

Talk about API Mikrotik: basis of syntax, libraries and developed software





Introduction

What's presentation
about?

Talk about API Mikrotik

- how get started
- basis of syntax
- libraries
- developed software

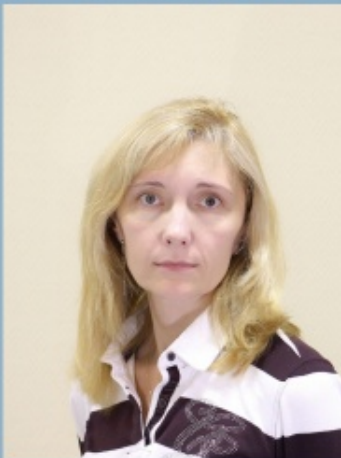
About Me



- IT experience since 2005
- Master degree, MBA-IT Management in Mirbis Moscow Business School
- Certifications: Mikrotik MTCNA, MTCTCE, MTCRE, MTCIPv6E, Microsoft MCSA,
- Developer experience: Object Oriented Programming (OOP), Delphi, PHP (Yii-framework)
- Positions: Senior Developer MUPSSOFT, freelancer, management partner.

About Us

We are a software development company that provides cutting edge engineering solutions, helping companies and enterprise clients untangle complex issues that always emerge during their management of a large number of devices MikroTik RouterOS journey.



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Talk about API Mikrotik: basis of syntax, libraries and developed software

