                                            isp2
 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                                           isp1
 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                                            isp2
 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                                           isp1
 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   .   **print**

,

       add, **remove**   **move**(**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   .
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**
        .   find   ,
        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                                            isp2
 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                                         isp1
 4 A S 0.0.0.0/0          r 10.1.0.1          0           isp1
[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] -

,

(**100**

)   ,

.

( ), .

[Ctrl]+[X] ,

.

Firewall

- TCP
  135   :

```
/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)

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. Mikrotik RouterOS

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MikroTik RouterOS   .

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.

- NAT. input

  NAT.
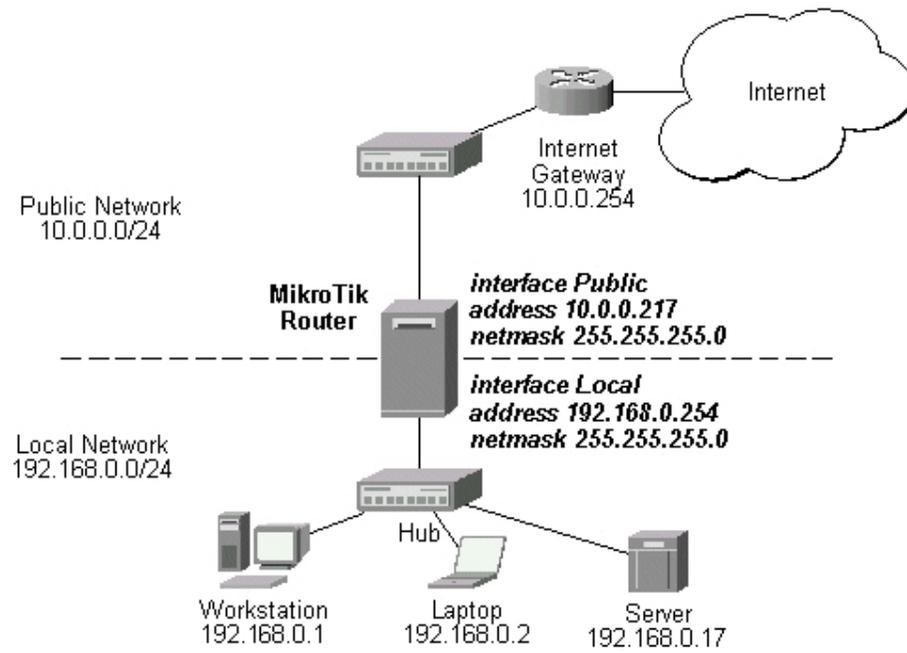
- (forward),
  NAT forward.

- output,
  NAT .

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 descovery

- **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 Service s Codepoint, DSCP   **RFC2474)**
ECN codepoints (Explicit Congestion Notification   **RFC3168),**
           IP   .   ,   **RouterOS**
           DiffServ   **ECN,**
           .

     RFC1349   :

- **normal -**   **(ToS=0)**

- **low-cost -**   **(ToS=2)**

- **max-reliability -**   **(ToS=4)**

- **max-troughput -**   **(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 -cmtp |
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**

<div style="background:green">

/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

</div>

                              4   **IP**   ，

<div style="background:green">

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

action=drop

</div>

                    : /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
```

-

-

-

-

IP .

input .

- .

.

.

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**
          ,   .

192.168.0.0/24.

forward.

forward

forward.   .

```
/ip firewall add name=customer

/ip firewall rule customer

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 protocol=tcp dst-address=192.168.0.17/32:80

  comment="Allow http connections to the server at 19 2.168.0.17"

add protocol=tcp dst-address=192.168.0.17/32:25

  comment="Allow SMTP connections to the server at 192.168.0.17"

add action=drop log=yes comment="Drop and log everything else"
```

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)

192.168.0.0/24

10.0.0.217,

.

192.168.0.0/24   **10.0.0.217**

.

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

destination NAT.

destination NAT

,

.

192.168.0.4

web   **80**   .

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
```

TCP ... :

135 ...

```
/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.

c

IP address:port   **forward**,

IP   ,   . : /ip firewall filter add

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

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

drop -   (ICMP   )

jump -   **jump-target**

log -

passthrough -

reject -   ICMP

return -

tarpit -   TCP   (SYN/ACK
                    TCP SYN   )

address-list(name) -   IP   ,
                                                        action=add-dst-address-liyst   **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(estabilished | invalid | new | related) -

estabilished -   ,

invalid -   .
                                        ICMP
                      .   .

new -   .

