

voxl**ink**

Mikro**Tik**
- TRAINING.RU

Multiwan and routing in MikroTik ROS v7



MU**oM**

Mikrotik User **Online Meeting**

Об авторе

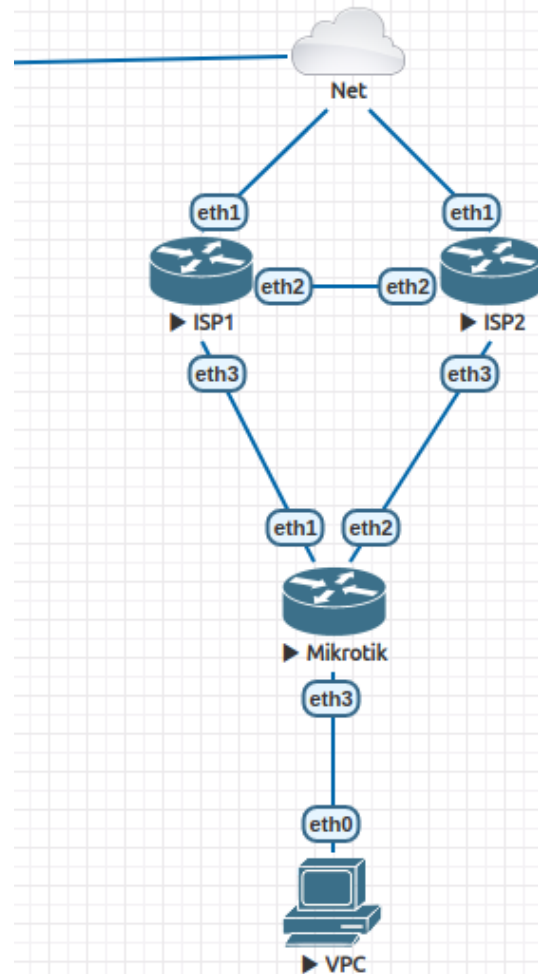
- Владимир Кузнецов
 - Сетевой инженер
 - Yandex
 - Telegram @smithy1208
 - v.kuznetsov48@ya.ru
- С сетями с 2008 года
 - 12 лет в провайдере
 - Строил сети и в аутсорсе, там и настиг меня MikroTik
 - MTCRE

01

Routing tables

Multiwan - несколько провайдеров с помощью таблиц маршрутизации

Схема Dualwan



Стартовые настройки

- Интерфейсы в провайдеров добавлены в интерфейс лист WAN
- Развешаны IP
- Включен masquerading для WAN

Базовые настройки:

```
/interface ethernet
set [ find default-name=ether1 ] comment=ISP1
set [ find default-name=ether2 ] comment=ISP2

/interface list
add name=WAN

/interface list member
add interface=ether1 list=WAN
add interface=ether2 list=WAN

/ip address
add address=198.51.100.6/29 interface=ether1
add address=203.0.113.6/29 interface=ether2
add address=192.168.88.254/24 interface=br-lan

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

Routing tables

Создать дополнительные роутинг таблицы

```
[admin@MikroTik] > /routing/table/export terse
# dec/11/2021 00:50:35 by RouterOS 7.1
# software id =
#
/routing table add disabled=no fib name=rtab-1
/routing table add disabled=no fib name=rtab-2
```

Route defaults

```
# Добавить дефолты в новые таблицы
```

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

```
# dec/11/2021 00:59:52 by RouterOS 7.1
```

```
# software id =
```

```
#
```

```
/ip route add distance=251 gateway=198.51.100.1
```

```
/ip route add distance=252 gateway=203.0.113.1
```

```
/ip route add gateway=198.51.100.1 routing-table=rtab-1
```

```
/ip route add gateway=203.0.113.1 routing-table=rtab-2
```

Маркировки (mangle)

Добавить маркировки

```
[admin@MikroTik] /ip/firewall/mangle> export
```

```
# dec/11/2021 01:07:11 by RouterOS 7.1
```

```
# software id =
```

```
#
```

```
/ip firewall mangle
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark in-interface=ether1 new-connection-mark=con-isp1 passthrough=yes
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark in-interface=ether2 new-connection-mark=con-isp2 passthrough=yes
```

```
add action=mark-routing chain=prerouting connection-mark=con-isp1 in-interface-list=!WAN new-routing-mark=rtab-1 passthrough=yes
```

