

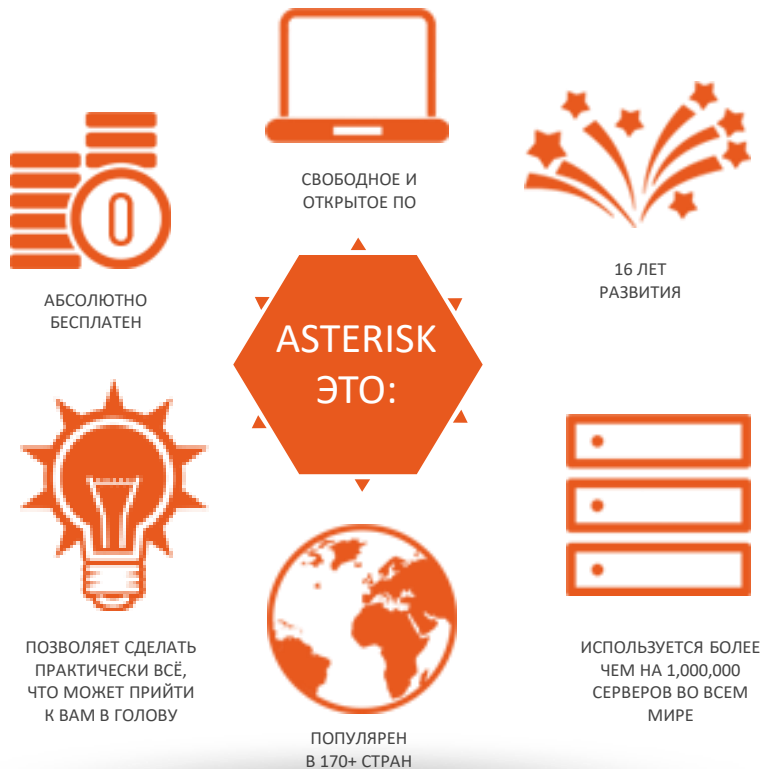
Сергей Грушко
«Вокс Линк»
sg@voxlink.ru



**МikroTik в сетях
IP-телефонии Asterisk**

ЧТО ТАКОЕ **ASTERISK**

Asterisk – это как Mikrotik, но только в IP-телефонии



О НАС



ПОЧЕМУ MIKROTIK НЕЗАМЕНИМ В VOIP?



IP-телефония и качество её работы зависит от сети передачи данных.



Хорошую, управляемую и масштабируемую сеть можно и нужно строить на Mikrotik

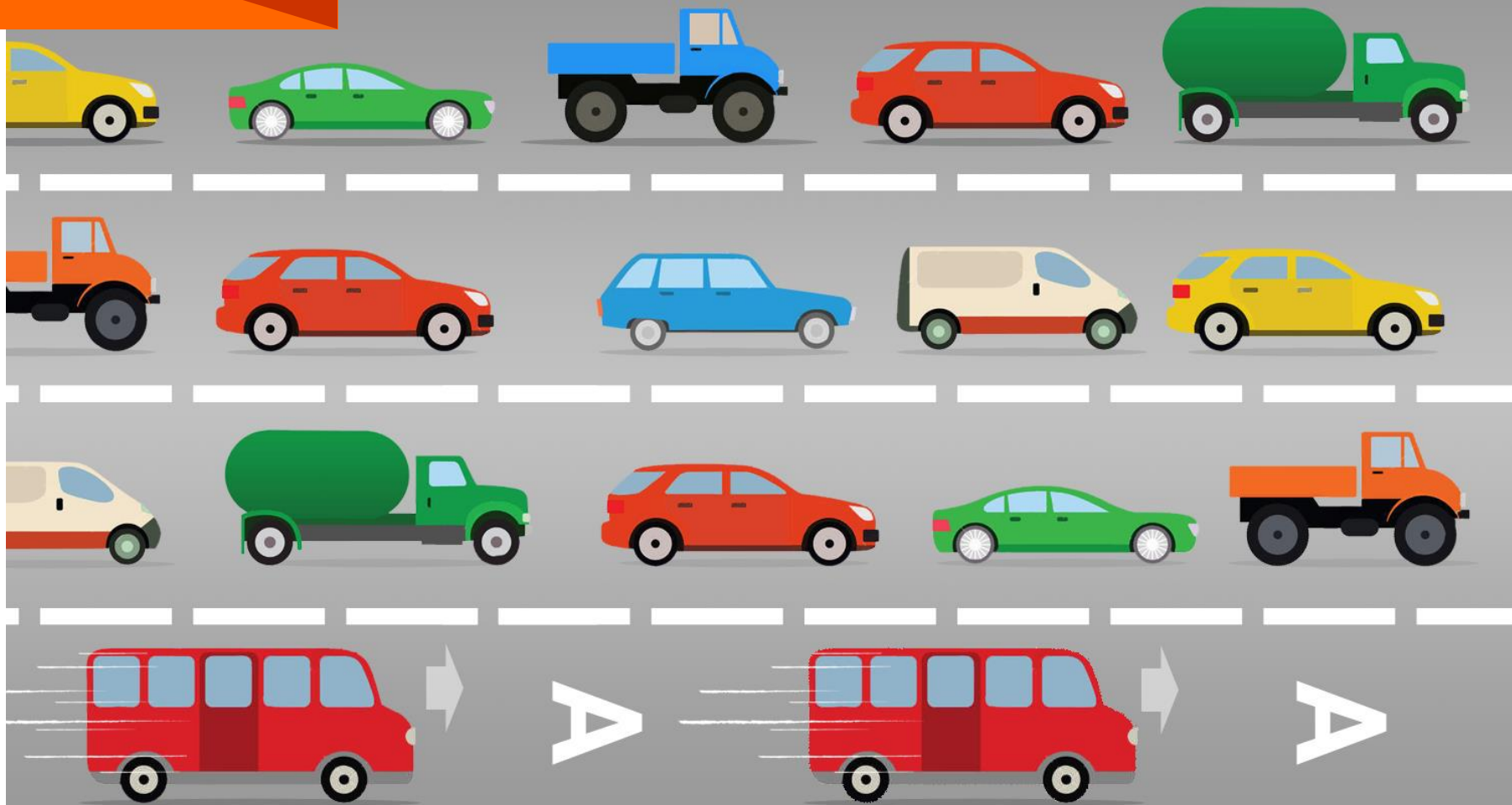
Инструменты Mikrotik для управления сетью