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

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**
                                        . : **1.1.1.1/24**   **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}) -

IP

. 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

no-timestamp -

record-route -

router-alert -   (alert)

strict-source-routing -

timestamp -

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

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

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**

Counter -   .
                                          nth

Packet -   .
            (   )   **0   Every**.
                              ,   **Every+1**
            ,   **0   Every**

out-interface (name) -   .

p2p (all-p2p | bit-torrent | blubster | direct-connect | edonkey | fasttrack | gnutella | soulseek |
warez | winmx) -   peer-to-peer(P2P)

packet-mark(text) -   mangle
                        .

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

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 -cmtp | 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 .
( ) 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**

: <u>IP</u>

:   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** -   (DSCP)
           new-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
  , ,
  (VLAN WMM-enabled)
- **strip-ipv4-options** - 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 (estabilished | 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** -   ,   -
                            (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 t echnique) 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 **/ip firewall layer7-**
protocol . :

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

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

- **burst** - -

log-prefix (text) -

                             action=mark-connection

new-dscp (integer: 0..63) -   DSCP
                            action=change-dscp

new-mss (integer) -   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**   .
                             nth
- **packet**   (   )   .
                       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 -cmtp | igmp | ipencap | ipip | ipsec -ah |
ipsec-esp | iso-tp4 | ospf | pup | rdp | rspf | st | tcp | udp | vmtp | 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   .   **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   IP
- **multicast** -   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

NAT

IP

.   NAT   NAT

natted   . NAT   (NAT   )

/   .

NAT:

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

. NAT   dstnat

IP   IP   .

NAT

NAT

.

NAT,   AH   IPsec. RouterOS

NAT   ,

.

dstnat   srcnat,   .

dstnat,   masquerade   srcnat

masquerade   srcnat   **to-address** IP

,   IP

.   **to-ports**,

(

web proxy).

dstnat (**action=nat**

action=redirect),   .

(   )

.   web   (web

)

web   .

dstnat   ,

web   IP   (IP

). Starting from HTTP/1.1

HTTP   web   ,

,   IP   .   (

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 adress/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 | auh | 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**.   ,
                  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 -cmtp | 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

- **WeightTreshold** -   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
                    192.168.0.0/24   10.5.8.109

masqueradin g,
'masquerading':

```
/ip firewall nat add chain=srcnat action=masquerade out-interface=Public
```

192.168.0.0/24
10.5.8.109   1024.

,   (DST-NAT).

DST-NAT

192.168.0.109

10.5.8.200,   .

IP   .   IP   :

```
/ip address add address=10.5.8.200/32 interface=Public
```

```
/ip firewall nat add chain=dstnat dst-address=10.5.8.200 action=dst-nat to-
addresses=192.168.0.109
```

```
/ip firewall nat add chain=srcnat src-address=192.168.0.109 action=src-nat
to-addresses=10.5.8.200
```

1:1

11.11.11.0/24   2.2.2.0/24,

action=netmap

```
/ip firewall nat add chain=dstnat dst-address=11.11.11.1-11.11.11.254
action=netmap to-addresses=2.2.2.1-2.2.2.254
```

```
/ip firewall nat add chain=srcnat src-address=2.2.2.1-2.2.2.254 action=netmap
to-addresses=11.11.11.1-11.11.11.254
```

: **system**

: **Level 1**

: IP

:

firewall address list   IP   .
filter, mangle, NAT   .

action=add-src-to-
address-list   **action=add-dst-to-address-list**   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 Menagment 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 Tuneling 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 Streem (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

<center>C</center>

<center>: **system**</center>
<center>: Level1</center>
<center>: **/ip socks**</center>
<center>: SOCKS version 4</center>
<center>:</center>

- Web Proxy
- NAT

SOCKS -   TCP
              ,   . SOCKS
                                    ,
          ,   WWW, FTP, TELET   .
      ,   SOKS   ,
                                                                                          ,

                                              .

                                                                                      SOCKS
        4.   SOCKS   /
                                          .
                                      ,
                                              .