```
add action=mark-routing chain=prerouting connection-mark=con-isp2 in-interface-list=!WAN new-routing-mark=rtab-2 passthrough=yes
```

```
add action=mark-routing chain=output connection-mark=con-isp1 new-routing-mark=rtab-1 passthrough=yes
```

```
add action=mark-routing chain=output connection-mark=con-isp2 new-routing-mark=rtab-2 passthrough=yes
```

При таких маркировках будут работать оба провайдера.

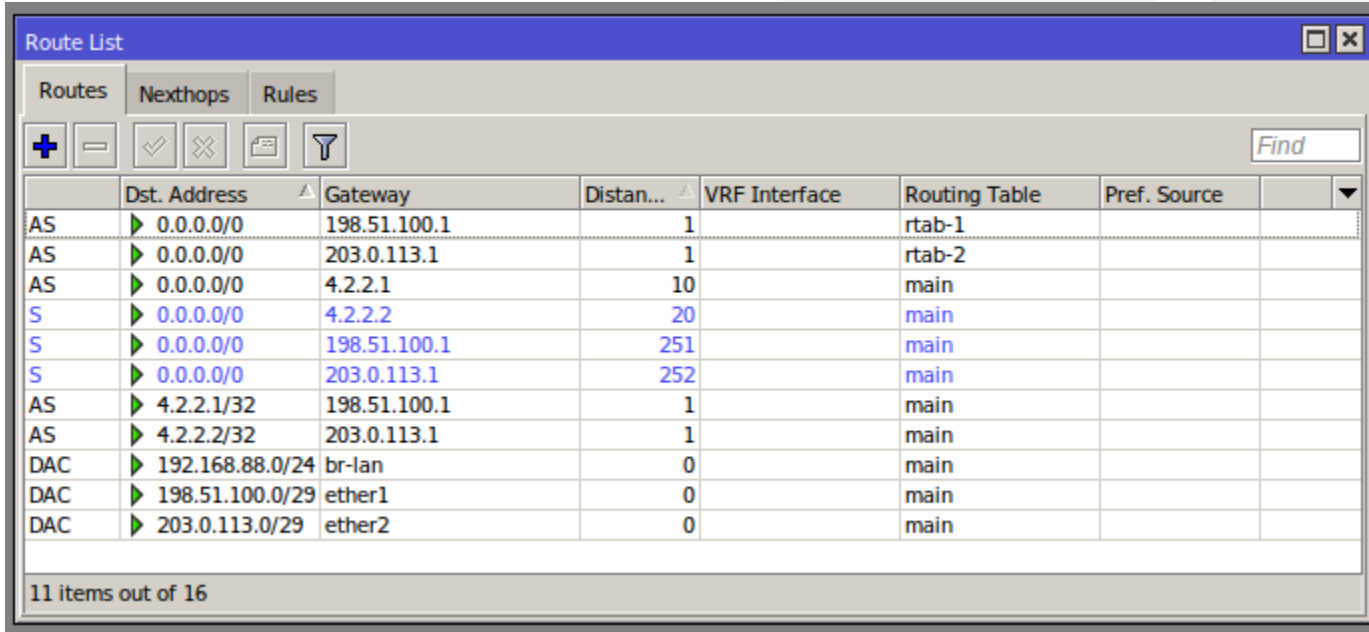
DST-NAT так же будет работать.

Route Recursive failover

Отказоустойчивость через рекурсивные маршруты