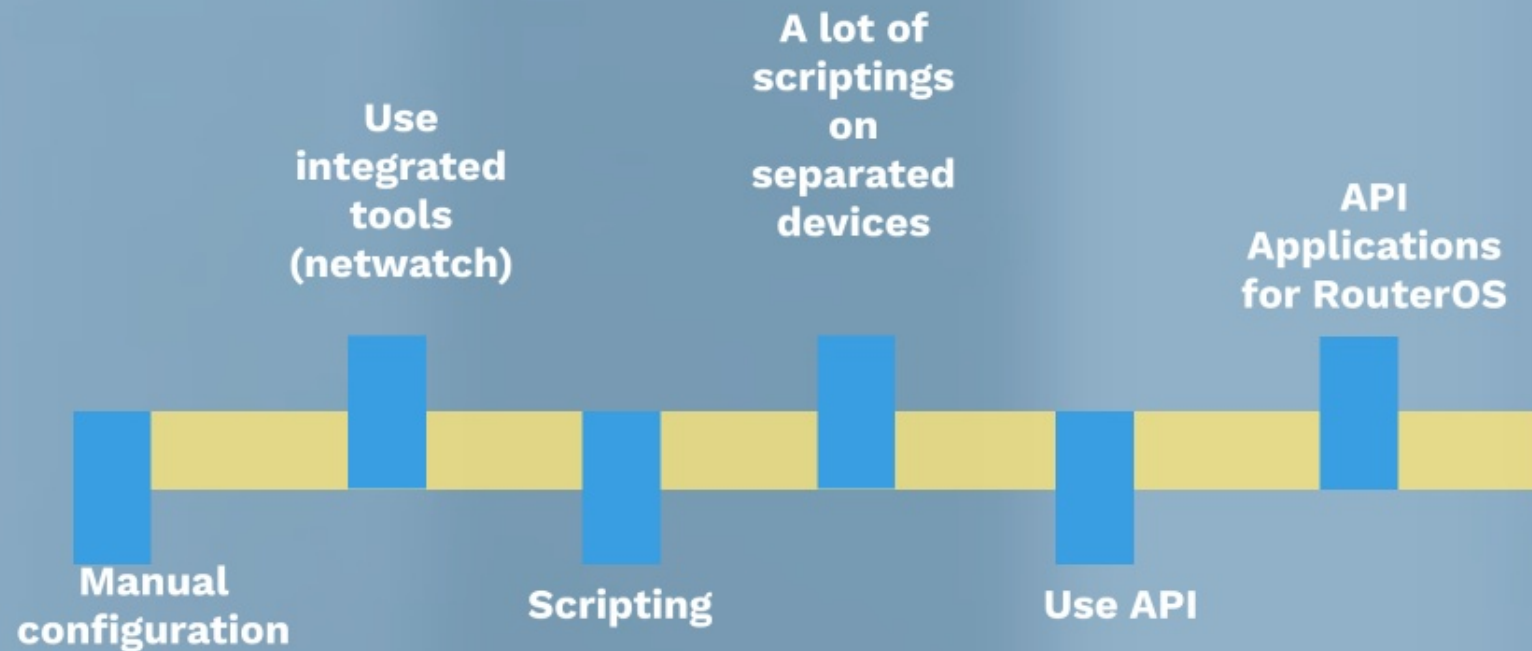




Start with Mikrotik API

the basis of syntax libraries

Why we need use Mikrotik API?



Benefits: API vs scripting

**Developed and apply on
separate host/services -
non-routerOS**

**Apply on huge count
Routers**

**Receive feedback from
RouterOS**

Permanent syntax

**Fast using start on one or
few devices**

**Ready Templates - should be
checked**

Weakness: API vs scripting

**intermediate or higher development
experiences preferable**

**Search libraries or custom
development**

**syntax may be changed
from terminal command**

**No feedback from
RouterOS**

**May be regular modification
syntax after RouterOS update**

**Scripting should be
modified on all RouterOS**

Mikrotik API get started

Application Programmable Interface (API) allows users to create custom software solutions to communicate with RouterOS to gather information, adjust configuration and manage router.

By default API uses port #8728 and service is enabled.

Corresponding service name is api.

<https://wiki.mikrotik.com/wiki/Manual:API>

Mikrotik API: communication

Communication with router is done by sending sentences to the router and receiving one or more sentences in return.

Sentence is sequence of words terminated by zero length word.

Word is part of sentence encoded in certain way - encoded length and data.

Communication happen by sending sentences to the router and receiving replies to sent sentences.

Each sentence sent to router using API should contain command as a first word followed by words in no particular order, end of sentence is marked by zero length word.

When router receives full sentence (command word, no or more attribute words and zero length word) it is evaluated and executed, then reply is formed and returned.

Mikrotik API: API words

Words are part of sentence. Each word has to be encoded in certain way - length of the word followed by word content. Length of the word should be given as count of bytes that are going to be sent.

Length of the word is encoded as follows:

Value of length	# of bytes	Encoding
$0 \leq \text{len} \leq 0x7F$	1	len, lowest byte
$0x80 \leq \text{len} \leq 0x3FFF$	2	len 0x8000, two lower bytes
$0x4000 \leq \text{len} \leq 0x1FFFFFF$	3	len 0xC00000, three lower bytes
$0x200000 \leq \text{len} \leq 0xFFFFFFFF$	4	len 0xE0000000
$\text{len} \geq 0x10000000$	5	0xF0 and len as four bytes

- Each word is encoded as length, followed by that many bytes of content;
- Words are grouped into sentences. End of sentence is terminated by zero length word;
- Scheme allows encoding of length up to **0x7FFFFFFF**, only four byte length is supported;
- Bytes of **len** are sent most significant first (network order);
- If first byte of word is **>= 0xF8**, then it is a reserved control byte. After receiving unknown control byte API client cannot proceed, because it cannot know how to interpret following bytes;
- Currently control bytes are not used;

Mikrotik API: Command word

First word in sentence has to be command followed by attribute words and zero length word or terminating word.

Name of command word should begin with '/'.

Names of commands closely follow CLI, with spaces replaced with '/'.

/login

/user/active/print

/interface/vlan/remove

/system/reboot

```
[admin@MikroTik] > user active print  
Flag: # - radius, M - by-radius
```

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

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



Mikrotik API: Attribute word

Each command word have its own list of attribute words depending on content.

```
=address=10.0.0.1
```

```
=name=iu=c3Eeg
```

```
=disable-running-check=yes
```

API Attribute word

Currently the only such API attribute is **tag**.

Mikrotik API: Query word

Sentences can have additional query parameters that restrict their scope.