<center>**SOCKS**</center>

                                  ,   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**

                                                    TCP   ,
         SOCKS   .

dst-address (read-only: IP address) - IP   (   )
RX (read-only: integer) -
src-address (read-only: IP address) - IP   (   )
TX (read-only: integer) -

TCP   :

```
[admin@MikroTik] ip socks connections> print
 # SRC-ADDRESS              DST-ADDRESS            TX        RX
 0 192.168.0.2:3242         159.148.147.196:80     4847      2880
 1 192.168.0.2:3243         159.148.147.196:80     3408      2127
 2 192.168.0.2:3246         159.148.95.16:80       10172     25207
 3 192.168.0.2:3248         194.8.18.26:80         474       1629
 4 192.168.0.2:3249         159.148.95.16:80       6477      18695
 5 192.168.0.2:3250         159.148.95.16:80       4137      27568
 6 192.168.0.2:3251         159.148.95.16:80       1712      14296
 7 192.168.0.2:3258         80.91.34.241:80        314       208
 8 192.168.0.2:3259         80.91.34.241:80        934       524
 9 192.168.0.2:3260         80.91.34.241:80        930       524
10 192.168.0.2:3261         80.91.34.241:80        312       158
11 192.168.0.2:3262         80.91.34.241:80        312       158
[admin@MikroTik] ip socks connections>
```

FTP   SOCKS

                              192.168.0.0/24   IP
10.1.0.104/24   IP **192.168.0.1/24**.   -   FTP
  IP   **10.5.8.8**.   FTP
                     192.168.0.2/24.

               ,   NAT(MASQUERADE)
            :

```
[admin@MikroTik] ip firewall nat> print
Flags: X - disabled, I - invalid, D - dynamic
 0   chain=srcnat src-address=192.168.0.0/24 action=masquerade
[admin@MikroTik] ip firewall nat>
```

FTP 10.5.8.8:

```
[admin@MikroTik] ip firewall filter> print
Flags: X - disabled, I - invalid, D - dynamic
 0   chain=forward src-address=192.168.0.0/24 dst-address=:21 action=drop
[admin@MikroTik] ip firewall filter>
```

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

```
[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   FTP   .
IP   **192.168.0.1** (/SOCK)   **1080.**

OSPF

C

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

Open Shortest Path First (   )   -
                              .

                                                                                    .
                                                                    . OSPF

              (   ).

                                          .

                        OSPF
(,   OSPF
            MTU).

            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
                    .

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

10e+8/   .
              :

ethernet   10

T1   64

64Kb/s   1562

              OSPF
type1   **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;   : 0.0.0.0) -   OSPF   .
area-id=0.0.0.0 -   .   OSPF
                                                                .
                                                            .   (   ).
                                                                                                    .
                                                                            .
                                          .

authetication(none | simple | md5;   : **none**) -
                                                                           OSPF

   - **none** -
   - **simple** -
   - **md5** -   md5

default-cost(integer;   : **1**) -
                                                                          .   .

name(name;   **""**) -   OSPF   .

stub(yes | no; умолчанию: **no**) - определяет является ли зона (локальной)

Указывается, что зона является тупиковой. Магистральная зона.

Не распространяется. CPU перегружается маршрутизации.

Зона может быть сконфигурирована как тупиковая.

Например, создадим новую OSPF зону с именем **local_10** и **area-id=0.0.0.15**
со следующими настройками:

```
[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                                none
 1  local_10          0.0.10.5        no   1                 none
[admin@WiFi] routing ospf area>
```

Подменю: **/routing ospf network**

Здесь определяются сети - интерфейсы, на которых работает.
Маршрутизатор рассылает сообщения (и.
слушает их). Сети OSPF объявляются,
(сеть) не активна.

Описание параметров C

area(name; умолчанию: **backbone**) - OSPF зона, к которой принадлежит эта сеть.

network(IP адрес; умолчанию: **20**) - сеть, на которой работает маршрутизатор.
networks которые пересекаются multiple зонами,
объявляются OSPF.

Для объявления одного интерфейса -
указывается адрес сети /32.

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 に ex,
と接続する :

```
[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 neigbor**

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

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

                                       :

1.   OSPF   ID=0.0.0.1,

Internet

main_gw 192.168.0.11

[OSPF_MAIN]   to_peer2 10.2.0.2

to_peer1 10.1.0.2

cost=1   to_main 10.2.0.1

[OSPF_peer_2]