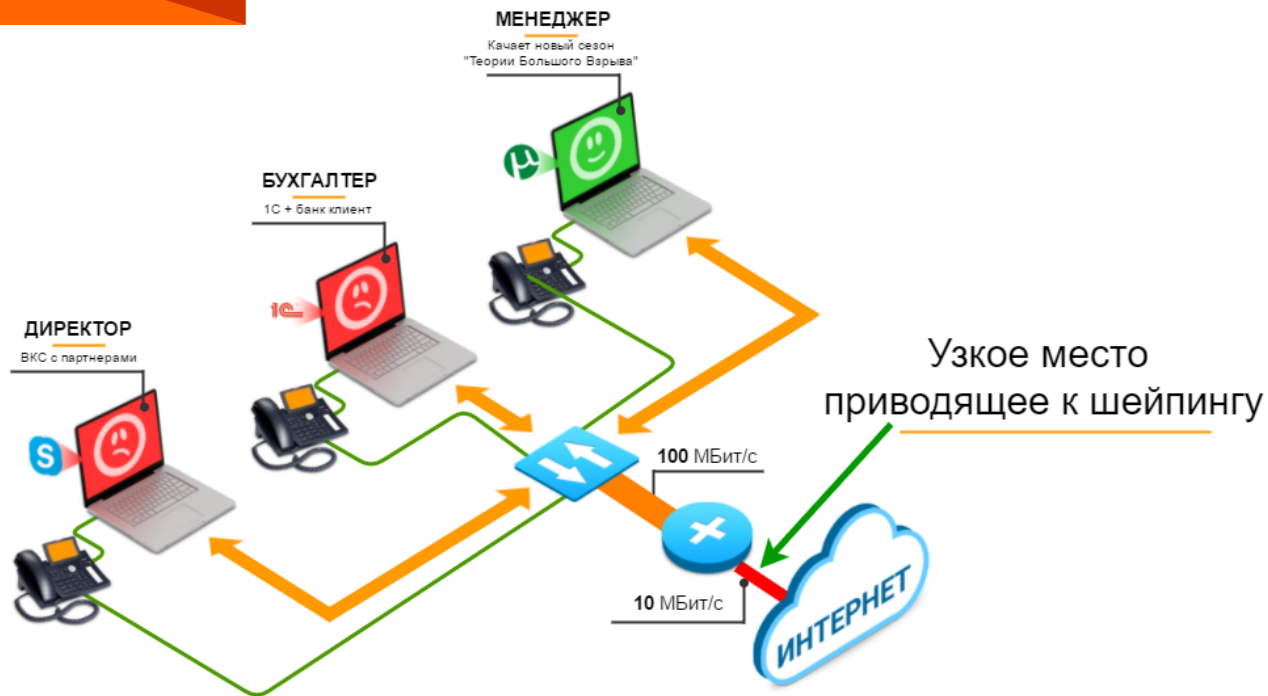
QoS



QoS

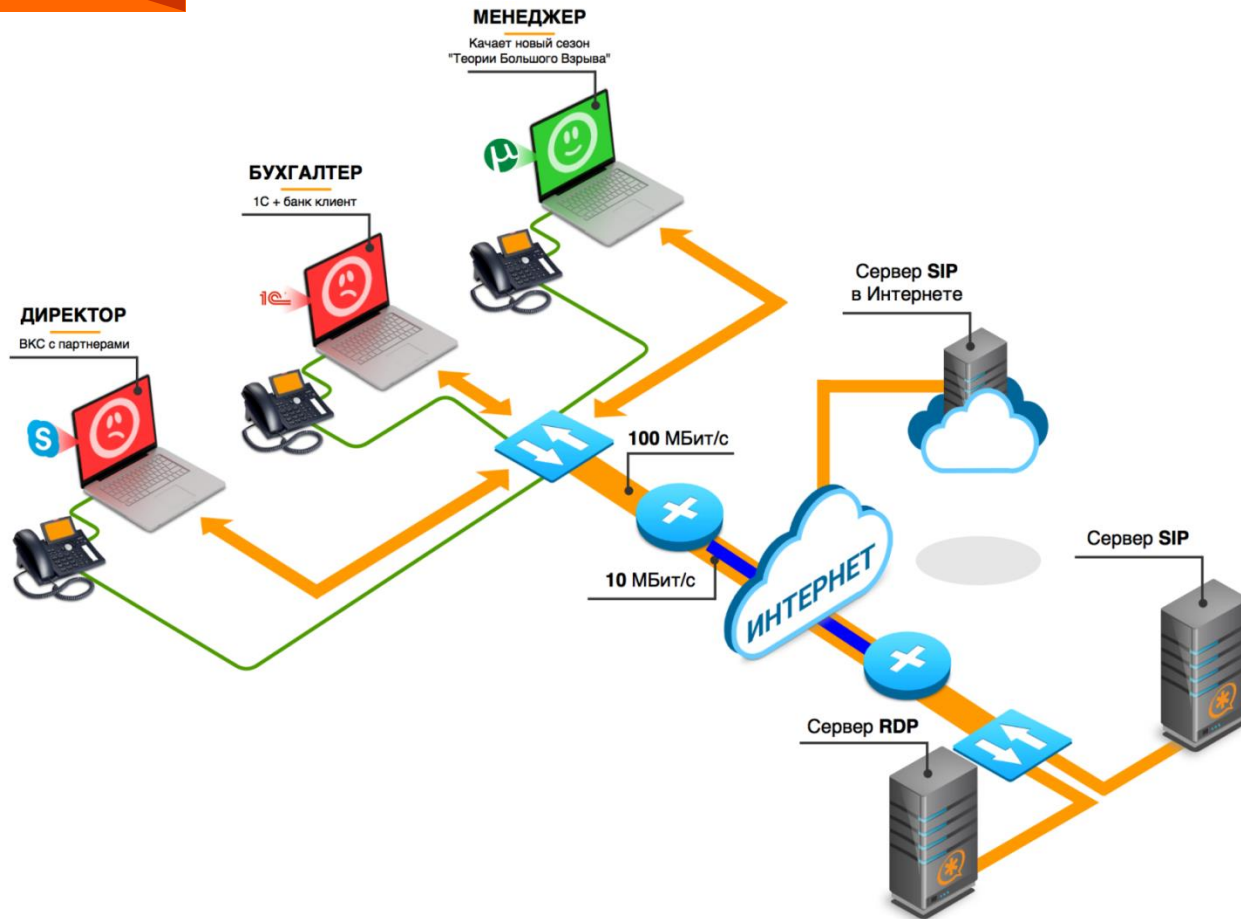


QoS

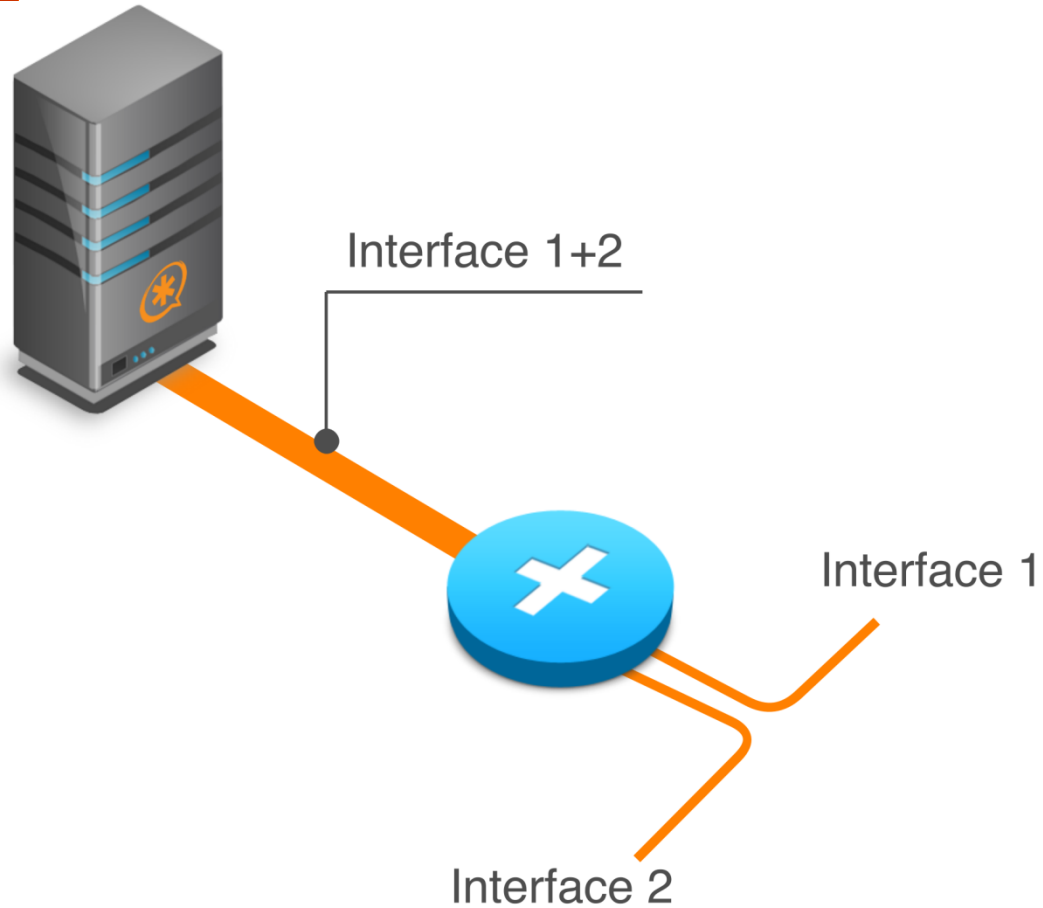


Официальные спонсоры
лагов на канале

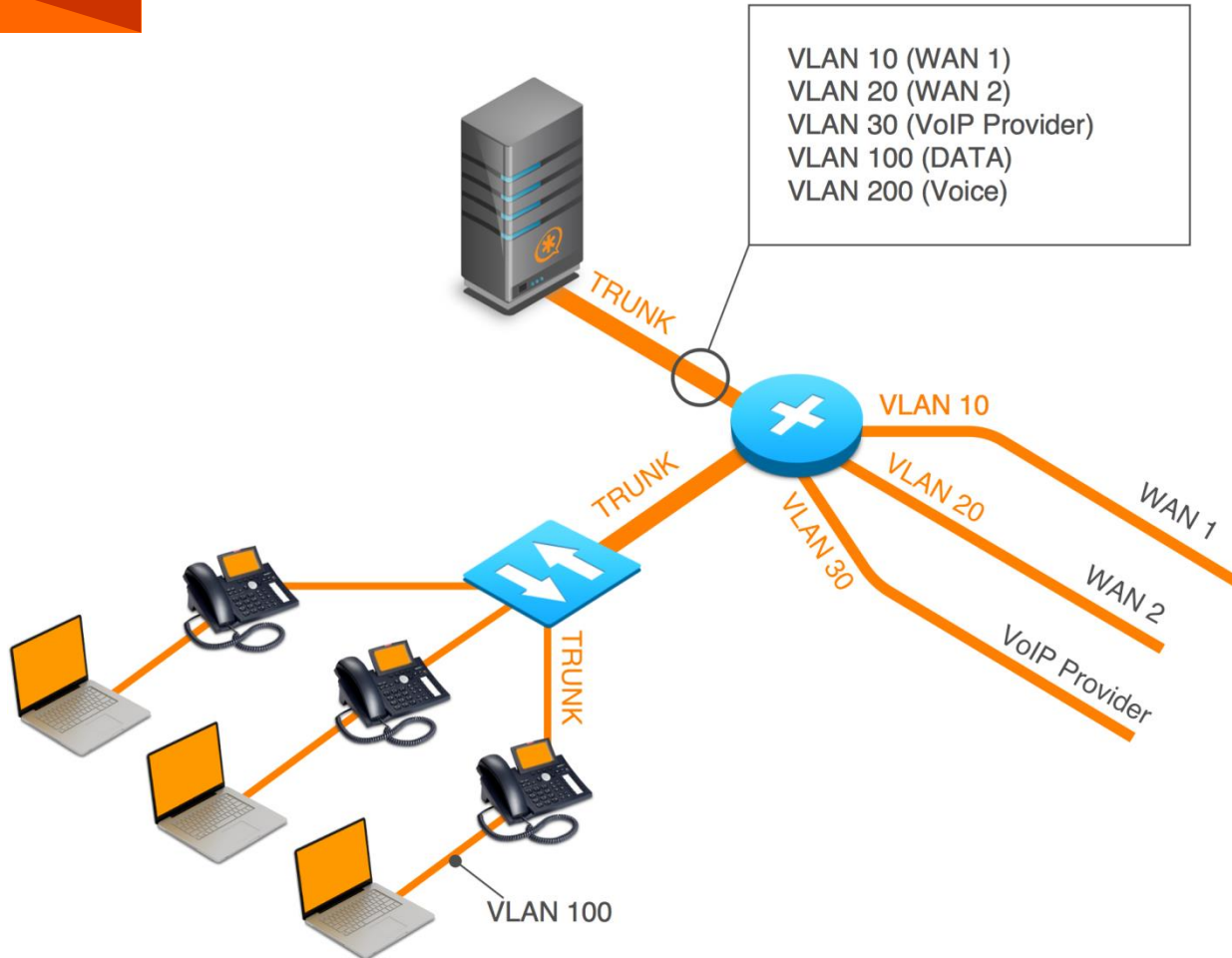
QoS внутри VPN



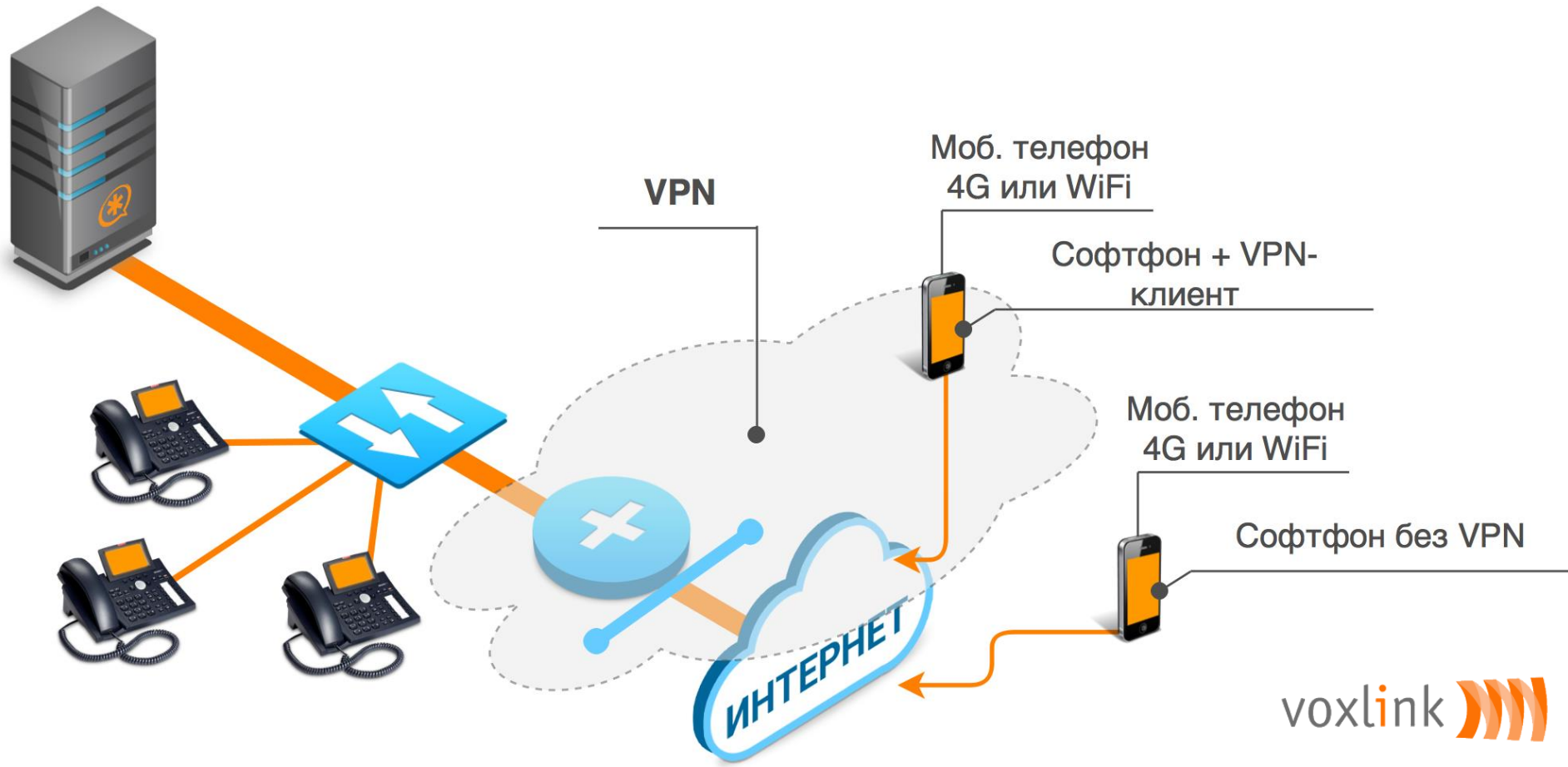
