IS-IS for the masses

Interoperability between Juniper, MikroTik and Huawei

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Agenda

- Hints of the IS-IS protocol
- IS-IS by MikroTik
- Testing

WhoamI

Lorenzo

- Founder of Grifonline / Linkwave ISP (1997)
- A user of MikroTik since 2006
- MikroTik Trainer since 2010 (all certfication MTCxxx)
- Founder of the Routing & Wireless Academy (2016)
- Proud member of RoutedWorld.com

Who's Who

- Network Consultants
- Our company is MPAE
  Your Additional Engine
- We work on major routing and security manufacturer
- Total ninety years old
- Today working on SRv6, Non-Terrestrial Network, Network inside the body, Security and DDoS
- We build and operate public, academic, corporate and government networks
- Working with TCP/IP since 1985

Hints of the IS-IS protocol

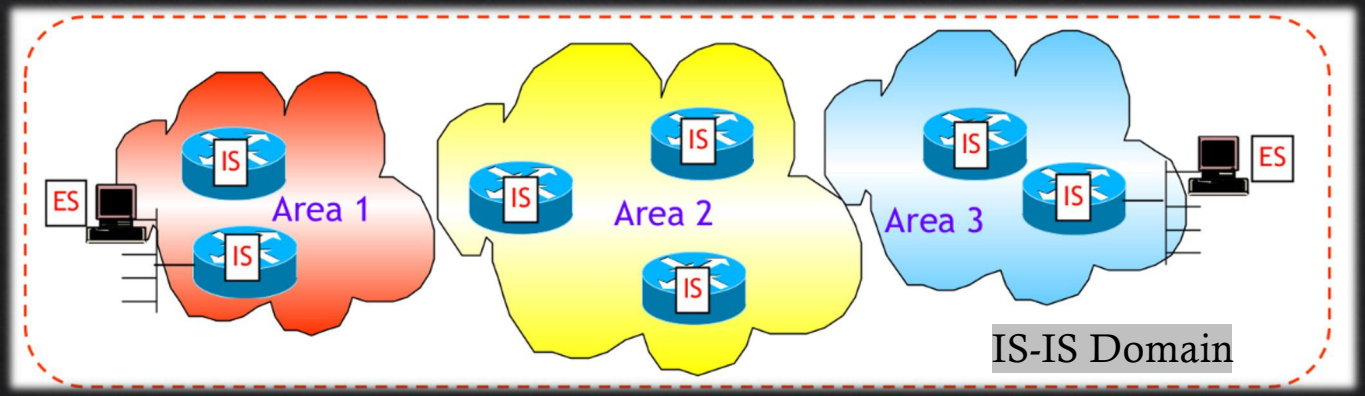
First of all: IS-IS is ……

- ✓ Intermediate System - Intermediate System
  ISO/IEC 10589: IS-IS intra-domain routing exchange protocol
- ✓ Integrated IS-IS is an extension of the IS-IS protocol for the routing in a mixed environment IP/OSI
  RFC 1195 (December 1990): Use of OSI IS-IS for Routing in TCP/IP and Dual Environments
- ✓ OSPFv2 - RFC 2178 (April 1998) IPv4 only
  OSPFv3 - RFC 5340 (July 2008) IPv6 only

First of all: IS-IS is ……

In a OSI network we can see 4 entities:

- ✓ The '**area'** is a logic entity made by routers and connections we can find inside. The areas are connected to build a backbone.
- ✓ The '**End System' (ES)** are nodes that doesn't have routing capabilities (host)
- ✓ The '**Intermediate System' (IS)** are nodes that having routing capabilities
- ✓ A **domain** is a set of OSI networks that contain a number of areas placed under a single administrative control.