Show interfaces ether
and vlan

```
/interface/print  
?type=ether  
?type=vlan  
?# !
```

Show routes with
comments

```
/ip/route/print  
?>comment=
```

Query	Description
?name	pushes 'true' if item has value of property <i>name</i> , 'false' if it does not.
?-name	pushes 'true' if item does not have value of property <i>name</i> , 'false' otherwise.
?name=x ?#name=x	pushes 'true' if property <i>name</i> has value equal to <i>x</i> , 'false' otherwise.
?<name=x	pushes 'true' if property <i>name</i> has value less than <i>x</i> , 'false' otherwise.
?>name=x	pushes 'true' if property <i>name</i> has value greater than <i>x</i> , 'false' otherwise.
?#operations	applies operations to the values in the stack. • operation string is evaluated left to right. • sequence of decimal digits followed by any other character or end of word is interpreted as a stack index. top value has index 0. • index that is followed by a character pushes copy of value at that index. • index that is followed by the end of word replaces all values with the value at that index. • ! character replaces top value with the opposite. • & pops two values and pushes result of logical 'and' operation. • pops two values and pushes result of logical 'or' operation. • . after an index does nothing. • . after another character pushes copy of top value.

Mikrotik API: Reply word

It is sent only by the router. It is only sent in response to full sentence send by the client.

First word of reply begins with '!'

Each sentence sent generates at least one reply (if connection does not get terminated)

Last reply for every sentence is reply that has first word **!done**

Errors and exceptional conditions begin with **!trap**

Data replies begin with **!re**

If API connection is closed, RouterOS sends **!fatal** with reason as reply and then closes the connection

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Libraries

which one should we use?
logins methods

Mikrotik API Libraries

API implementations in different languages, provided by different sources.

in the Wiki

- in PHP
- in Delphi #1
- in Delphi #2
- Swift
- in C #1
- in C #2
- in C using winsock
- API in C++
- in C#
- in Flash Actionscript 3
- in Ruby on rails
- in VB .NET
- in java see java client on github from Gideon LeGrange
- in NodeJS
- Python3
- in RUST GPL v3
- in GO by andredossantos

on the MikroTik Forum

- in Perl [by Hugh](#)
- in Delphi [by Rodolfo](#)
- in Delphi #2 [by Chupaka](#)
- in NodeJS [by Trakkasure](#)
- in VB [by luche512](#)
- on PHP for sparks framework [by vthinkteam](#)
- for Windows PowerShell [by navidasi](#)

External sources

- in .NET (C#) high-level api solution [forum thread](#) [additional info](#) [by danikf](#)
- in PHP [by boen_robot](#)
- in C [by Håkon Nessjæen](#)
- in Java [by Gideon LeGrange](#)
- in Erlang [by Valery Comtiñon](#)
- in GO [by André Luiz dos Santos](#)
- in Python3 [by Arturs Laizans](#)

Mikrotik API Python

https://wiki.mikrotik.com/wiki/Manual:API_Python3

```
class ApiRos:
```

```
    "Routeros api"
```

```
    def __init__(self, sk):
```

```
        def login(self, username,  
pwd):
```

```
        def talk(self, words):
```

```
        def writeSentence(self,  
words):
```

```
        def readSentence(self):
```

```
        def writeWord(self, w):
```

```
    def readWord(self):
```

```
    def writeLen(self, l):
```

```
    def readLen(self):
```

```
    def writeStr(self, str):
```

```
    def writeByte(self, str):
```

```
    def readStr(self, length):
```

```
    def open_socket(dst, port,  
secure=False):
```

```
    def main():
```

API Login Methods

v6.43 and preview versions

/login



!done
=ret=ebddd18303a54111e2dea05a92ab46b4

/login

=name=admin

=response=001ea726ed53ae38520c8334f82d44c9f2



!done

this login method is deprecated and no longer supported in versions above 6.45.1.

API Login Methods

v6.43 and above versions

/login

=name=admin

=password=



Password is sent in plain text.