```
[admin@MikroTik] /ip/route> export
# dec/11/2021 01:28:53 by RouterOS 7.1
# software id =
#
/ip route
add distance=251 gateway=198.51.100.1
add distance=252 gateway=203.0.113.1
add gateway=198.51.100.1 routing-table=rta-1
add gateway=203.0.113.1 routing-table=rta-2
add dst-address=4.2.2.1/32 gateway=198.51.100.1 scope=11
add dst-address=4.2.2.2/32 gateway=203.0.113.1 scope=11
add check-gateway=ping distance=10 gateway=4.2.2.1 target-
scope=11
add check-gateway=ping distance=20 gateway=4.2.2.2 target-
scope=11
```

Route recursive

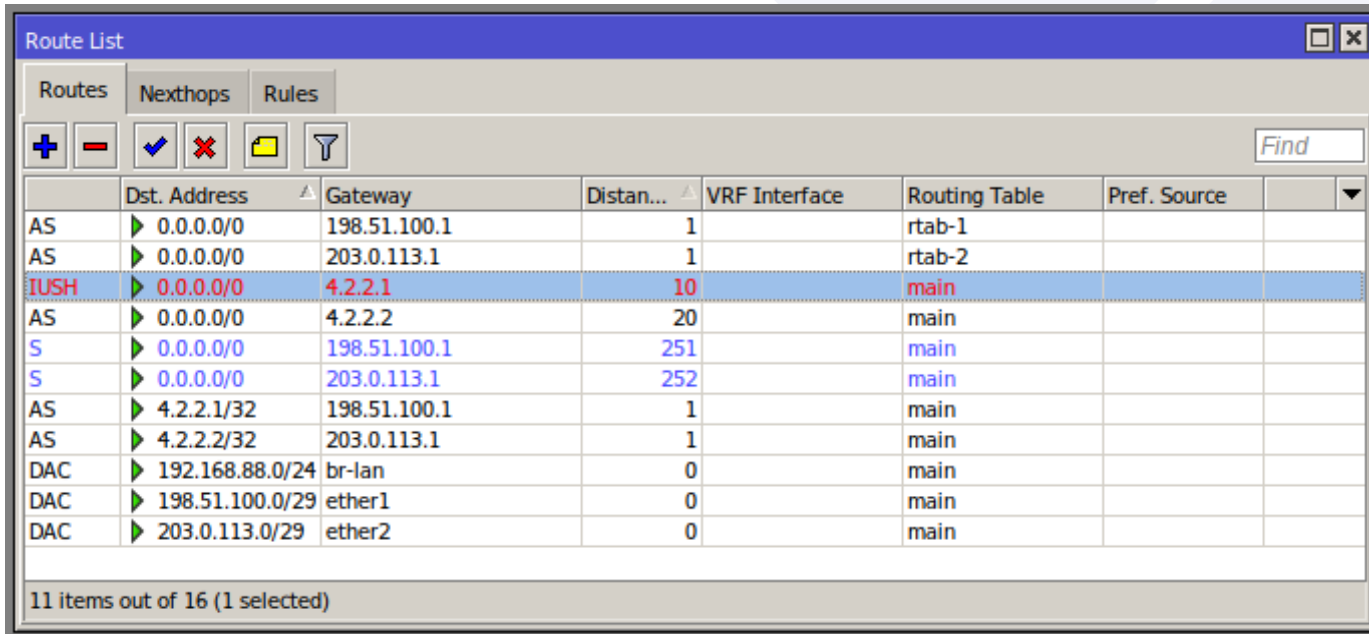


The screenshot shows the 'Route List' window in Mikrotik WinBox. The window has tabs for 'Routes', 'Nexthops', and 'Rules'. Below the tabs are several icons: a plus sign, a minus sign, a checkmark, a cross, a document, and a funnel. A search box labeled 'Find' is on the right. The main area contains a table with the following data:

	Dst. Address	Gateway	Distan...	VRF Interface	Routing Table	Pref. Source	
AS	▶ 0.0.0.0/0	198.51.100.1	1		rtab-1		
AS	▶ 0.0.0.0/0	203.0.113.1	1		rtab-2		
AS	▶ 0.0.0.0/0	4.2.2.1	10		main		
S	▶ 0.0.0.0/0	4.2.2.2	20		main		
S	▶ 0.0.0.0/0	198.51.100.1	251		main		
S	▶ 0.0.0.0/0	203.0.113.1	252		main		
AS	▶ 4.2.2.1/32	198.51.100.1	1		main		
AS	▶ 4.2.2.2/32	203.0.113.1	1		main		
DAC	▶ 192.168.88.0/24	br-lan	0		main		
DAC	▶ 198.51.100.0/29	ether1	0		main		
DAC	▶ 203.0.113.0/29	ether2	0		main		

11 items out of 16

Route recursive. Fail ISP1



Route List

Routes Nexthops Rules

+ - ✓ ✗ 📄 🔍 Find

	Dst. Address	Gateway	Distanc...	VRF Interface	Routing Table	Pref. Source	
AS	▶ 0.0.0.0/0	198.51.100.1	1		rtab-1		
AS	▶ 0.0.0.0/0	203.0.113.1	1		rtab-2		
IUSH	▶ 0.0.0.0/0	4.2.2.1	10		main		
AS	▶ 0.0.0.0/0	4.2.2.2	20		main		
S	▶ 0.0.0.0/0	198.51.100.1	251		main		
S	▶ 0.0.0.0/0	203.0.113.1	252		main		
AS	▶ 4.2.2.1/32	198.51.100.1	1		main		
AS	▶ 4.2.2.2/32	203.0.113.1	1		main		
DAC	▶ 192.168.88.0/24	br-lan	0		main		
DAC	▶ 198.51.100.0/29	ether1	0		main		
DAC	▶ 203.0.113.0/29	ether2	0		main		

11 items out of 16 (1 selected)

Check gateway