First of all: IS-IS is ……

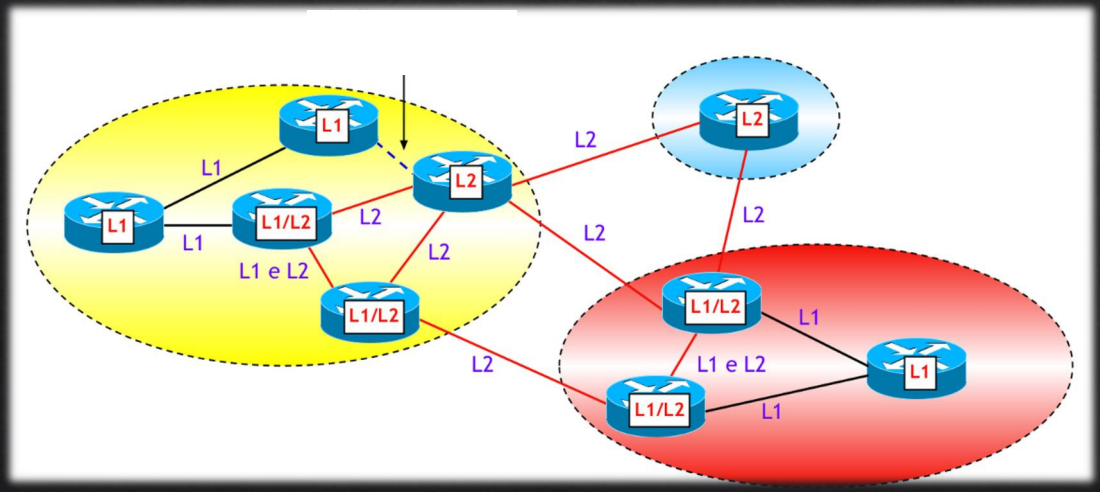
- ✓ Supports ISO (Open Systems Interconnection) and IPv4/IPv6
- ✓ IGP (interior gateway protocols)
- ✓ Link state
- ✓ Link State DataBase (LSDB)
- ✓ Shortest Path First Algorithm (Dijkstra)
- ✓ Updates, flooding process
- ✓ Two levels of hierarchical routing:
  Level-1 (routing intra-area)
  Level-2 (routing inter-area)

First of all: IS-IS is ……

- ✓ IS-IS provides two types of LSDB
  - ✓ **Level-1** (L1) LSDB: They contain topological information about the L1 and L1/L2 ISs of a single area and are used for determining intra-area paths
  - ✓ **Level-2** (L2) LSDB: contain topological information about the Backbone and are used for determining inter-area paths

Relationship between IS types and LSDB types

- ✓ L1 ISs have only one L1 LSDB
- ✓ L2 ISs have only one L2 LSDB
- ✓ L1/L2 ISs have one L1 LSDB and one L2 LSDB



Why IS-IS ??

- IS-IS uses a single link-state advertisements (LSA) PDU (LSP), versus OSPF's five
- IS-IS is a protocol that handles IPv4 and IPv6 in the same instance
- IS-IS is simpler and more efficient
- IS-IS uses a single routing domain
- IS-IS is faster at converging

OSPF

- Works at layer 3 (IPv4 or IPv6)
- Router ID in IPv4 format
- Mandatory backbone area (0.0.0.0) where to connect the other areas
- Designated router DR/BDR
- LSA updated every 30 min
- Boundary router between areas
- Can be used with BFD
- Supports authentication and encryption