Mikrotik API Python

Login method

https://wiki.mikrotik.com/wiki/Manual:API_Python3

```
class ApiRos:
    "Routeros api"
    def __init__(self, sk):
        self.sk = sk
        self.currenttag = 0

    def login(self, username, pwd):
        for repl, attrs in self.talk(["/login", "=name=" + username,
                                     "=password=" + pwd]):
            if repl == '!trap':
                return False
            elif '=ret' in attrs.keys():
                #for repl, attrs in self.talk(["/login"]):
                chal = binascii.unhexlify((attrs['=ret']).encode(sys.stdout.encoding))
                md = hashlib.md5()
                md.update(b'\x00')
                md.update(pwd.encode(sys.stdout.encoding))
                md.update(chal)
                for repl2, attrs2 in self.talk(["/login", "=name=" + username,
                                                "=response=00" + binascii.hexlify(md.digest()).decode(sys.stdout.encoding) ]):
                    if repl2 == '!trap':
                        return False
        return True
```


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What else for develop own application?

Place where we keep or collect our data

Text files

SQLite (used in Dude application)

Databases

MS SQL

MySQL

PostgreSQL

FireBird

Oracle

Databases

Consider continuous growth of data (tasks with collect logging information)
Exists of libraries of interaction with a programming language
Transaction management (read, write)
Needs for the network and/or the multiple appeal to a database

Stream Data

data stream is a sequence of digitally encoded coherent signals (packets of data or data packets) used to transmit or receive information that is in the process of being transmitted.

Tasks

Data flow
logging

Variables

Tstream (Delphi)
Iostream (C++)

Threads

A thread of execution is the smallest sequence of programmed instructions that can be managed independently

Tasks

Execution independent
tasks for different
RouterOS

logging

Examples

Backup tasks
Change
configurations
Traffic Accounting

Example thread

```
TOneMoreThread=class(tthread)
  private

  protected
  procedure execute; override;

end;
```

```
procedure TOneMoreThread.execute;
var Code:LongInt;
begin
  inherited;

  //work code with RouterOS
  //at separate thread
end;
```

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Results: our developed software

Mupsbox - software to manage a group of routers MikroTik ROS. Ideal for Mikrotik users serving any number of routers.



Mupsbox v1.1.51 by MupsSoft

Settings Windows Help

Devices
Configurator
Backup
Traffic
Syslog
GeoIPFI
GeoTrack
QoS
NetFlow
Customer
HotSpot