VLAN



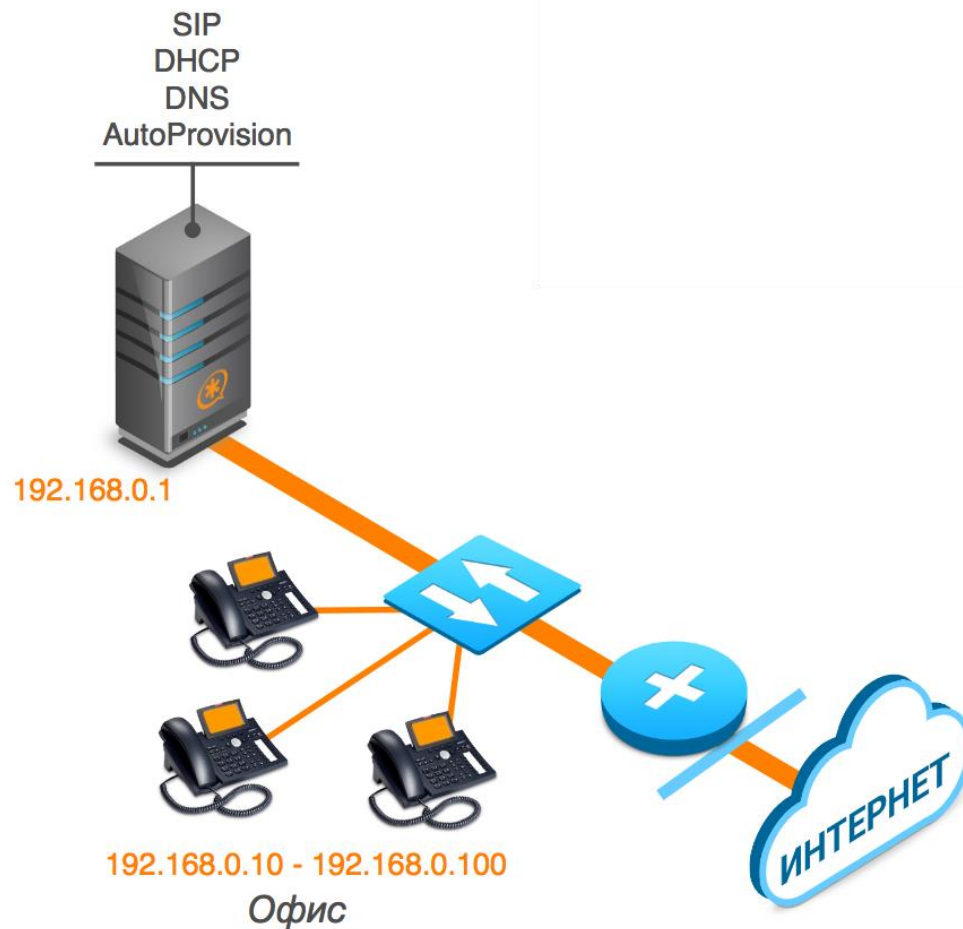
VLAN: Server-On-A-Stick



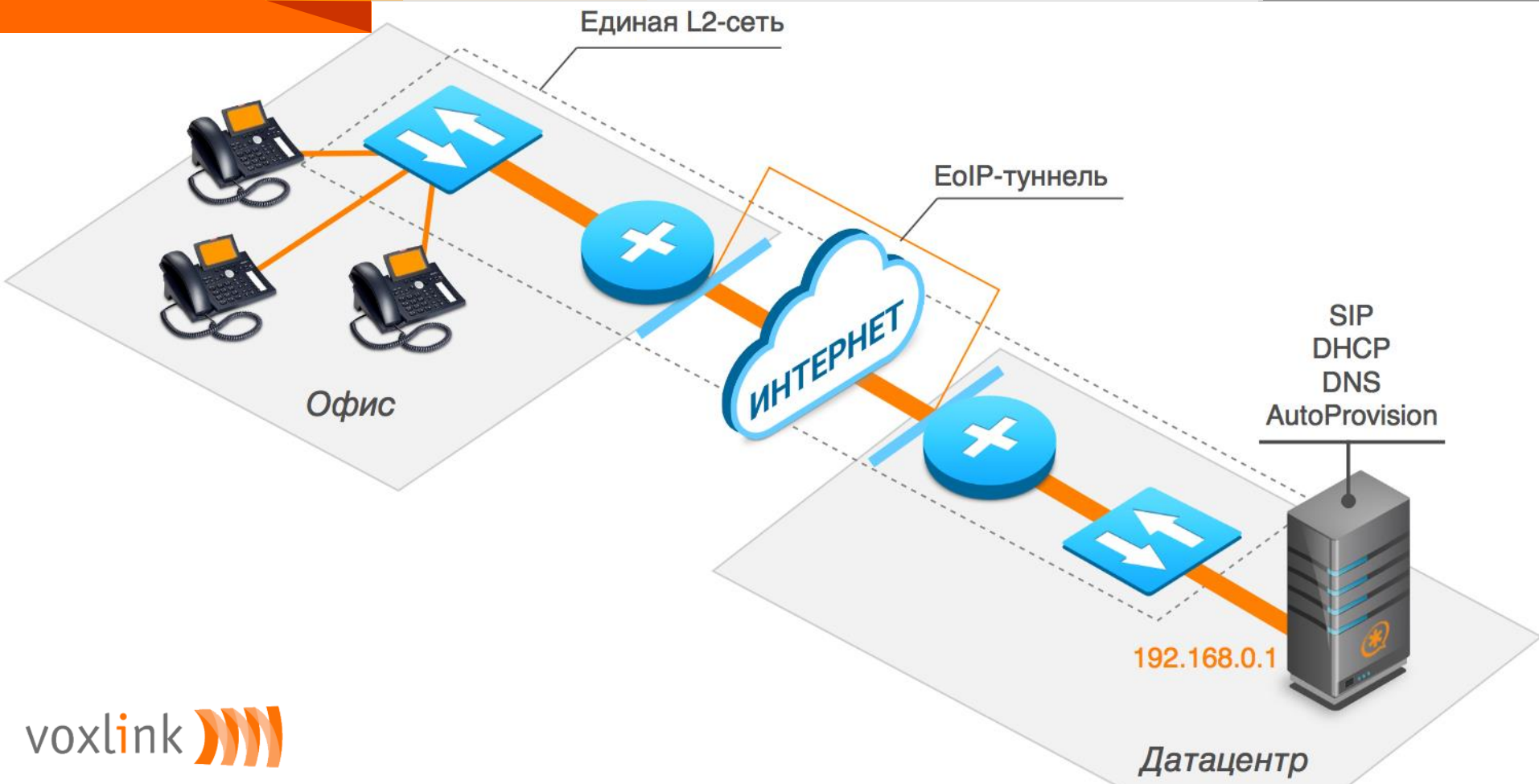
VPN



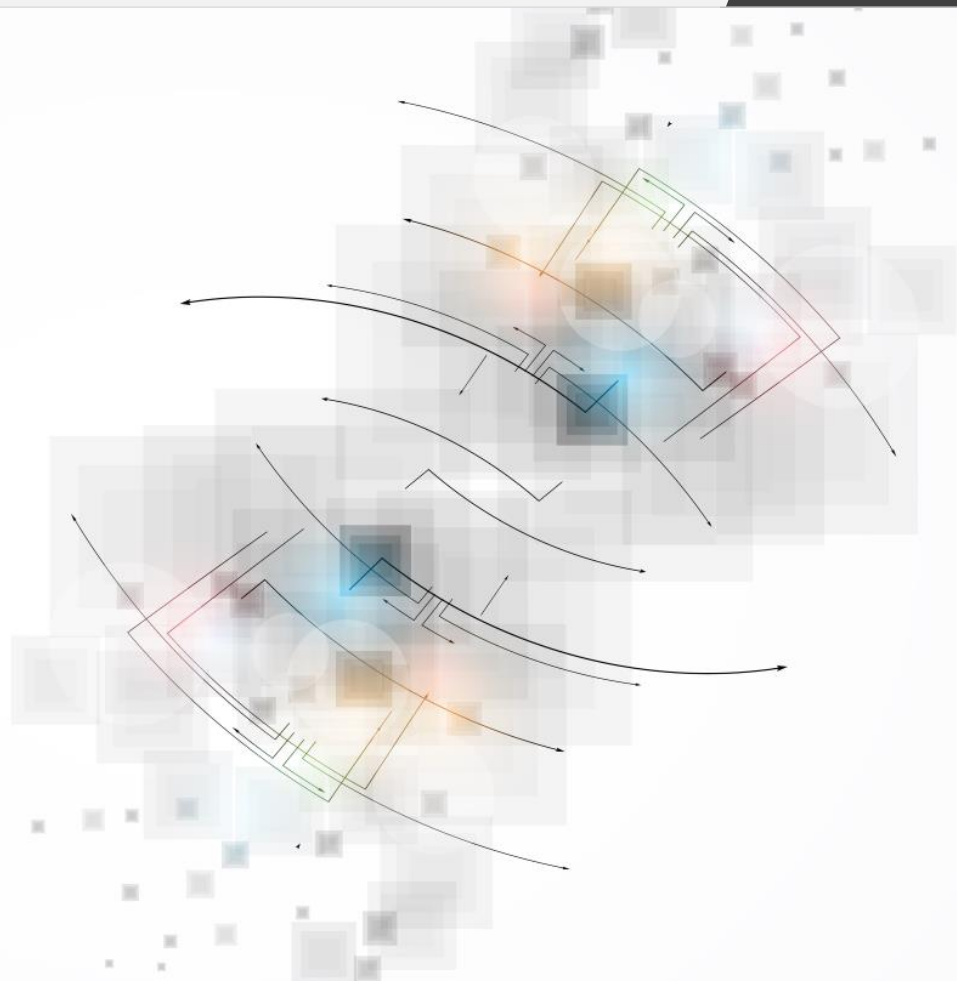
ЕoIP: вынос в ДЦ



EoIP: вынос в ДЦ



Функциональные ВОЗМОЖНОСТИ



Asterisk и Mikrotik можно интегрировать между собой.