```
## log check gateway ISP1
```

```
10:29:41 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

```
10:29:51 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

```
10:30:01 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

```
10:30:11 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

```
10:30:21 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

```
10:30:31 forward: proto ICMP (type 8, code 0), 198.51.100.6->4.2.2.1,
```

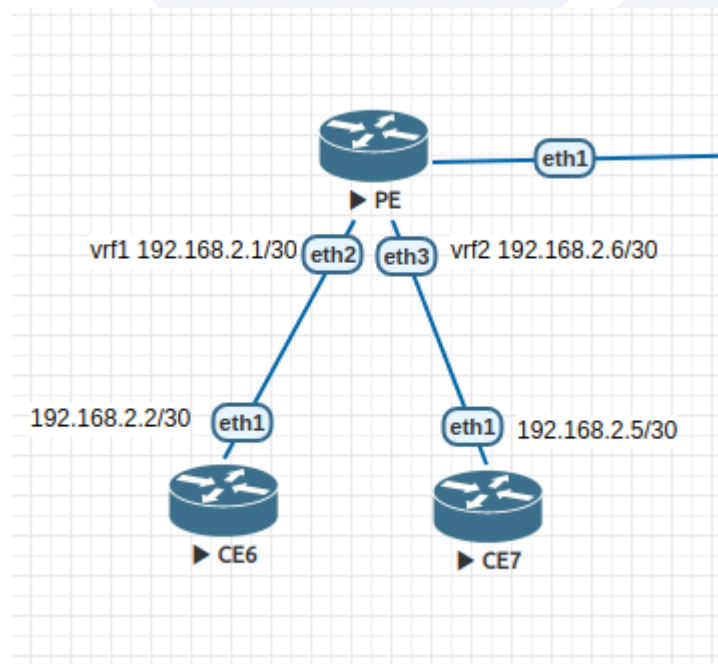
02

VRF изолированный!

Закрою гештальт с MUM 2019 <https://clck.ru/ZRYyM>
слайды 17-21



Схема VRF



PE

Provider Edge router —
граничный
маршрутизатор
провайдера

```
[admin@PE] > export
# dec/13/2021 11:18:15 by RouterOS 7.1
# software id =
#
/ip vrf
add interfaces=ether3 name=vrf2
add interfaces=ether2 name=vrf1
/ip address
add address=192.168.2.1/30 interface=ether2 network=192.168.2.0
add address=192.168.2.6/30 interface=ether3 network=192.168.2.4
/ip dhcp-client
add interface=ether1
/system identity
set name=PE
```

CE6

Customer Edge router —
граничный маршрутизатор
клиента, который
подключен в сеть
провайдера.

```
[admin@CE6] > export
# dec/13/2021 11:15:17 by RouterOS 6.46.8
# software id =
#
#
#
/ip address
add address=192.168.2.2/30 interface=ether1 network=192.168.2.0
/ip route
add distance=1 gateway=192.168.2.1
/system identity
set name=CE6
[admin@CE6] >
[admin@CE6] > ping count=2 192.168.2.1
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.1                          56  64 5ms
    1 192.168.2.1                          56  64 3ms
sent=2 received=2 packet-loss=0% min-rtt=3ms avg-rtt=4ms max-rtt=5ms

[admin@CE6] > ping count=2 192.168.2.6
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.1                          84  64 3ms  net unreachable
    1 192.168.2.1                          84  64 3ms  net unreachable
sent=2 received=0 packet-loss=100%

[admin@CE6] > ping count=2 192.168.2.5
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.1                          84  64 3ms  net unreachable
    1 192.168.2.1                          84  64 3ms  net unreachable
sent=2 received=0 packet-loss=100%
```