Device List

Device on group Groups

Use group filtering Select groups

Use timer 5 min

	Hostname	Board name	Model	IP Address	Success connection	Fail connection	current version	new version	current firmware	new firmware
1	MTI-CAP-C1	cAP Lite	RouterBOARD cAP Li-2nd	172.28.88.14	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
2	MTI-CAP-C2	cAP Lite	RouterBOARD cAP Li-2nd	172.28.88.12	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
3	MTI-CAP-C3	cAP Lite	RouterBOARD cAP Li-2nd	172.28.88.15	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
4	MTI-CAP-Office	RB1132UG-2HnD	1132UG-2HnD	172.28.88.11	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
5	MTI-CAP-QTraining	RB1132UG-2HnD	1132UG-2HnD	172.28.88.16	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
6	MTI-CAP-HAW	v86		172.28.88.2	19.06.2019 14:02:33		6.44.3 (stable)		6.44.3	
7	MTI-COR-1036-0n	CCR1036-8G-2S+	CCR1036-8G-2S+	172.28.1.8	19.06.2019 14:02:35		6.43.16 (long-term)		6.43.16	
8	MTI-Core-MTI-Group	CCR1009-8G-1S	CCR1009-8G-1S	172.28.1.1	19.06.2019 14:02:35		6.43.16 (long-term)		6.43.16	
9	MTI-QTraining-Router	RB3001UAGS	RouterBOARD 3001UAGS	10.8.8.6	19.06.2019 14:02:34		6.44.3 (stable)		6.44.3	
10	MTI-SW-QTraining	CRS226-24G-2S+	CRS226-24G-2S+	10.8.8.14	19.06.2019 14:02:37		6.44.3 (stable)		6.44.3	
11	MTI-SW-e1	NEX	RouterBOARD 750G-13	172.28.1.4	19.06.2019 14:02:35		6.44.2 (stable)	6.44.3	6.44.2	
12	MTI-SW-e2	RB950-2n	951-2n	172.28.1.5	19.06.2019 14:02:37		6.44.3 (stable)		6.44.3	
13	MTI-SW-e3	hAP ac lite	RouterBOARD 952U-5ac2nd	172.28.1.6	19.06.2019 14:02:35		6.44.3 (stable)		6.44.3	
14	MTI-SW-e4	RB950-2n	951-2n	172.28.1.7	19.06.2019 14:02:37		6.44.3 (stable)		6.44.3	
15	MTI-SW1	CRS226-24G-4S+	CRS226-24G-4S+	172.28.1.2	19.06.2019 14:02:36		6.43.12 (stable)	6.44.3	6.43.12	
16	MTI-SW2	CRS226-24G-2S+	CRS226-24G-2S+	172.28.1.3	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
17	MTI-TheDude	v86		172.31.5.5	19.06.2019 14:02:34		6.43.12 (stable)	6.44.3	6.44.3	
18	SOS-Care-COR1036	CCR1036-12G-4S	CCR1036-12G-4S	192.168.20.1	19.06.2019 14:02:35		6.43.14 (long-term)	6.43.16	6.43.14	
19	SOS-CRS226-205	CRS226-4C-205-4S+	CRS226-4C-205-4S+	10.10.10.121	19.06.2019 14:02:35		6.43.2 (stable)	6.44.3	6.43.2	
20	SOS-FALIBRO	NEX lite	RouterBOARD 750-12	192.168.4.1	19.06.2019 14:02:35		6.43.14 (long-term)	6.43.16	6.43.14	
21	SOS-EndUserV	v86		192.168.20.111	19.06.2019 14:02:35		6.43.12 (stable)	6.44.3	6.44.3	
22	SOS-CRS226-24G-Cafe	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.136	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
23	SOS-WIFI-Engineers	wAP ac	RouterBOARD wAP G-ShacT2	172.16.88.107	19.06.2019 14:02:35		6.44.2 (stable)	6.44.3	6.44.2	
24	SOS-WIFI_3F_P	wAP ac	RouterBOARD wAP G-ShacT2	172.16.88.109	19.06.2019 14:02:35		6.43.14 (long-term)	6.43.16	6.43.14	
25	SOS-SW_3Floor_Corp	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.201	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
26	SOS-SW_3Floor_InfP	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.202	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
27	SOS-SW_3Floor_InfSec	CRS226-24G-4S+	CRS226-24G-4S+	10.10.10.208	19.06.2019 14:02:35		6.43.8 (stable)	6.44.3	6.43.8	
28	SOS-SW_3Floor_Corp2	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.203	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
29	SOS-SW_3Floor_Corp3	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.204	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
30	SOS-SW_3Floor_Corp4	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.205	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
31	SOS-SW_3Floor_InfP2	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.206	19.06.2019 14:02:35		6.43.4 (stable)	6.44.3	6.43.4	
32	SOS-SW_3Floor_InfP3	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.207	19.06.2019 14:02:37		6.43.4 (stable)	6.44.3	6.43.4	
33	SOS-WIFI_Logistik	cAP	RouterBOARD cAP 2nd	172.16.88.108	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
34	SOS-WIFI_Marketing	cAP	RouterBOARD cAP 2nd	172.16.88.104	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
35	SOS-WIFI_Zakaz1	cAP	RouterBOARD cAP 2nd	172.16.88.105	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
36	SOS-WIFI_Zakaz2	wAP ac	RouterBOARD wAP G-ShacT2	172.16.88.106	19.06.2019 14:02:37		6.44.2 (stable)	6.44.3	6.44.2	
37	SOS-IT-CRS226-24G	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.138	19.06.2019 14:02:37		6.43.2 (stable)	6.44.3	6.43.2	
38	SOS-Bilder-326-24G	CRS226-24G-2S+	CRS226-24G-2S+	10.10.10.129	19.06.2019 14:02:37		6.43.2 (stable)	6.44.3	6.43.2	

Items - 38

You have 8 failed connected devices!