- Asterisk может посылать команды на Mikrotik
- Mikrotik может посылать команды на Asterisk

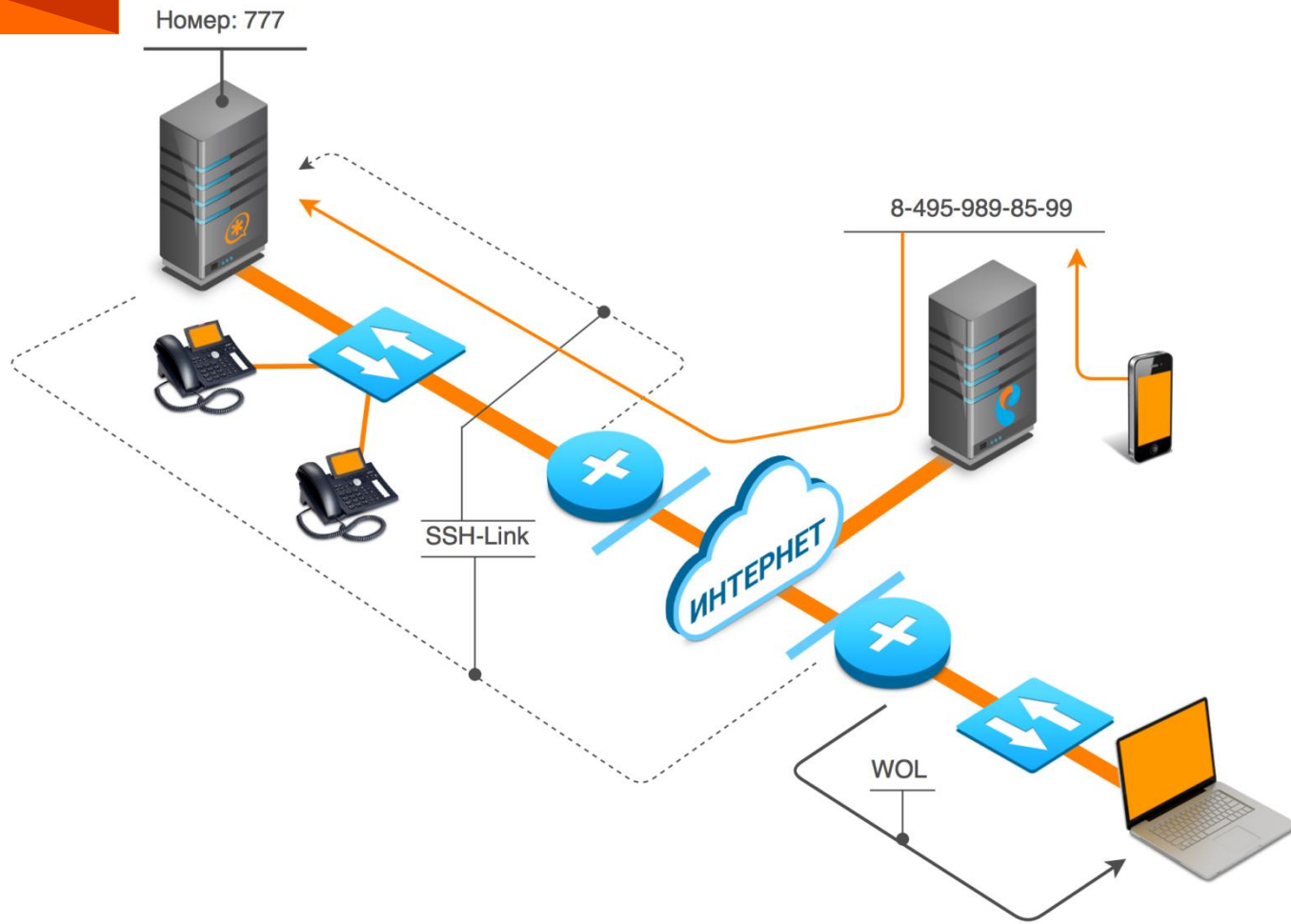
Примеры использования такой интеграции:

- Управление Mikrotik с любого телефонного аппарата (хоть Panasonic)
- Изменение настроек Asterisk при смене IP-адреса при Dual-WAN
- Выполнение произвольных скриптов на Asterisk при событии на Mikrotik
- Выполнение произвольных скриптов на Mikrotik при событии на Asterisk

Как делается интеграция:

- По API
- По SSH

Связь Mikrotik & Asterisk



DHCP сервер

Voxlink@192.168.192.1 (Office-314-RouterSwitch) - WinBox v6.35.2 on CRS125-24G-1S-2HnD (mipsbe)

Safe Mode

Hide Passwords

RouterOS WinBox

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
LCD
MetaROUTER
Partition
Make Supout.rif
Manual
Exit

DHCP Server

DHCP Networks Leases Options Option Sets Alerts

Find

Address	Gateway	DNS Servers	Domain	WINS Servers	Next Server
... Для загрузки CeroOS Asterisk: BootFileName: pxelinux.0/... Для загрузки WTWare: 5.4.16/ware.pxe					
192.168.10.0/24					192.168....
192.168.66.0/24					
192.168.100.0/24					
192.168.192.0/24					192.168....

DHCP Network <192.168.192.0/24>

Address: 192.168.192.0/24

Gateway: 192.168.192.1

Netmask: 24

DNS Servers: 192.168.192.1

Domain: voxlink.ru

WINS Servers:

NTP Servers: 79.137.209.155

CAPS Managers:

Next Server: 192.168.192.102

Boot File Name:

DHCP Options: tftpd66

DHCP Option Set:

OK
Cancel
Apply
Comment
Copy
Remove

4 items (1 selected)

DHCP сервер

168.192.1 (Office-314-RouterSwitch) - WinBox v6.35.2 on CRS125-24G-1S-2HnD (mipsbe)

Safe Mode

Hide Passwords

DHCP Server

DHCP Networks Leases Options Option Sets Alerts

Find

Name	Code	Value
128	128	s'192.127.200.155'
129	129	s'
130	130	s'
131	131	s'
132	132	s'
133	133	s'
134	134	s'
local	66	s'
mitel	43	s'
mitel_new	43	s'
option-150	150	s'
tftp66-trainer	66	s'
tftp66_test	66	s'
tftpd66	66	s'
tftpd66-Grush...	66	s'

DHCP Option <tftp66_test>

Name: tftp66_test

Code: 66

Value: s'192.168.192.102'

Raw Value: 3139322e3136382e...

OK

Cancel

Apply

Copy

Remove

WinBox

New Terminal

LCD

MetaROUTER

Radius

Log

Files

Queues

System

Routing

IP

Mesh

Switch

PPP

Bridge

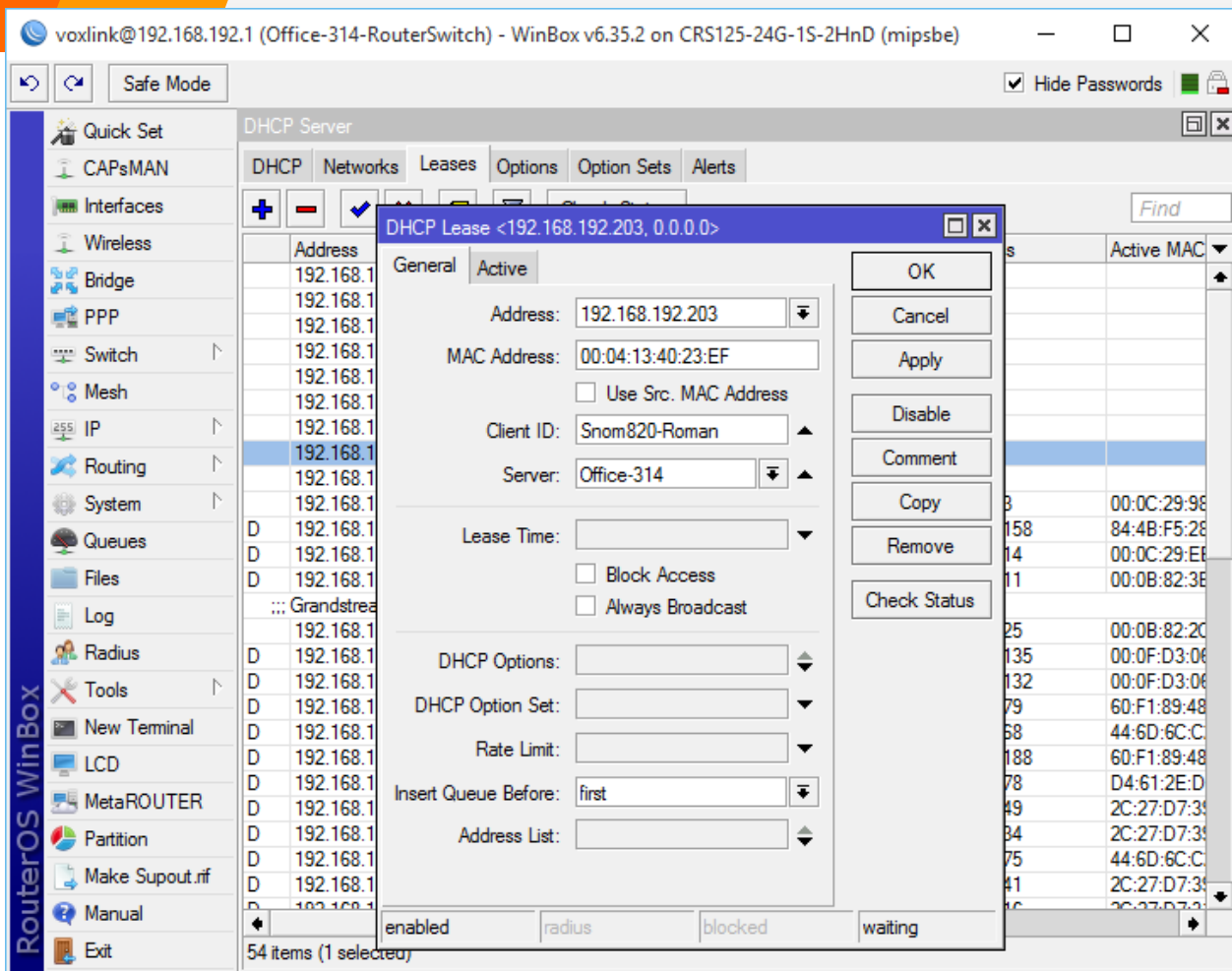
Wireless

Interfaces

CAPsMAN

Quick Set

DHCP сервер



TFTP сервер

192.168.192.1 (Office-314-RouterSwitch) - WinBox v6.35.2 on CRS125-24G-1S-2HnD (mipsbe)

Safe Mode

Hide Passwords

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
LCD
MetaROUTER
Partition
Make Supout.tif

DHCP Server

DHCP Networks Leases Options Option Sets Alerts

DHCP Lease <192.168.192.203, 0.0.0.0>

Address

Active MAC

TFTP

New TFTP

IP Addresses: 0.0.0.0

Req. Filename:

Real Filename:

☒ Allow

☒ Read Only

Hits: 0

enabled

OK

Cancel

Apply

Disable

Copy

Remove

0 items

#	IP Address	Address List	Read Only	Hits
D	192.168.1			84
D	192.168.1			75
D	192.168.1			41

2C:27:D7:3

44:6D:6C:C

2C:27:D7:3

Cloud DynDNS

11.1 (MikroTik) - WinBox v6.29.1 on RB2011UiAS-2HnD (mipsbe)

Memory: 101.9 MiB CPU: 7% ☒ Hide Passwords

Safe Mode

Terminal

Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
LCD
MetaROUTER

DHCP Server

DHCP Networks Leases

Address / Gateway

192.168.11.0/24

DHCP Network <192.168.11.0/24>

Address: 192.168.11.0/24
Gateway: 192.168.11.1
Netmask: 24

OK
Cancel
Apply

Cloud

☒ DDNS Enabled
☒ Update Time

Public Address: 37.204.156.82
DNS Name: 444a024a1c16.sn.mynetname.net

OK
Cancel
Apply
Force Update

updated

Next Server:
Boot File Name:
DHCP Options:
DHCP Option Set:

- Quick Set
- CAPsMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- Routing
- System
- Queues
- Files
- Log
- Radius
- Tools
- New Terminal
- LCD
- MetaROUTER
- Partition
- Make Supout.rf
- Manual

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

Find

	Name	Ports	SIP Direct Media
	ftp	21	
X	h323		
X	irc	6667	
	pptp		
X	sip	5060, 5061	yes
	tftp	69	