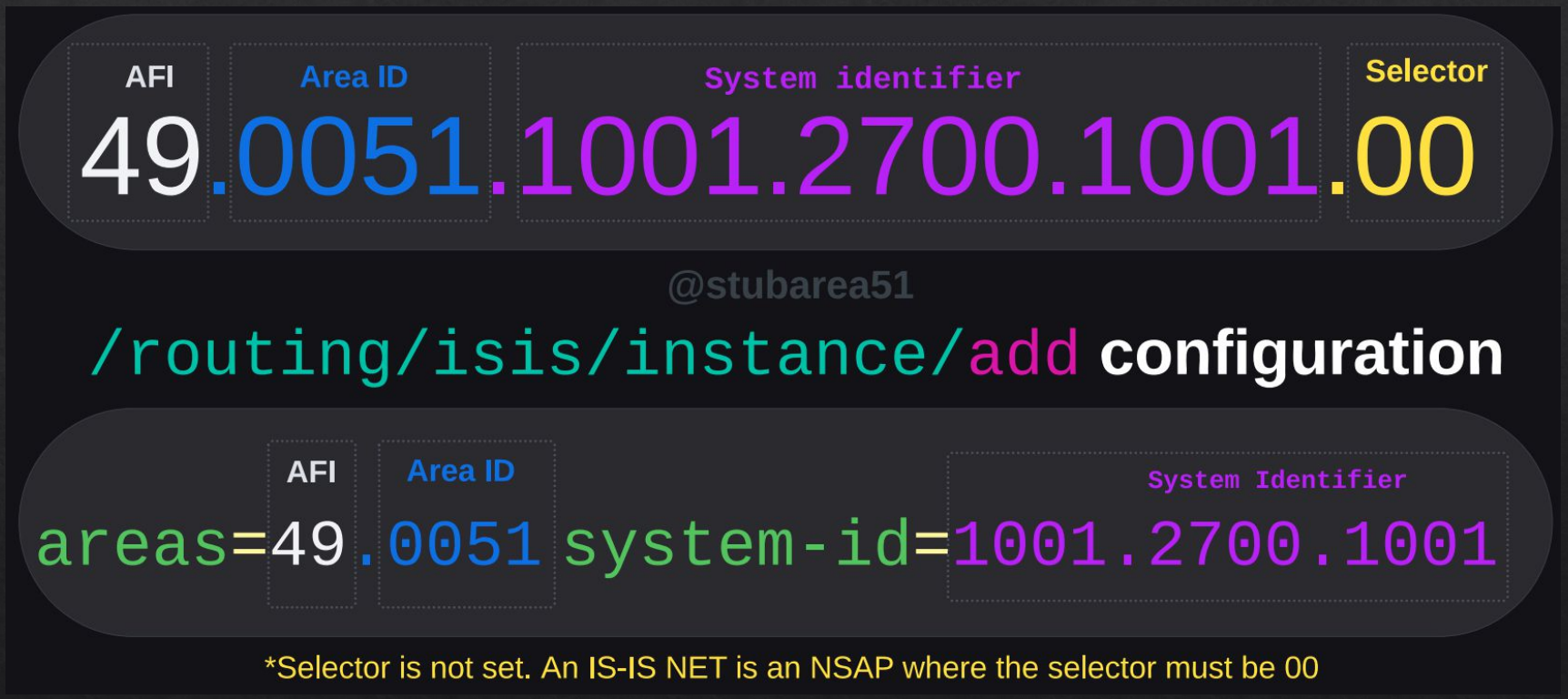
IS-IS

- Works at layer 2 (LLC/OSI)
- System ID in CLNS format
- Free design: L1 – L2 (*backbone) – L1/L2
- Designated IS DIS (no backup)
- LSP updated every 20 min
- Border router between areas
- Can be used with BFD
- Does not support authentication and/or encryption