Results: our developed software

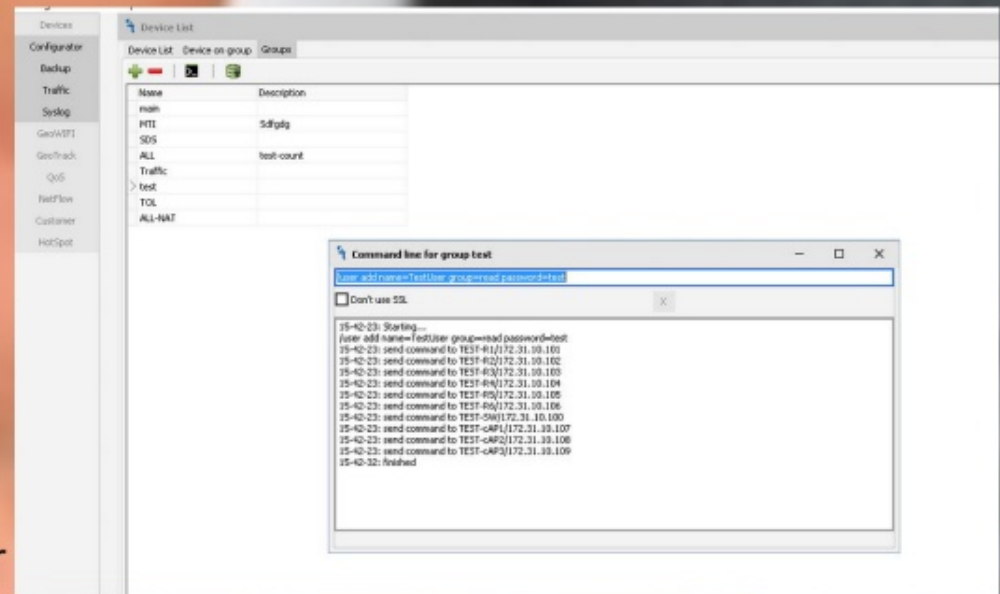


Devices

The device function works simultaneously with the Mikrotik device group.

The administrator can regularly check the devices for availability, the relevance of the operating system version and, if necessary, update the ROS and FW via the Internet using the Mikrotik services.

Simultaneously send commands to all devices or specific groups of devices. Filter devices by any attribute (name or part of it, ip address) to view and create reports.

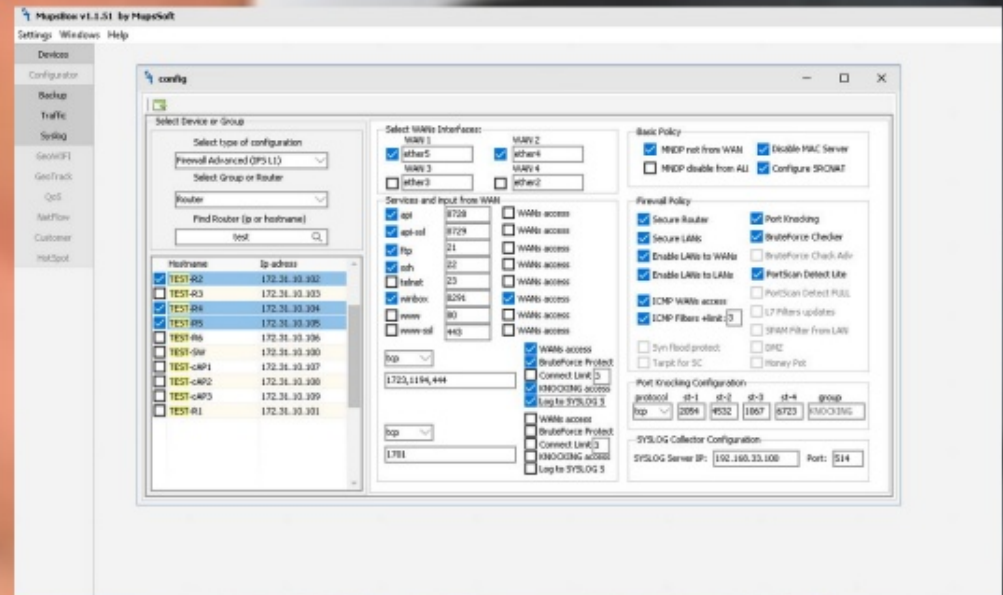


Results: our developed software



Configurator

The configurator allows you to centrally configure all your routers or devices that are grouped into special groups. It is possible to load ready-made firewall configurations onto devices. Both basic and advanced firewall configurations are available. Ready configs are made by skilled experts in the field of safety. With the MupsBox configurator, you can be confident that your router and private networks are secure. It is possible to easily configure QoS functions, port forwarding, configure tunnels between routers.