cost=1

cost=1   to-peer1 10.3.0.2

to_main 10.1.0.1

[OSPF_peer_1]   backup 10.3.0.1
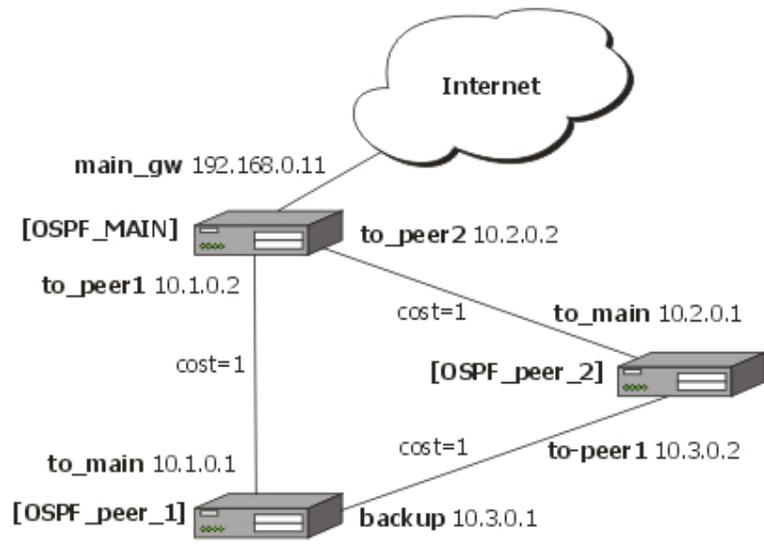
2.   OSPF   .
                    peer1   peer2   OSPF   .
main_gw   OSPF

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         1500
  1   R to_peer_1                             ether                        0
          0         1500
  2   R to_peer_2                             ether                        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
```

```
 0   R to_main                                      ether              0
        0          1500
 1   R to_peer_1                                    ether              0
        0          1500
```

IP   :

```
[admin@OSPF_peer_2] ip address> print
Flags: X - disabled, I - invalid, D - dynamic
  #   ADDRESS          NETWORK          BROADCAST          INTERFACE
  0    10.2.0.1/24               10.2.0.0          10.2.0.255
to_main
  1    10.3.0.2/24               10.3.0.0          10.3.0.255
to_peer_1
```

:

```
[admin@OSPF_peer_2] 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
```

:

```
[admin@OSPF_peer_2] routing ospf network> print
Flags: X - disabled, I - invalid
  #   NETWORK          AREA
  0    10.2.0.0/24          local_10
  1    10.3.0.0/24          local_10
```

,   ,   ,
,   :

```
[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
```

[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
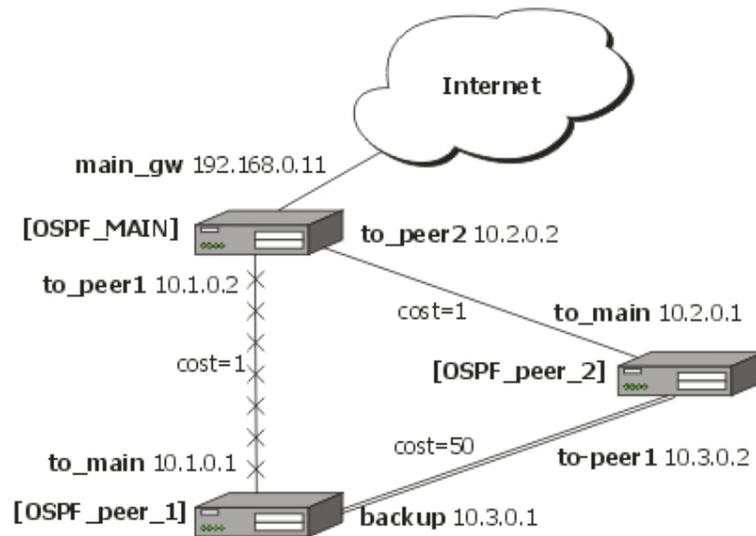 4 Io 10.1.0.0/24 110
 5 DC 10.1.0.0/24 r 0.0.0.0 0 to_main

```
[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

(,
. .).
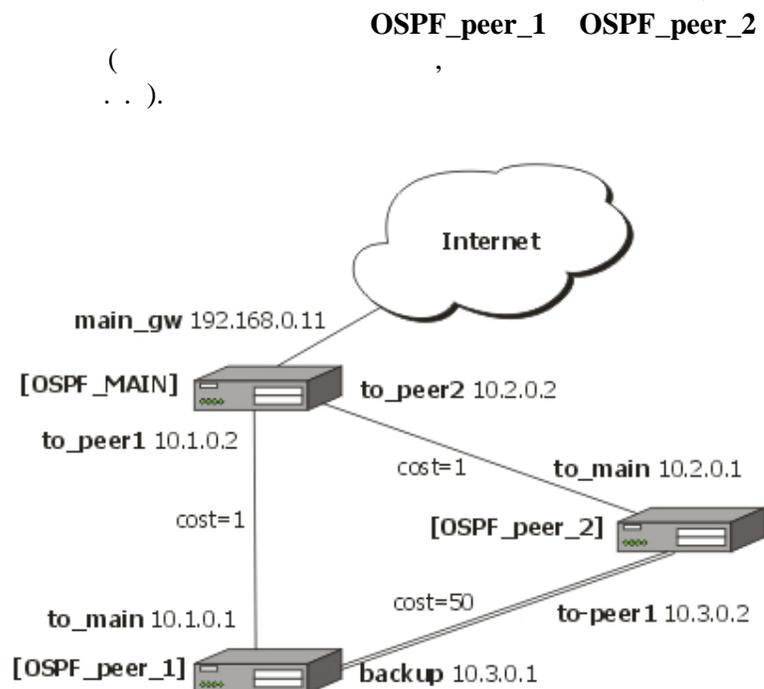
OSPF_peer_2   50.   ,
                      :

```
[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
```