RouterOS and IS-IS

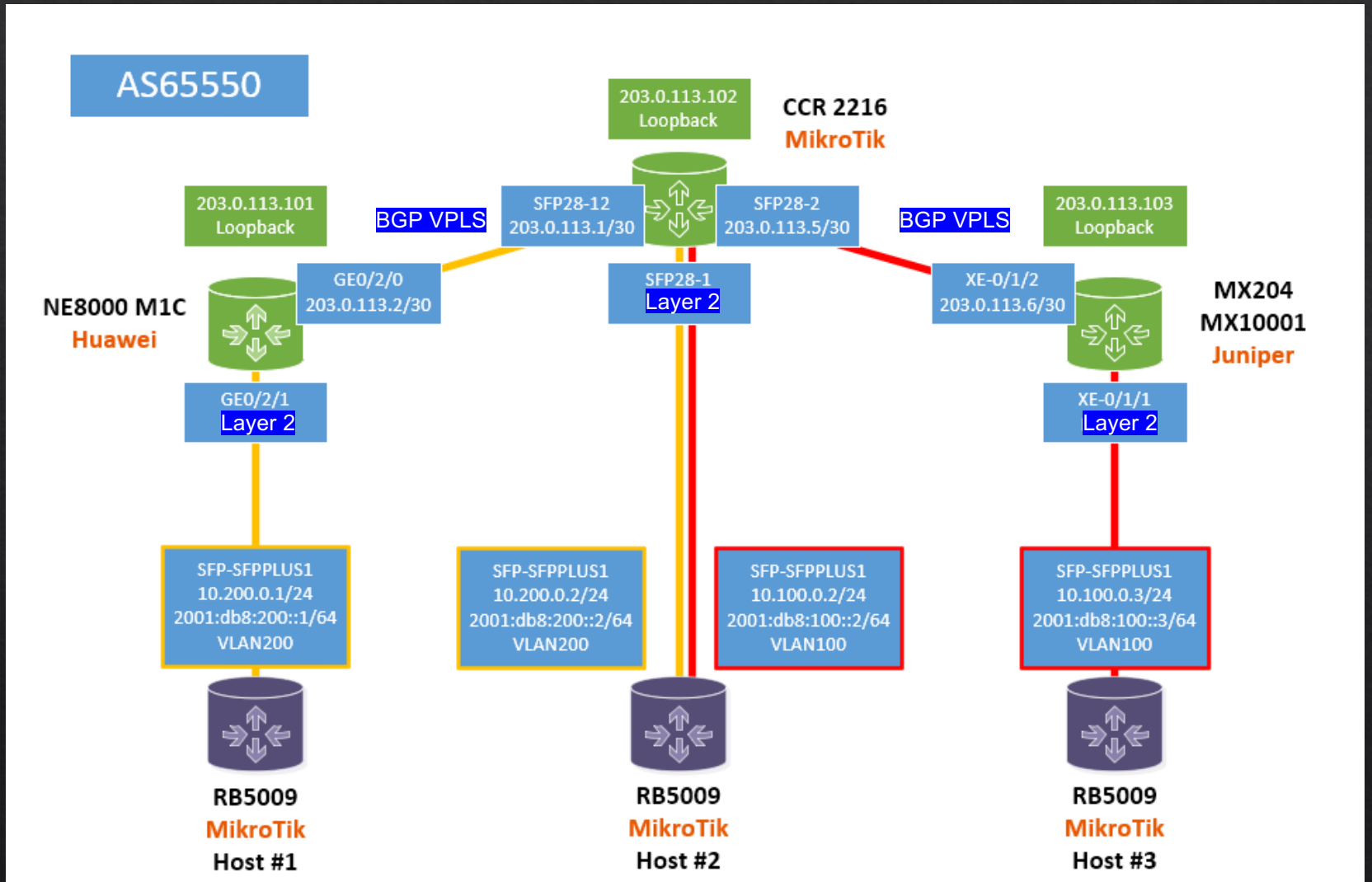
- ✓ Implemented since RouterOS version 7.13 (December 2023)
- ✓ Currently configurable via CLI only (no WinBox)
- ✓ Not present on RouterOS version 6.XX
- ✓ Working implementation but still under development
- ✓ First presentation by Kevin Myers at MTPC Prague (February 2024)