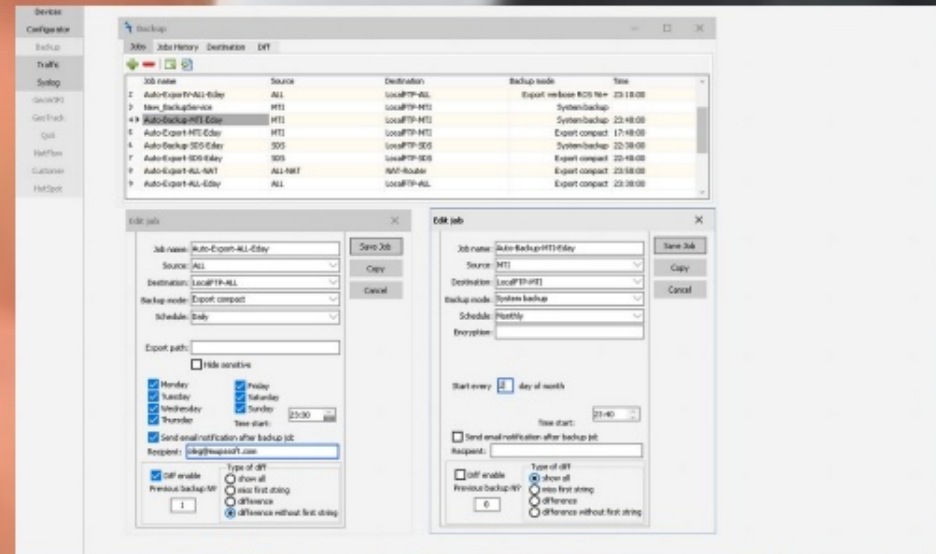


Results: our developed software



Backup configuration

Regular saving of router settings is the most important task of any system administrator. With the Mupsbox program, you can simultaneously build backups from all of your routers, as well as collected in specific groups. You can save the settings in whole or in part (backup file, export). Any modes are available: manual mode, automatic on schedule (time and date). Backups with Mupsbox is simple, reliable and without SCRIPTS!



Results: our developed software



Traffic counter

Provides information about traffic flow in your IP Networks. You can easily see which branch office most consumes Internet traffic, which user in the local network is the most active consumer of Internet traffic, or which resource is the most popular in terms of traffic consumption. Based on the collected data, it is possible to build reports for analysis.

1.1.51 BytMapSoft
File Help

Traffic

Jobs Traffic Snapshots Report

Search [] Search [] AVE [] [172.31.10.] [11.06.2019] [15.06.2019] [Dates]