Firewalling Service <sip>

Name: sip

Ports: 5060
5061

☒ SIP Direct Media

disabled

OK
Cancel
Apply
Enable

Connection List

RouterOS WinBox

- Quick Set
- CAPsMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- Routing
- System
- Queues
- Files
- Log
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- Make Supout.tif
- Manual

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

Tracking Find

	Src. Address	Dst. Address	Pr...	Connecti...	Timeout	TCP State	Orig./Repl. Rate
SAC	85.30.235.148:1701	217.174.103.170:1701	17 (u...		00:02:54		0 bps/0 bps
SACs	192.168.10.35:5060	192.168.10.155:5060	17 (u...		00:02:46		0 bps/0 bps
SACs	192.168.10.101:5060	89.208.190.2:5060	17 (u...		00:02:15		0 bps/0 bps
SACs	192.168.10.102:5060	89.208.190.2:5060	17 (u...		00:02:00		0 bps/0 bps
SACs	192.168.10.103:5060	89.208.190.2:5060	17 (u...		00:02:38		0 bps/0 bps
SACs	192.168.10.104:5060	89.208.190.2:5060	17 (u...		00:02:24		0 bps/0 bps
SACs	192.168.10.105:5060	89.208.190.2:5060	17 (u...		00:02:18		0 bps/0 bps
SACs	192.168.10.106:5060	89.208.190.2:5060	17 (u...		00:02:53		0 bps/0 bps
SCs	192.168.10.106:16544	8.8.8.8:53	17 (u...		00:00:03		0 bps/0 bps
SCs	192.168.10.106:17960	8.8.8.8:53	17 (u...		00:00:03		0 bps/0 bps
SCs	192.168.10.106:18099	8.8.8.8:53	17 (u...		00:00:03		0 bps/0 bps
SCs	192.168.10.106:62933	8.8.8.8:53	17 (u...		00:00:03		0 bps/0 bps
SACs	192.168.10.107:5060	192.168.10.2:5060	17 (u...		00:01:40		0 bps/0 bps
SACs	192.168.10.108:5060	192.168.10.2:5060	17 (u...		00:02:58		4.4 kbps/3.6 kbps
SACs	192.168.10.111:5060	209.155.5060	17 (u...		00:02:41		0 bps/0 bps
SACs	192.168.10.114:4569	209.155.4569	17 (u...		00:02:52		0 bps/0 bps
SACs	192.168.10.114:5060	192.168.10.2:5060	17 (u...		00:02:53		0 bps/0 bps
Cs	192.168.10.114:5060	209.3.5060	17 (u...		00:00:02		0 bps/0 bps
SACs	192.168.10.114:33227	209.156.1197	17 (u...		00:02:51		0 bps/0 bps
SACs	192.168.10.125:5060	209.155.5060	17 (u...		00:02:41		0 bps/0 bps
SACs	192.168.10.149:50960	232.247.443	17 (u...		00:00:44		0 bps/0 bps
SCs	192.168.10.149:56685	77.88.8.8:53	17 (u...		00:00:02		0 bps/0 bps
SACs	192.168.10.149:56778	173.194.122.201:443	17 (u...		00:02:06		0 bps/0 bps
SACs	192.168.10.149:62271	108.177.14.189:443	17 (u...		00:02:56		0 bps/0 bps
SACs	192.168.10.149:62704	173.194.32.151:443	17 (u...		00:02:45		0 bps/0 bps
SCs	192.168.10.149:64035	84.245.131.253:2544	17 (u...		00:00:02		0 bps/0 bps

WAKE ON LAN

RouterOS WinBox

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

Terminal

```
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] >
[voxlink@Office-314-RouterSwitch] > /tool wol
interface mac
[voxlink@Office-314-RouterSwitch] > /tool wol interface=
GRE-FAVIMedia      eoip-cluster-tunnel  vlan10-class-329      eoip-MKP
GRE-VPN-SERVER      ether...              vlan192-office-314    pptp-Sheremetyevo
Grushko-Home        12tp-in1              vlan217-Internet      vlan10
bridge-comp-class   12tp_m1               voxlink-guest          vlan192
bridge-global        loopback               wlan1                  <12tp-gorlov>
bridge-local         sfp1                  GRE-KRD                <12tp-mediastyle>
[voxlink@Office-314-RouterSwitch] > /tool wol interface=bridge-local mac=00:00:00
:00:00:00
```

6 items (1 selected)

RouterOS WinBox

- CAPSMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- Routing
- System
- Queues
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- Radius
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- LCD
- MetaROUTER
- Partition
- Make Supout.rif
- Manual
- Exit

Asterisk на Mikrotik

Asterisk может быть установлен непосредственно на Mikrotik в Metarouter

Производительность – несколько вызовов в секунду.

Как увеличить:

- Использовать Direct IP (“Canreinvite”)
- Отключить транскодирование
- Не использовать MoH, Voice Announcements
- Упростить диалплан

METAROUTER

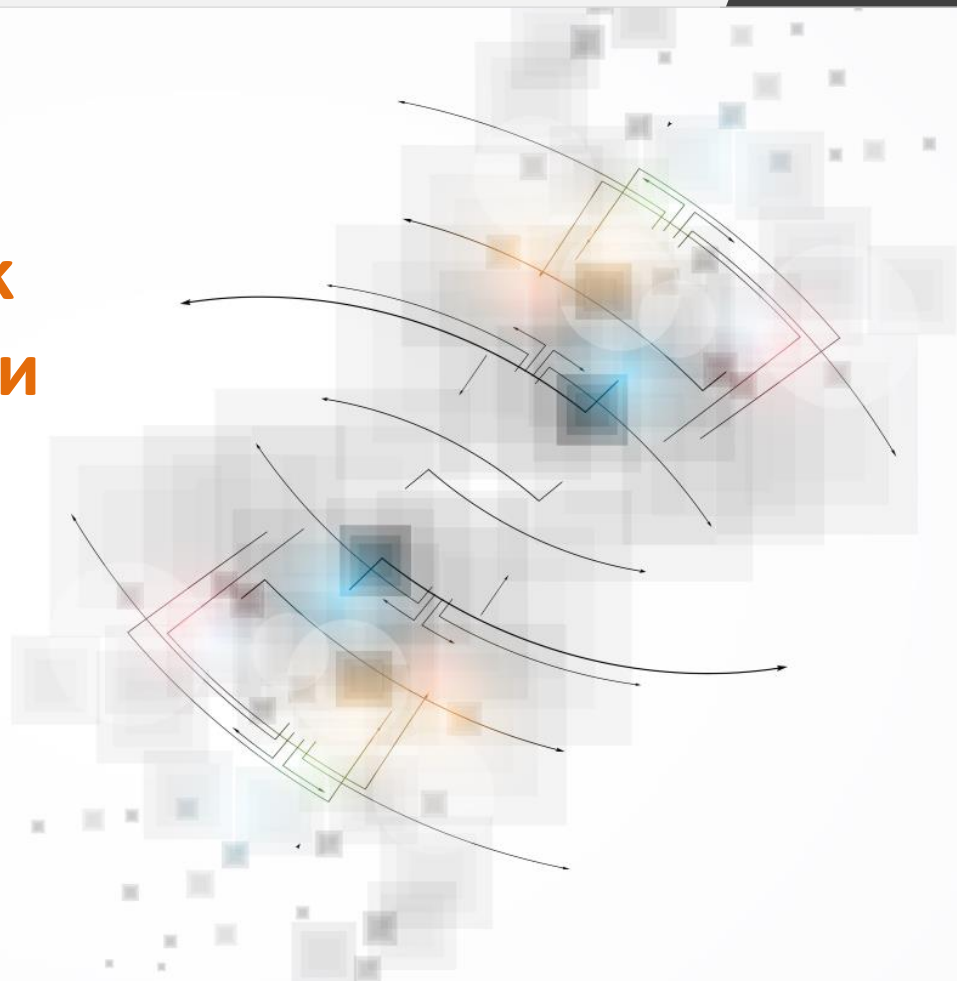
MikroTik

Asterisk™

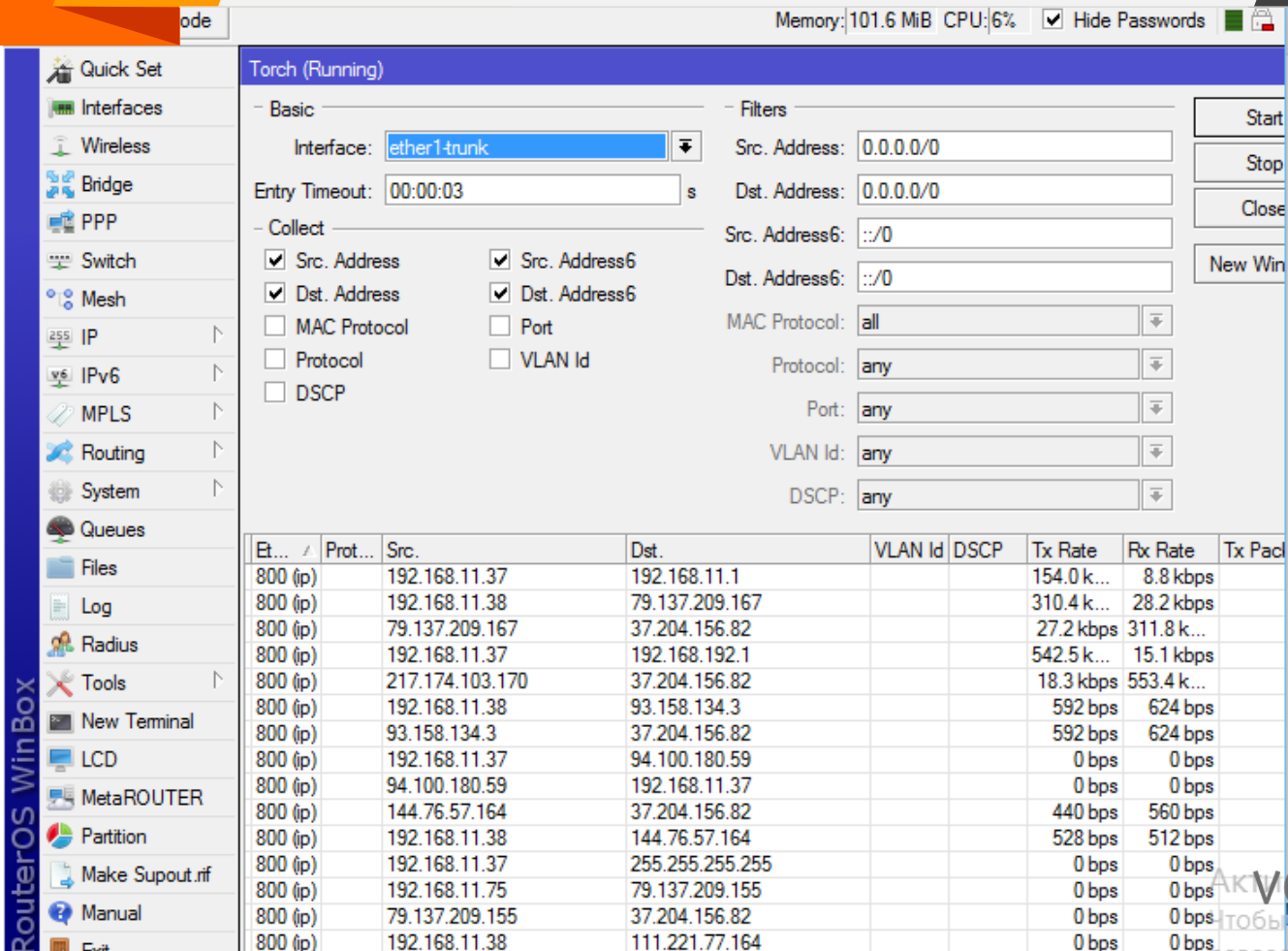
А ты
хорошо
подумал?