RouterOS Configuration



https://help.mikrotik.com/docs/display/ROS/IS-IS

Live Test

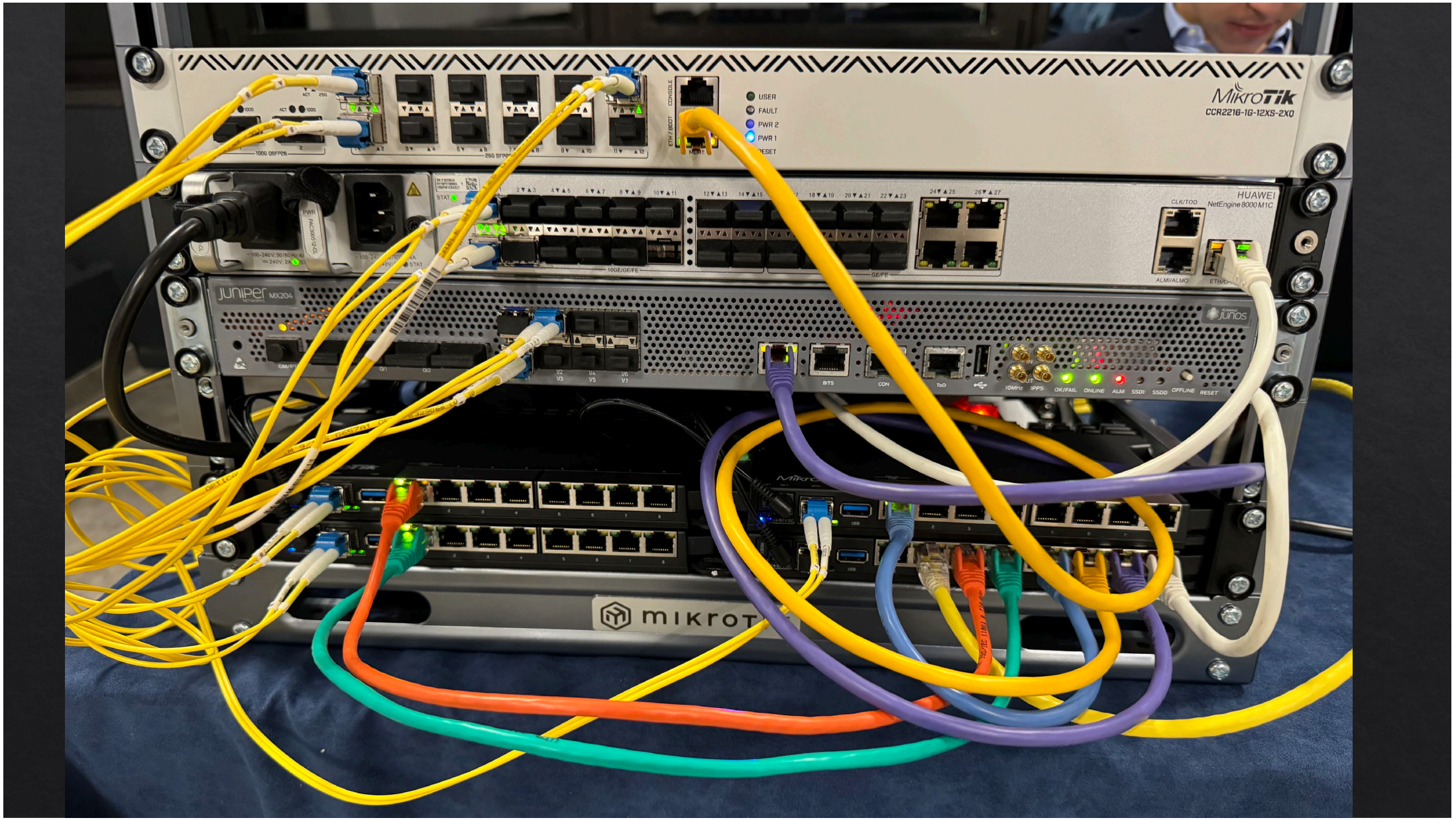


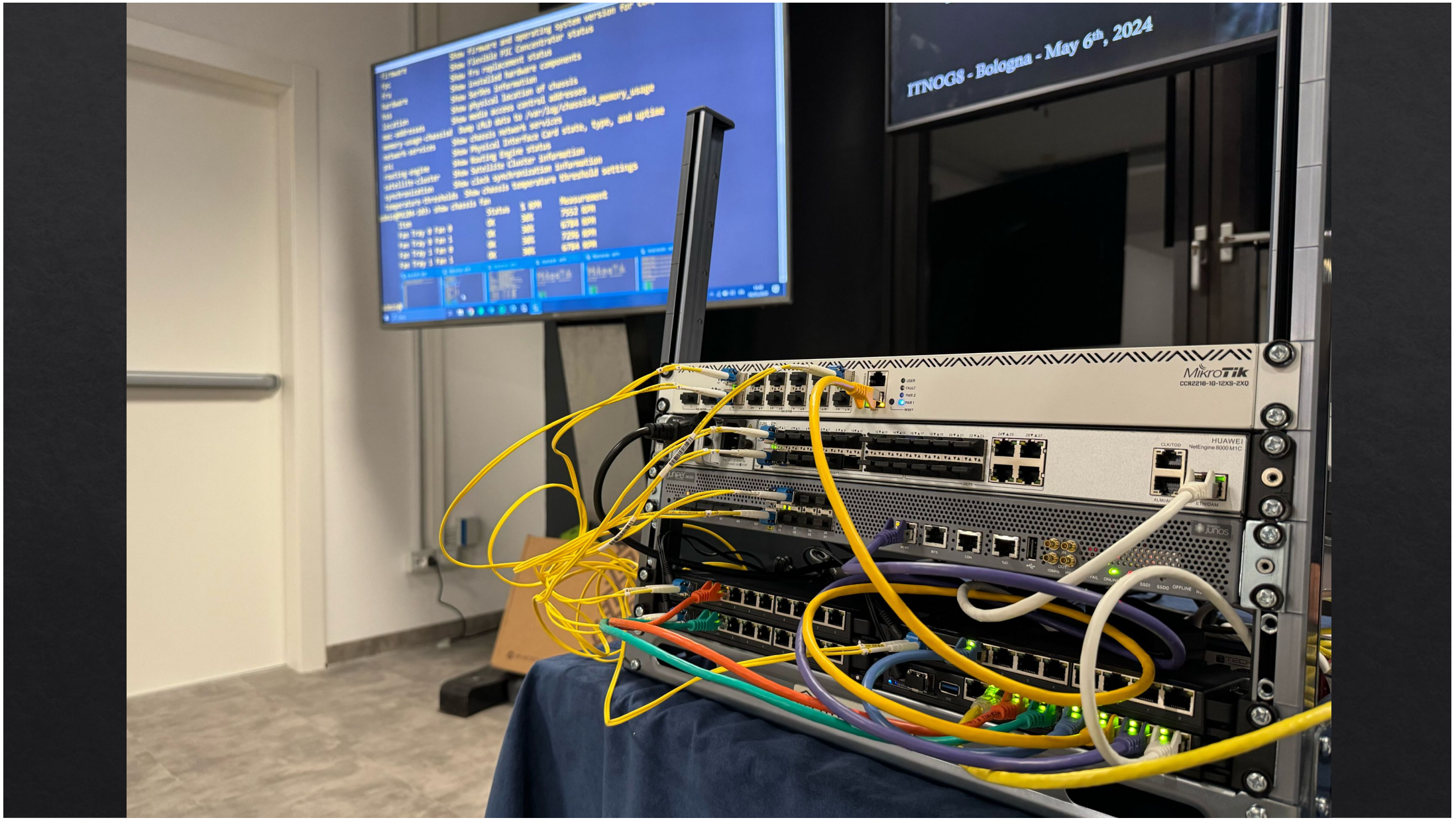
Our Setup

- ✓ RouterOS 7.14.3 Stable
- ✓ JUNOS 22.4R3
- ✓ Versatile Routing Platform (VRP) 8.220

Link 10Gbps

F/O Single Mode


MikroTik
CCR2216-1G-12XS-2XQ
USER
FAULT
PWR 2
PWR 1
HUAWEI
NetEngine 8000 M1C
juniper
MX204
junos
MIKROTIK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And that’s all …… but ….