Name	Src address	Dst address	Device	Src address	Dst address	Gbytes
☐ MTI-COR-1000-In	☒ 172.31.17.218	☒ 172.31.10.940	MTI-COR-PTI-Group	172.31.3.2	172.31.30.111	2,364.42
☒ MTI-COR-PTI-Group	☒ 172.22.5.20	☒ 172.31.10.111	MTI-COR-PTI-Group	172.31.8.6	172.31.30.113	2,139.7
☐ SCS-MALLMO	☒ 172.31.17.222	☒ 172.31.10.186	MTI-COR-PTI-Group	172.31.5.5	172.31.30.113	1,400.62
☐ SCS-COR-CCR006	☒ 105.120.180.220	☒ 172.31.10.132	MTI-COR-PTI-Group	172.31.3.2	172.31.30.111	1,182.47
☐ TOL-IPMTI	☒ 86.196.177.300	☒ 172.31.10.130	MTI-COR-PTI-Group	172.31.5.5	172.31.30.114	8,032.73
☐ TOL-HomeCare	☒ 106.92.104.190	☒ 172.31.10.162	MTI-COR-PTI-Group	86.82.61.80	172.31.30.111	8,791.93
	☒ 1.1.1.1	☒ 172.31.10.394	MTI-COR-PTI-Group	83.8.8.6	172.31.30.111	8,751.84
	☒ 30.172.192.303	☒ 172.31.10.184	MTI-COR-PTI-Group	30.9.90.102	172.31.30.111	8,901.11
	☒ 176.102.29.135	☒ 172.31.10.181	MTI-COR-PTI-Group	159.203.177.40	172.31.30.112	8,215.90
	☒ 54.209.125.233	☒ 172.31.10.185	MTI-COR-PTI-Group	35.73.232.191	172.31.30.114	8,215.20
	☒ 99.190.70.2	☒ 172.31.10.180	MTI-COR-PTI-Group	172.31.5.50	172.31.30.111	8,199.86
	☒ 146.206.78.25	☒ 172.31.10.180	MTI-COR-PTI-Group	30.9.9.5	172.31.30.111	8,351.23
	☒ 105.5.137.179	☒ 172.31.10.189	MTI-COR-PTI-Group	16.72.229.71	172.31.30.114	8,149.76
	☒ 105.89.12.132	☒ 172.31.10.187	MTI-COR-PTI-Group	172.31.3.2	172.31.30.114	0,126.1
	☒ 172.31.17.219	☒ 172.31.10.180	MTI-COR-PTI-Group	172.31.8.24	172.31.30.116	8,111.89
	☒ 8.8.8.8	☒ 172.31.10.113	MTI-COR-PTI-Group	93.95.99.58	172.31.30.114	8,095.61
	☒ 82.145.213.46	☒ 172.31.10.135	MTI-COR-PTI-Group	35.72.186.121	172.31.30.114	8,089.66
	☒ 213.186.249.82	☒ 172.31.10.349	MTI-COR-PTI-Group	213.129.135.11	172.31.30.111	0,061.2
	☒ 172.22.5.25	☒ 172.31.10.246	MTI-COR-PTI-Group	172.31.8.11	172.31.30.102	8,088.81
	☒ 43.77.226.194	☒ 172.31.10.383	MTI-COR-PTI-Group	23.59.190.153	172.31.30.114	8,045.79
			MTI-COR-PTI-Group	172.31.8.92	172.31.30.108	8,042.25

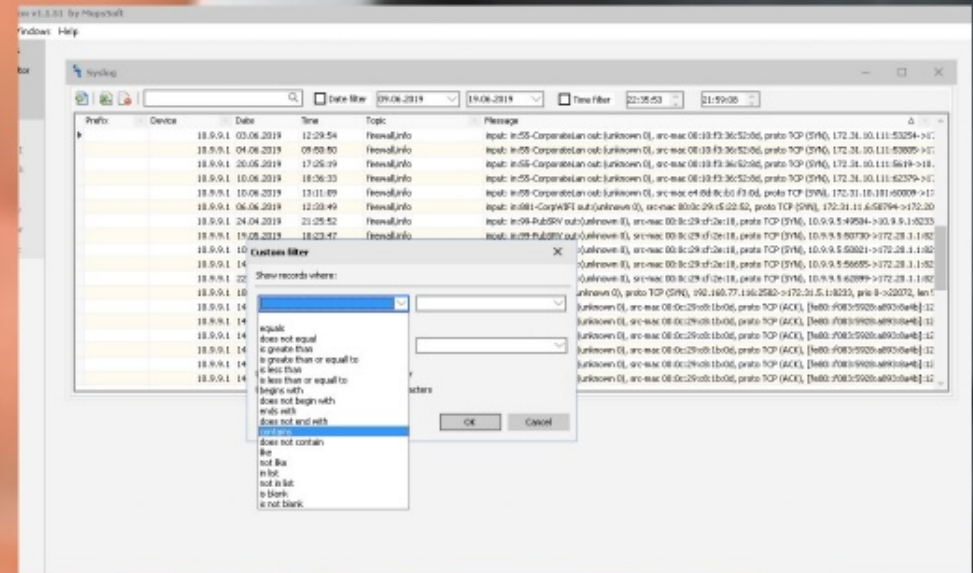
Delect all Select All Delect all Select All Delect all Select All GO Total: 12,801.91 Gbytes

Results: our developed software



Syslog Server

Provides the ability to capture important events (collect logs). Logging is the most important task of the system administrator. Analysis of reports will help to respond to events in a timely manner and take the necessary measures. Greatly simplifies the work detailed search and convenient reports.



Talk about API Mikrotik: basis of syntax, libraries and developed software



Contact Info

How can people find you?



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