                                                                multi
                  ,
           10.3.0.0/24   **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
```

40   (hello-
interval).   ,   ,
                                    .

.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]** -
                                    .

                              ,   **path_args**
      action_args.   **prefix**, **path**, **action**   **params**   .
                  :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** тасвирларни **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] >
```

.   "   "
.   .
'[' ']',
.
.   ,   : **find**, **/ping** -
"   ", **time** -
, **incr** **decr**   , **add** -
.

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>
```

.
.

[admin@MikroTik] interface> enable [find type=ether]

[admin@MikroTik] interface>

, ip

,

.

'('and')'.

.

- -   .   .

- -   .   ,   ,   ip   ip
        .

! -   **NOT**.   .

/ -   .   .
                    .

. -   .
                              .

^ -   **XOR**.   ip   .

~ -   .   ip   .

* -   .
                    .

& -   **AND**.   ip   .

&& -   **AND**.   .

+ -   .   ,   ip   .

< -   .   ,   ,
     ip   .   .

<< -   .   ,   ip
          .   ip   ,   ,   ip   .

<= -   .   ,
                    ip   .   .

>> -   .   ,   ip
          .   ip   ,   ,   ip   .

| -   **OR**.   ip   .
|| -   **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@ikroTik] 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>
```

.

,   ,   ,   , ip   ,
.   ,
.
:

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

64 ,
-9223372036854775808
9223372036854775807. ,
0x.
.
. .

true **false**. **yes** **true** **no**
false. *****.

.
.

. .
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 -   ,
                                          .   **do**   .
                          while   **if**.   **do**   .
                                              while
                                                                              do
                                                                        .
                                              if
                          else   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.

                              (**:local**

            :for   **:foreach** ,   **: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   **do**   .
                    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   -   ,
                    .   **do**   **else**.
                                    true   **do**   ,

else.   **else**   (   ).

```
[admin@MikroTik] > :if (yes) do={:put yes} else={:put no}

true

[admin@MikroTik] > :if ([/ping 10.0.0.1 count=1] = 0) do {:put "gw unreachable"}

10.0.0.1 pong timeout

1 packets transmitted, 0 packets received, 100% packet loss

gw unreachable

[admin@MikroTik] >
```

            log   .
                 , **message**
facility(   ),   .
                  facility   **System-info**

```
[admin@MikroTik] > :log facility=Firewall-Log message="Very Good <br /><br />... Thing
happened. We have received our first packet!"

[admin@MikroTik] >
```

put -   ,   .

resolve -   , DNS -   ip   .
                                    DNS   (**/ip dns**   )
              .

```
[admin@MikroTik] ip route> /ip dns set primary -dns=159.148.60.2
[admin@MikroTik] ip route> :put [:resolve www.example.com]
192.0.34.166
```

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

.

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

Get

print.   **print,**   **get**
.   .   **get**

                    ,

.
.

monitor   **do**
.
.

                            get   **print,**
            (   ).
                        [tab]
                    get.

                            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   .

-

-                                 ,   (netwatch tool)
    ping

-

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>
```

.2

: **/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
        .

                                                                                                  .

                                                                            "hello"
"kuku".

: **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>
```

"Cust0".   9
          64 Kb/s   5   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>
```

e-mail,   e-mail   SMTP
FROM: .

```
[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>
```

: advanced-tools

: 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 -**

triger(| | ;   :   ) -

- **above -**   ,

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

- **below -**   ,

                                                                ether2,
15kbs   ether1   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(   )

       : **advanced-tools**

      : Level1

      : **/tools sigwatch**

        :

        :

Sigwatch

count(:   ) -   .

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

[high | low]   System-info   sigwatch

name(   ) -   sigwatch

on-condition(on | off | change;   : **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**

                                                                              on-
condition
off

```
[admin@10.MikroTik] tool sigwatch> 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>
```

                               :
                                  .
             .   .
       .