Инструменты Mikrotik для траблшутинга сети



TORCH



Отладка

RouterOS WinBox

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

Terminal

```
[voxlink@Office-314-RouterSwitch] >  
[voxlink@Office-314-RouterSwitch] >  
[voxlink@Office-314-RouterSwitch] >  
[voxlink@Office-314-RouterSwitch] >
```

Packet Sniffer Settings

General Streaming Filter

Memory Limit: 1000 kb

☐ Only Headers

File Name: 123.pcap

File Limit: 10000 kb

OK Cancel Apply Start Stop Packets Connections Hosts Protocols

File List

File Name	Type
123.pcap	.pcap file
Office-314-RouterSwitch-20140524-...	backup
Office-314-RouterSwitch-20140602-...	backup
Office-314-RouterSwitch-20140602-...	backup
Office-314-RouterSwitch-20140714-...	backup
ar9330-3.10.fwf	.fwf file
audiocodes.pcap	.pcap file
auto-before-reset.backup	backup
autosupout.old.rif	.rif file
autosupout.rif	.rif file
bc.rsc	script
bpdu.pcap	.pcap file
console-dump.txt	.txt file
dark-login-form	directory

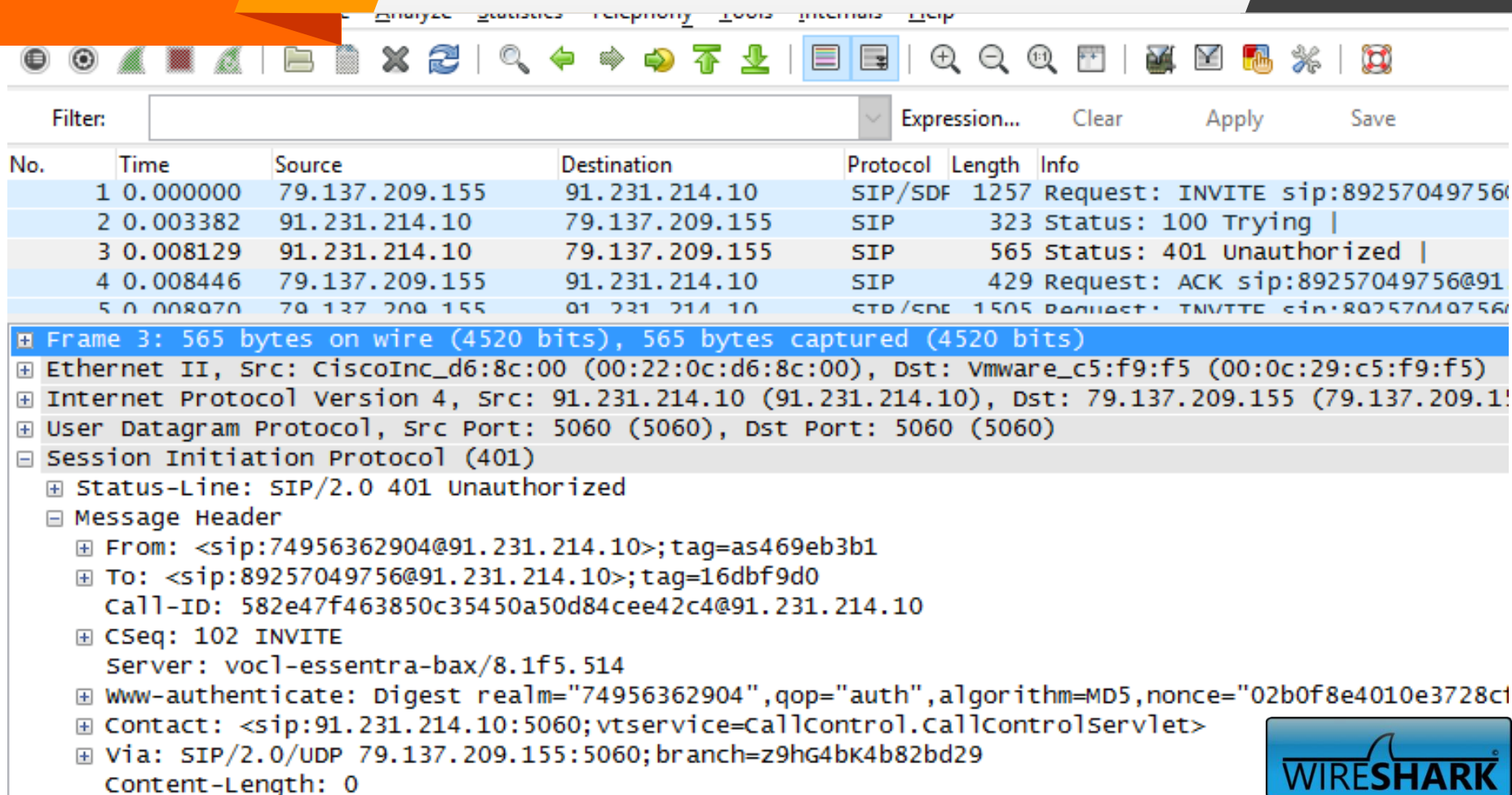
81 items 32.9 MiB of 128.0 MiB used 74% free

6 items (1 selected)

stopped

voxlink

PACKET SNIFFER + WIRESHARK



Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	79.137.209.155	91.231.214.10	SIP/SDF	1257	Request: INVITE sip:89257049756@91.231.214.10
2	0.003382	91.231.214.10	79.137.209.155	SIP	323	Status: 100 Trying
3	0.008129	91.231.214.10	79.137.209.155	SIP	565	Status: 401 Unauthorized
4	0.008446	79.137.209.155	91.231.214.10	SIP	429	Request: ACK sip:89257049756@91.231.214.10
5	0.008970	79.137.209.155	91.231.214.10	SIP/SDF	1505	Request: INVITE sip:89257049756@91.231.214.10

Frame 3: 565 bytes on wire (4520 bits), 565 bytes captured (4520 bits)

- ☒ Ethernet II, Src: CiscoInc_d6:8c:00 (00:22:0c:d6:8c:00), Dst: Vmware_c5:f9:f5 (00:0c:29:c5:f9:f5)
- ☒ Internet Protocol Version 4, Src: 91.231.214.10 (91.231.214.10), Dst: 79.137.209.155 (79.137.209.155)
- ☒ User Datagram Protocol, Src Port: 5060 (5060), Dst Port: 5060 (5060)
- ☒ Session Initiation Protocol (401)
 - ☒ Status-Line: SIP/2.0 401 Unauthorized
 - ☒ Message Header
 - ☒ From: <sip:74956362904@91.231.214.10>;tag=as469eb3b1
 - ☒ To: <sip:89257049756@91.231.214.10>;tag=16dbf9d0
Call-ID: 582e47f463850c35450a50d84cee42c4@91.231.214.10
 - ☒ CSeq: 102 INVITE
Server: vocl-essentra-bax/8.1f5.514
 - ☒ www-authenticate: Digest realm="74956362904",qop="auth",algorithm=MD5,nonce="02b0f8e4010e3728c1"
 - ☒ Contact: <sip:91.231.214.10:5060;vtservice=CallControl.callControlServlet>
 - ☒ Via: SIP/2.0/UDP 79.137.209.155:5060;branch=z9hg4bk4b82bd29
Content-Length: 0



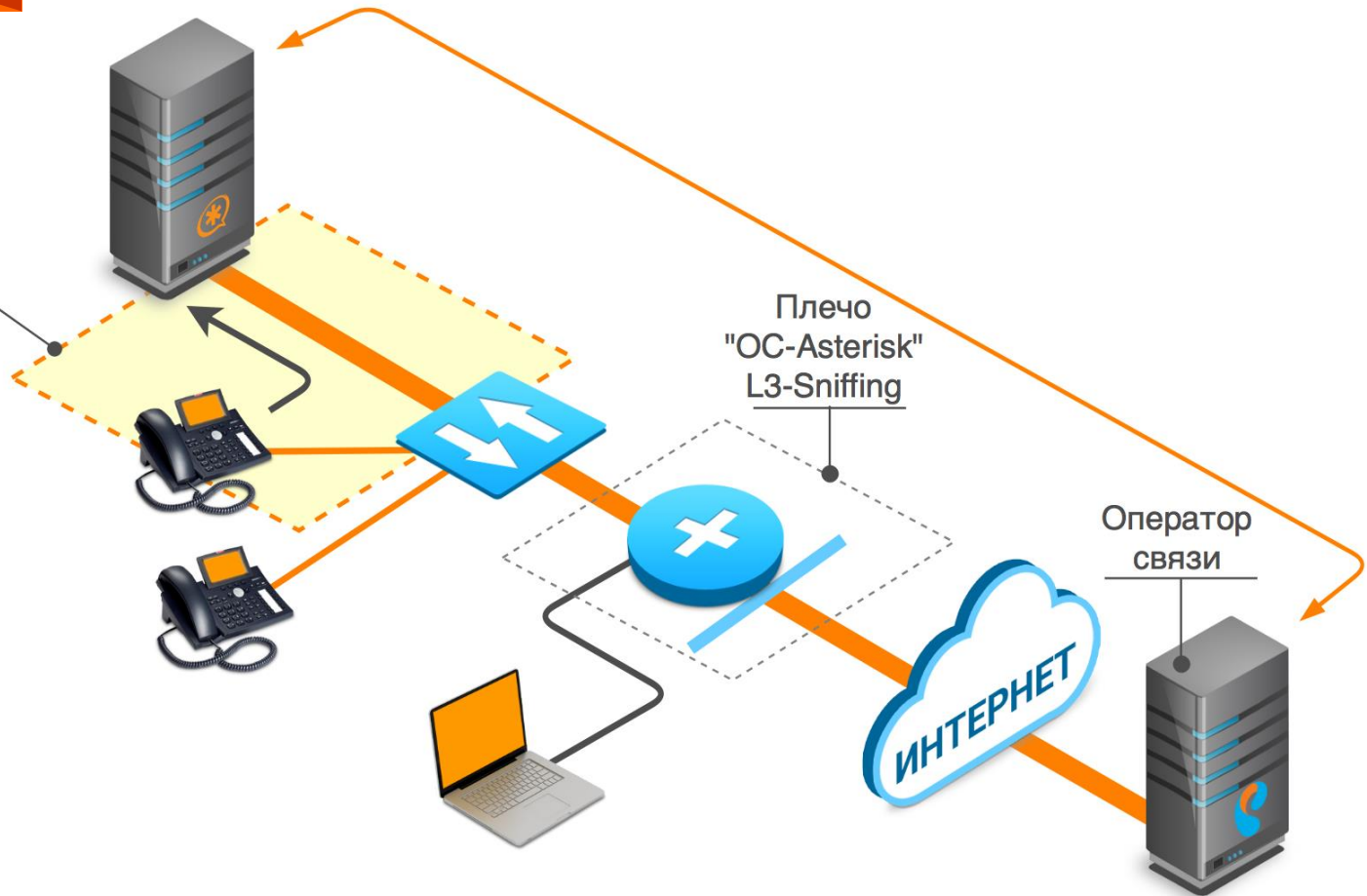
PACKET SNIFFER + WIRESHARK

Плечо
"Asterisk-Local Phone"
L2 - Sniffing - Mirroring

Плечо
"OC-Asterisk"
L3-Sniffing

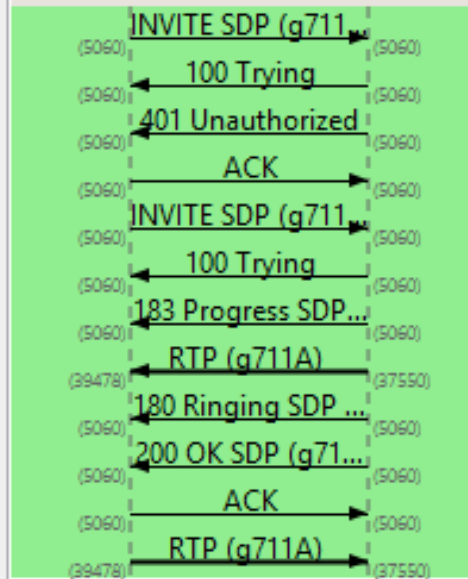
Оператор
СВЯЗИ

ИНТЕРНЕТ



PACKET SNIFFER + WIRESHARK

0.000000
0.003382
0.008129
0.008446
0.008970
0.012393
1.360315
1.872298
4.716167
10.622056
10.622918
10.791342