Behind the scene:

Connecting RouterOS with Junos

- ✓ The IS-IS protocol was not working at the begin.
- ✓ Federico found in the ROS's logs: "IS-IS areas-max mismatch" error
- ✓ Checking the Wiki for "areas-max" parameter: nothing found. https://help.mikrotik.com/docs/display/ROS/IS-IS
- ✓ No ones seems to know something about this setting for the IS-IS protocol.
- ✓ Found the setting in RouterOS CLI:

```
[admin@AP1] > routing/isis/instance/add
afi             copy-from           l1.lsp-max-size             l1.out-filter-chain
areas           disabled            l1.lsp-refresh-interval...  l1.out-filter-select
areas-max       in-filter-chain     l1.lsp-update-interval      l1.redistribute
comment         l1.lsp-max-age      l1.originate-default        l2.lsp-max-age
[admin@AP1] > routing/isis/instance/add areas-max=
```

Connecting RouterOS with Junos

- ✓ Looking at Juniper docs: https://www.juniper.net/documentation/us/en/software/junos/cli-reference/topics/ref/statement/max-areas-edit-protocols-isis.html

Description

Modify the maximum number of IS-IS areas advertised.

This value is included in the Maximum Address Area field of the IS-IS common PDU header included in all outgoing PDUs.

The maximum number of areas you can advertise is restricted to 36 to ensure that the IIH PDUs have enough space to include other type, length, and value (TLV) fields, such as the Authentication and IPv4 and IPv6 Interface Address TLVs.

Options

number—Maximum number of areas to include in the IS-IS hello (IIH) PDUs and link-state PDUs.

- **Range:** 3 through 36
- **Default:** 3

Connecting RouterOS with Junos

- ✓ Federico setup **max-areas 3** on Junos and **areas-max=3** on RouterOS
- ✓ But it still didn't work.
- ✓ Using Wireshark discovered that if you set 3 on Junois the value will be still 0 but if you will setup 4 will be 4.
- ✓ No chances to get 3.
- ✓ Federico setup **nothing** on Junos and **areas-max=0** on RouterOS
- ✓ IS-IS was now up and running between Junos and RouterOS ☺

Connecting RouterOS with Huawei

- ✓ The IS-IS protocol was **not** working between RouterOS and Huawai at the begin. Again ☹
- ✓ After the experience with Juniper and RouterOS Federico take a look on the Huawei documentation: https://support.huawei.com/enterprise/en/doc/EDOC1100278527/113089db/understanding-is-is

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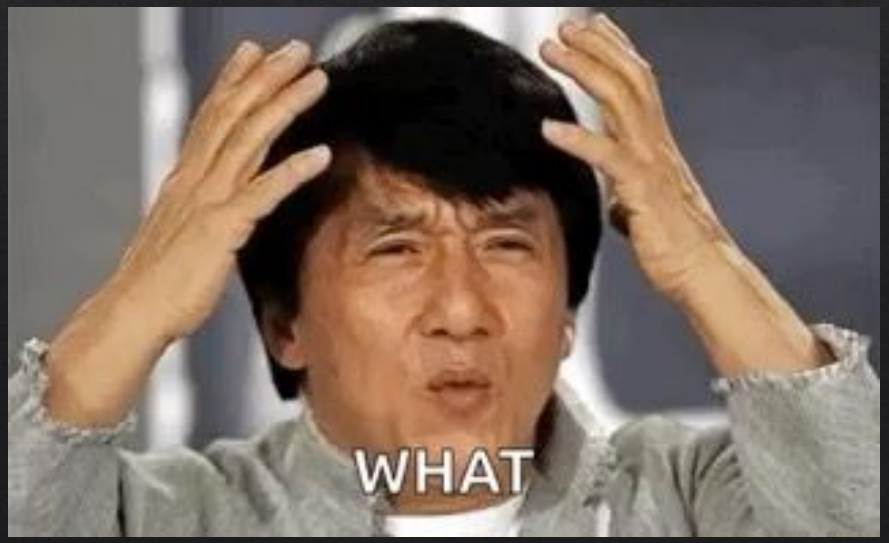
📖 **NOTE**

A maximum of three area addresses can be configured in an IS-IS process, and therefore, you can configure only a maximum of three NETs. When you configure multiple NETs, ensure that their system IDs are the same.