CE7

Customer Edge router —
граничный маршрутизатор
клиента, который
подключен в сеть
провайдера.

```
[admin@CE7] > /export
# dec/13/2021 10:59:34 by RouterOS 6.46.8
# software id =
#
#
#
/ip address
add address=192.168.2.5/30 interface=ether1 network=192.168.2.4
/ip route
add distance=1 gateway=192.168.2.6
/system identity
set name=CE7
```

```
[admin@CE7] > /ping count=2 192.168.2.6
SEQ HOST                               SIZE TTL TIME STATUS
0 192.168.2.6                          56 64 2ms
1 192.168.2.6                          56 64 2ms
sent=2 received=2 packet-loss=0% min-rtt=2ms avg-rtt=2ms max-rtt=2ms
```

```
[admin@CE7] > /ping count=2 192.168.2.1
SEQ HOST                               SIZE TTL TIME STATUS
0 192.168.2.6                          84 64 2ms net unreachable
1 192.168.2.6                          84 64 2ms net unreachable
sent=2 received=0 packet-loss=100%
```

```
[admin@CE7] > /ping count=2 192.168.2.2
SEQ HOST                               SIZE TTL TIME STATUS
0 192.168.2.6                          84 64 2ms net unreachable
1 192.168.2.6                          84 64 5ms net unreachable
sent=2 received=0 packet-loss=100%
```

03

VRF "route leaking"

vrf-lite and "route leaking"

PE

"route leaking"

```
[admin@PE] > /export
# dec/13/2021 11:29:48 by RouterOS 7.1
# software id =
#
/ip vrf
add interfaces=ether2 name=vrf1
add interfaces=ether3 name=vrf2
/ip address
add address=192.168.2.1/30 interface=ether2 network=192.168.2.0
add address=192.168.2.6/30 interface=ether3 network=192.168.2.4
/ip dhcp-client
add interface=ether1

/ip route
add distance=1 dst-address=192.168.2.4/30 gateway=ether3@vrf2 routing-table=vrf1
add distance=1 dst-address=192.168.2.0/30 gateway=ether2@vrf1 routing-table=vrf2

/system identity
set name=PE
```

CE6

"route leaking"

```
[admin@CE6] > /export
# dec/13/2021 11:37:58 by RouterOS 6.46.8
# software id =
#
#
#
/ip address
add address=192.168.2.2/30 interface=ether1 network=192.168.2.0
/ip route
add distance=1 gateway=192.168.2.1
/system identity
set name=CE6
```

```
[admin@CE6] > ping count=2 192.168.2.1
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.1                          56 64 4ms
    1 192.168.2.1                          56 64 2ms
sent=2 received=2 packet-loss=0% min-rtt=2ms avg-rtt=3ms max-rtt=4ms
```

```
[admin@CE6] > ping count=2 192.168.2.6
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.6                          56 64 4ms
    1 192.168.2.6                          56 64 4ms
sent=2 received=0 packet-loss=100%
```

```
[admin@CE6] > ping count=2 192.168.2.5
  SEQ HOST                                SIZE TTL TIME  STATUS
    0 192.168.2.5                          56 63 8ms
    1 192.168.2.5                          56 63 7ms
sent=2 received=2 packet-loss=0% min-rtt=7ms avg-rtt=7ms max-rtt=8ms
```

04

VRF management

PE

vrf management



```
[admin@PE] /ip/service> set ssh vrf=vrf1
[admin@PE] /ip/service> pri
Flags: X, I - INVALID
Columns: NAME, PORT, CERTIFICATE, VRF
#  NAME      PORT  CERTIFICATE  VRF
0  X telnet    23      none         main
1  X ftp      21      none         main
2  X www      80      none         main
3  ssh       22      none         vrf1
4  X www-ssl  443    none         main
5  X api      8728   none         main
6  winbox    8291   none         main
7  X api-ssl  8729   none         main
```

vrf management

Route leaks не помогли

```
[admin@CE6] > sys ssh 192.168.2.1  
password:
```

```
MMM      MMM      KKK      TTTTTTTTTTTT      KKK  
MMMM     MMMM     KKK      TTTTTTTTTTTT      KKK  
MMM MMMM MMM III  KKK KKK  RRRRRR      000000      TTT      III  KKK  KKK  
MMM  MM  MMM  III  KKKKK  RRR  RRR  000 000      TTT      III  KKKKK  
MMM      MMM  III  KKK KKK  RRRRRR      000 000      TTT      III  KKK  KKK  
MMM      MMM  III  KKK KKK  RRR  RRR  000000      TTT      III  KKK  KKK
```