Comment

SIP From: <sip:74956362904@91.231.214.10> To: <sip:8925704@89.25704>

SIP Status

SIP Status

SIP Request

SIP From: <sip:74956362904@91.231.214.10> To: <sip:8925704@89.25704>

SIP Status

SIP Status

RTP Num packets:4334 Duration:86.658s SSRC:0x30705E55

SIP Status

SIP Status

SIP Request

RTP Num packets:3888 Duration:77.739s SSRC:0x1CDC3287

PACKET SNIFFER + WIRESHARK

S

5	36	33	36	33	30	30	34	40	30	31	35	33	33	10563630	04001	33
---	----	----	----	----	----	----	----	----	----	----	----	----	----	----------	-------	----

voxl**ink** 

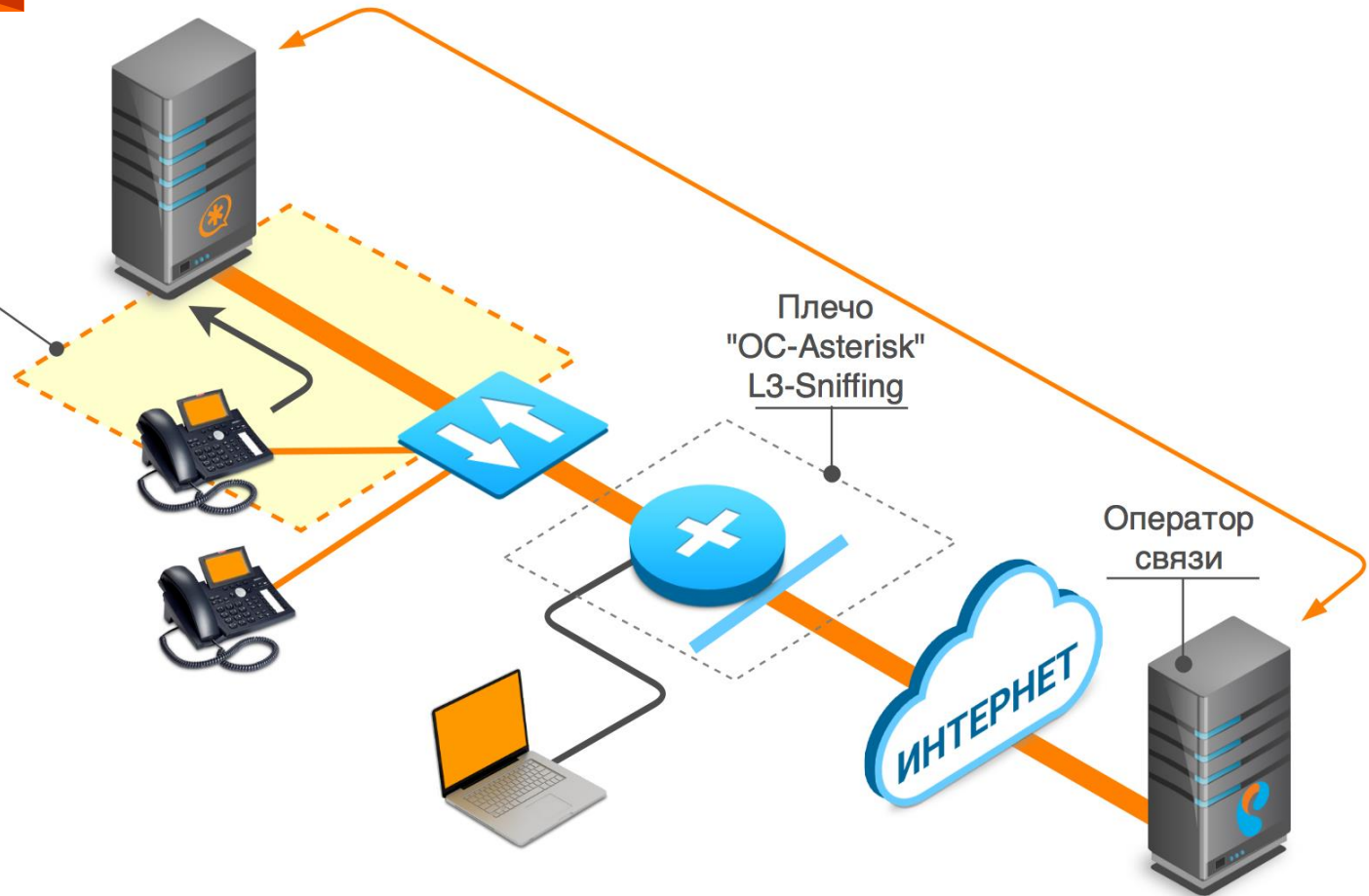
REALTIME WIRESHARK

Плечо
"Asterisk-Local Phone"
L2 - Sniffing - Mirroring

Плечо
"OC-Asterisk"
L3-Sniffing

Оператор
СВЯЗИ

ИНТЕРНЕТ



REALTIME WIRESHARK

Capture

No.	Capture	Interface	Link-layer header Prom.	Mode	Snapslen [B]	Buffer [MiB]	Capture Filter
	☐	Ethernet 2 fe80::d1d4:279:febfb:37c2 10.10.51.1	Ethernet	enabled	262144	2	

☐ Capture on all interfaces
☒ Use promiscuous mode on all interfaces
Capture Filter:

Capture Files

File:

☐ Use multiple files

☒ Next file every packet(s)
☐ Next file every megabyte(s)
☐ Ring buffer with minute(s)

Stop Capture Automatically After...

☐ packet(s) ☐ megabyte(s)
☐ file(s) ☐ minute(s)

Interface Management

Pipes Local Interfaces Remote Interfaces

Remote Interfaces

Host

Wireshark: Remote Interface

Host:

Port:

Authentication

☒ Null authentication
☐ Password authentication

Username:

Password:

Manage Interfaces

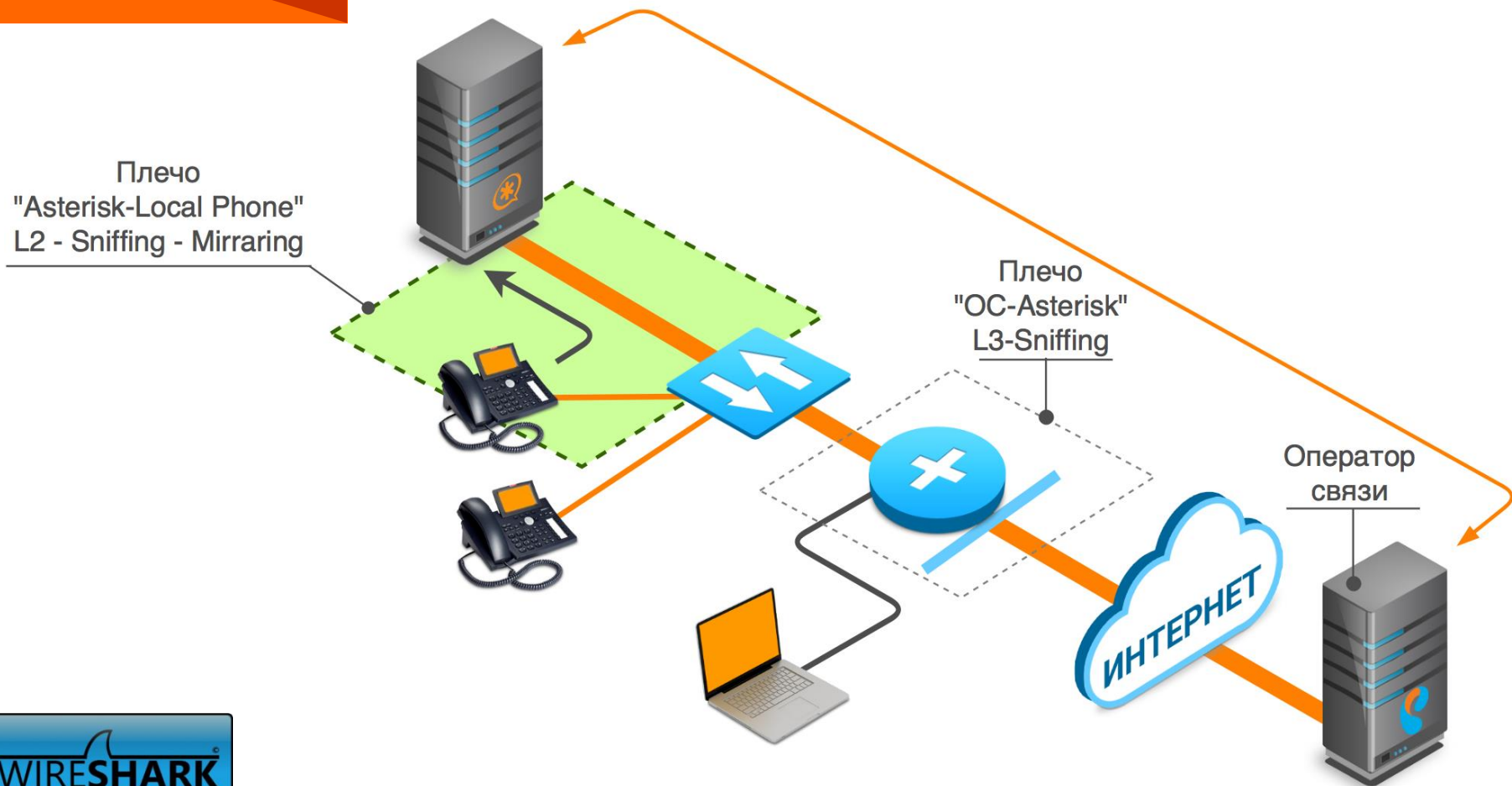
Compile selected BPFs

Options

☐ Resolve network-layer names
☐ Resolve transport-layer name
☒ Use external network name resolver