The Routers in an area must have the same area address.

Connecting RouterOS with Huawei

- ✓ On Huawei **Maximum Area Address**: maximum number of area addresses supported by an IS-IS area. Currently, this field has a fixed value of **0**, indicating that a maximum of **three** area addresses are supported.
- ✓ Basically this is how Huawei is managing this parameter:
- ✓ Will accept 0 and 3. But in the output is 3.



Connecting RouterOS with Huawei

- ✓ Federico setup **areas-max=3** on RouterOS
- ✓ IS-IS was now up and running between Huawei and RouterOS ☺

Connecting RouterOS with Huawei and Juniper

- ✓ But our goal was to interconnect two different vendors with RouterOS
- ✓ In the same network
- ✓ This misterious parameter can be setup on RouterOS and Juniper only.
- ✓ And this parameter, that almost no one know and setup, is in the INSTANCE of ISIS in RouterOS. We can't specifi two different values.

- ✓ Huawei <> RouterOS: will work setting **areas-max=3** on RouterOS
- ✓ RouterOS <> Juniper: will work setting **areas-max=0** on RouterOS
- ✓ Huawei <> Juniper: will work with no settings

What about the RFC??

- ✓ I started to investigate about the implementation of ISIS in RouterOS.
- ✓ Reading the RFC 1195, also updated by rfc1349, rfc5302, rfc5304 it appear that this value just ‘should match’.
- ✓ So it seems the RouterOS implementation is correct against the RFC.

- ✓ But what about the other vendors?

What about the RFC??

- ✓ I found the RFC 3719 (February 2004)
- ✓ Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS)

```
3.2.  maximumAreaAddresses

ISO 10589 requires that all Intermediate Systems in an area or domain
   use a consistent value for maximumAreaAddresses.  Common practice is
   for an implementation to use the value 3.  Therefore an
   implementation that only supports 3 can expect to interoperate
   successfully with other conformant systems.

ISO 10589 specifies that an advertised value of 0 is treated as
   equivalent to 3, and that checking the value for consistency may be
   omitted if an implementation only supports the value 3.

An implementation SHOULD use the value 3, and it SHOULD check the
   value advertised in IS-IS PDUs it receives.  If a router receives a
   PDU with maximumAreaAddresses that is not 0 or 3, it MUST discard the
   PDU
```

How we solved our lab?

- ✓ We had no other chance than:
- ✓ Creating TWO instances in RouterOS, one to Juniper and one to Huawei;
- ✓ Redistribute the routes.
- ✓ Was not a ‘good solution’ but solved the lab.

```
/routing isis instance
add afi=ip areas=49.0001 areas-max=0 disabled=no l2.redistribute=connected \
    name=isis-juniper system-id=2030.0011.3102

add afi=ip areas=49.0001 areas-max=3 l2.redistribute=connected name=\
    isis-huawei system-id=2030.0011.3102
```

What I think about our discovery

- ✓ We did not had an expensive Cisco device to make test with this brand, that's why we used Huawei and Juniper, brand in the same market range of MikroTik (almost..)
- ✓ But it seems that all the vendors did something against the ISO 10589 stated in the RFC 3719
- ✓ I hope with our experience you'll be able to integrate RouterOS with other vendors running ISIS
- ✓ Do we'll need this kind settings on RouterOS?


Q&A


Thank You !
More details ? Contact us