MikroTik RouterOS 7.1 (c) 1999-2021

<https://www.mikrotik.com/>

Press F1 for help

```
[admin@PE] >
```

```
[admin@CE7] > sys ssh 192.168.2.6  
connectHandler: Connection refused
```

Welcome back!

```
# Route leaks не помогли.
```

05

VRF vpn

VRF RD & RT

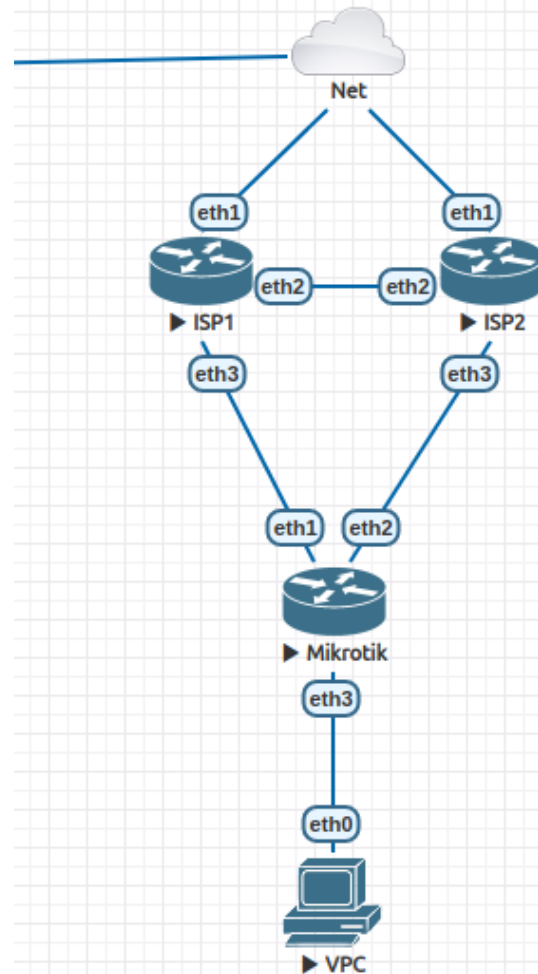
```
#####  
# vrf vpn  
#####
```

```
[admin@PE] /routing/bgp/vpn> add  
copy-from      export-route-targets  label-allocation-policy  vrf  
disabled       import-filter          redistribute  
export-filter  import-route-targets  route-distinguisher
```

06

VRF internet

Схема Dualwan



VRF internet

```
/ip vrf
add interfaces=ether1 name=vrf1
add interfaces=ether2 name=vrf2

/ip address
add address=10.51.100.6/29 interface=ether1
add address=10.51.100.6/29 interface=ether2

/ip route
add check-gateway=ping distance=251 dst-address=0.0.0.0/0 gateway=10.51.100.1@vrf1 routing-table=main
add check-gateway=ping distance=252 dst-address=0.0.0.0/0 gateway=10.51.100.1@vrf2 routing-table=main
add dst-address=192.168.88.0/24 gateway=br-lan routing-table=vrf1
add dst-address=192.168.88.0/24 gateway=br-lan routing-table=vrf2
```

Без маркировок

VRF internet

Route List

Routes Nexthops Rules

+ - ✓ ✗ 📁 🔍 Find

	Dst. Address	Gateway	Distance	VRF Interface	Routing Table	Pref. Source
AS	0.0.0.0/0	10.51.100.1@vrf1	251		main	
S	0.0.0.0/0	10.51.100.1@vrf2	252		main	
DAC	10.51.100.0/29	ether1@vrf1	0		vrf1	
DAC	10.51.100.0/29	ether2@vrf2	0		vrf2	
DAC	192.168.88.0/24	br-lan	0		main	
AS	192.168.88.0/24	br-lan	1		vrf1	
AS	192.168.88.0/24	br-lan	1		vrf2	

7 items out of 12 (1 selected)

Ссылки

- <https://habr.com/ru/post/463813/>

- СДСМ MPLS L3VPN
<https://habr.com/post/273679/>

- MUM 2019 (mikrotik mpls)
<https://clck.ru/ZRYyM>





Спасибо за внимание!

Буду рад ответить на все ваши вопросы сейчас или свяжитесь со мной в будущем:

Telegram @smithy1208
v.kuznetsov48@ya.ru

← Конфиги

MUOM

Mikrotik User Online Meeting