Start **Close**

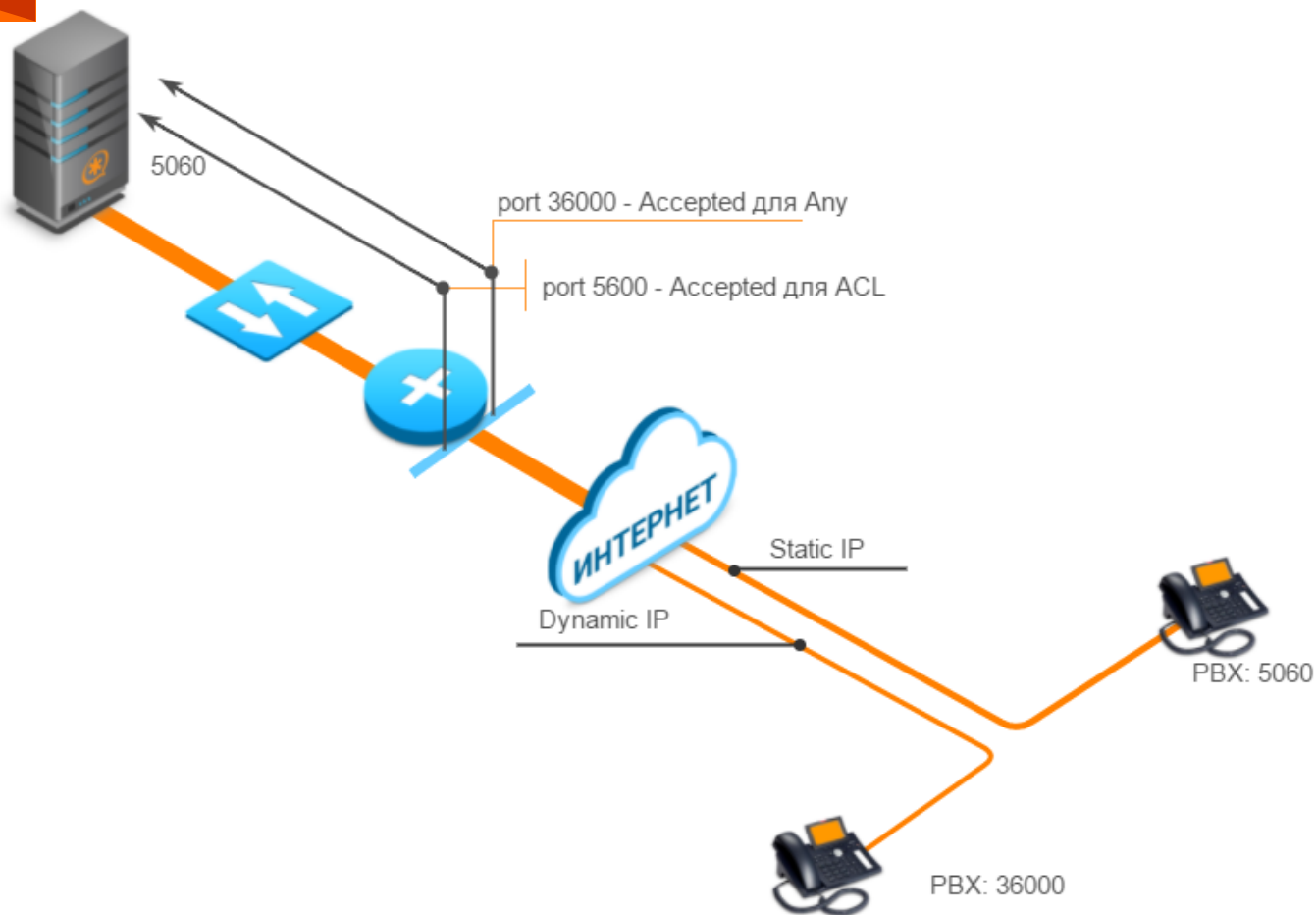
ЗЕРКАЛИРОВАНИЕ SWITCH-ПОРТА



Инструменты Mikrotik для обеспечения Безопасности Asterisk



ПЕРЕНОС SIP-ПОРТА



ФИЛЬТРАЦИЯ НЕ-РФ СЕТЕЙ



ФИЛЬТРАЦИЯ СКАНИРОВАНИЯ SIP

New Firewall Rule

General Advanced Extra Action Statistics

Connection Limit

Limit: 100

Netmask: 32

Limit

Rate: 1 / sec

Burst: 5

Dst. Limit

Rate: 1 / sec

Burst: 5

Limit By: dst. address

Expire: 100.00 s

Nth

Every: 2

Packet: 0

Time

Time: 00:00:00 - 1d 00:00:00

☒ sun ☒ mon ☒ tue ☒ wed ☒ thu ☒ fri ☒ sat

Src. Address Type

Address Type:

☐ Invert

Dst. Address Type

Address Type: unicast

☐ Invert

PSD

Weight Threshold: 21

Delay Threshold: 00:00:03

Low Port Weight: 3

High Port Weight: 1

OK

Cancel

Apply

Disable

Comment

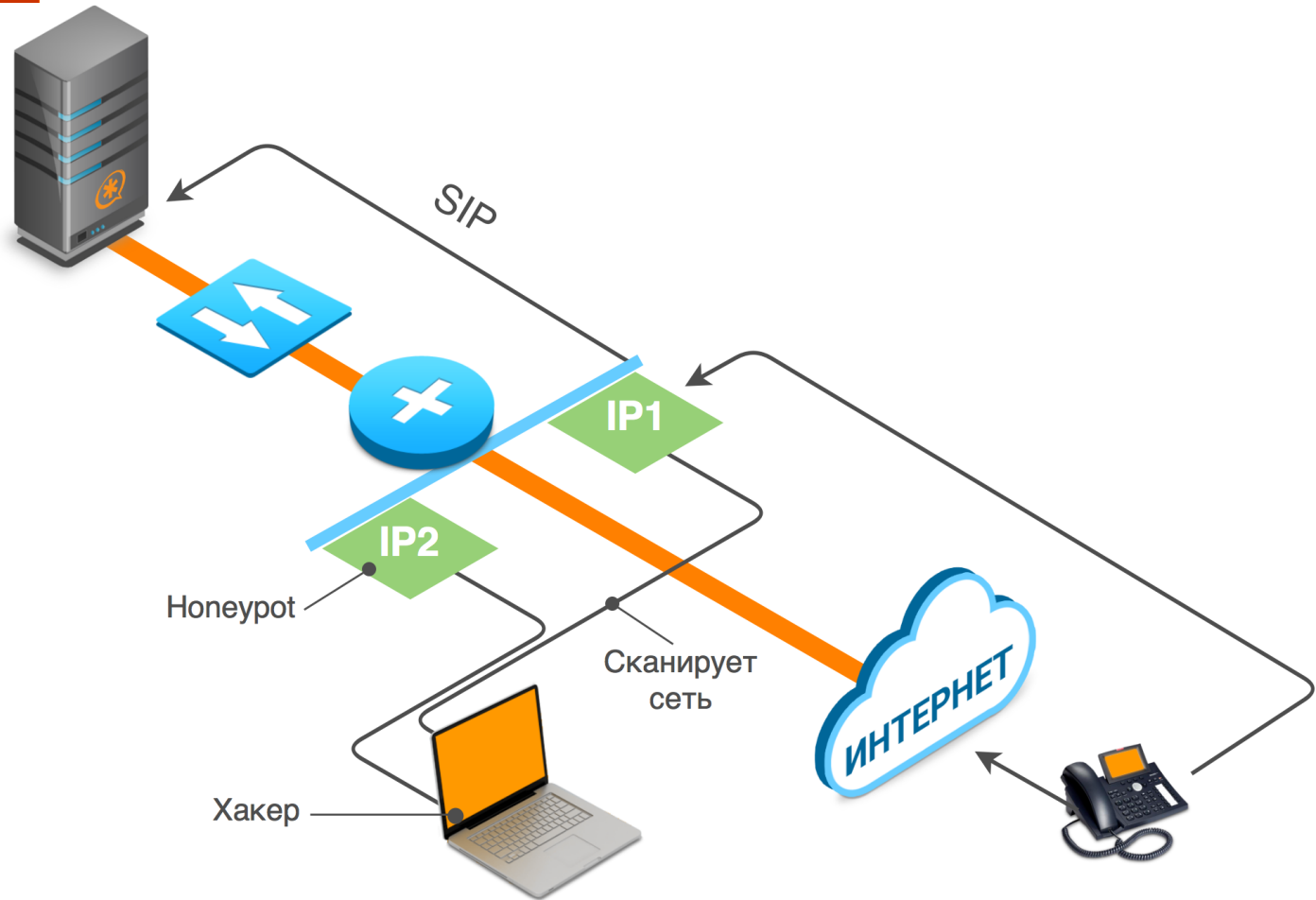
Copy

Remove

Reset Counters

Reset All Counters

SIP-HoneyPot



НОЧНОЕ ЗАКРЫТИЕ ПОРТОВ

☒ Hide Passwords 

erOS WinBox

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
LCD
MetaROUTER
Partition
Make Supout.tif

Firewall

Filter Rules NAT Mangle

+ - ✓ ✗ 📁

#	Action	Chain
... Prevent NAT to private		
0	return	srcnat
1 X	+ dst...	dstnat
2 X	+ dst...	dstnat
... place hotspot rules here		
3 X	pas...	unused
4	+ * dst...	dstnat
5	+ * dst...	dstnat
6	+ * dst...	dstnat
7	= mas...	srcnat
8	+ * dst...	dstnat
9	+ * dst...	dstnat
... SSH from ESX to ESX		
10	+ * dst...	dstnat
11	+ * dst...	dstnat
12	+ * dst...	dstnat
13	+ * dst...	dstnat
14	+ * dst...	dstnat
... ESX 329		
15 X	+ dst...	dstnat
16	+ * dst...	dstnat
17	+ * dst...	dstnat
18	+ * dst...	dstnat
19 X	+ dst...	dstnat
20	+ * dst...	dstnat

NAT Rule <5090>

General Advanced Extra Action Statistics

Connection Limit
Limit
Dst. Limit
Nth

Time
Time: 00:00:00 - 1d 00:00:00

☒ sun ☒ mon ☒ tue ☒ wed ☒ thu ☒ fri ☒ sat

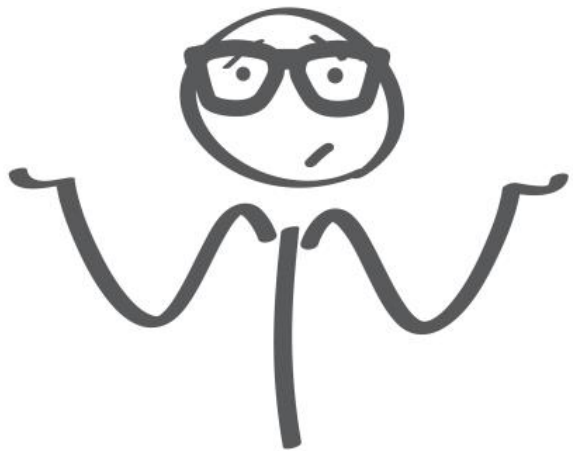
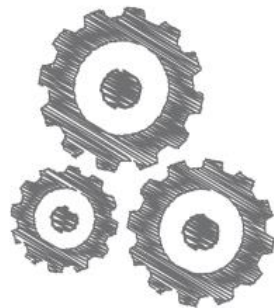
Src. Address Type
Dst. Address Type
PSD
Hotspot
IP Fragment

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

В последних версиях RouterOS появилась возможность добавлять в Firewall FQDN-адреса вместо IP-адресов

Это позволяет нам прописывать в ACL клиентов, работающих с динамическими адресами

В чем главная проблема Mikrotik



В чем главная проблема Mikrotik

А теперь попробуйте объяснить своему клиенту, что все что перечислено выше – может стоить всего от 20 долларов и тут нет никакого подвоха!



1390 руб.



3800 руб.

Спасибо за внимание!



Внедрение IP-телефонии
на IP-ATC Asterisk

Грушко Сергей
генеральный директор
группы компаний Вокс Линк

Телефон:

+7 (495) 989-85-33 * 701

+7 (926) 350-31-63

Email: sergey@voxlink.ru