Autoconfiguration and advanced Monitoring

of MikroTik Devices

Agenda

- Company introduction

- Motivation
- Tools
- Examples

FMS Internetservice GmbH

Value Added Distribution

FMS Internetservice GmbH

- Value Added Distributor
  - Distribution
  - Training
  - Consulting
  - Support

- Founded 1997
- Southern Germany

Our MikroTik History

- Oldest active MikroTik Distributor in Germany
- Early training partner TR11 & TR23
- First MTCSA certified German distributor
- 4 certified MikroTik consultants
- > 60 years of MikroTik experience ☺

- Inhouse training facility for all levels

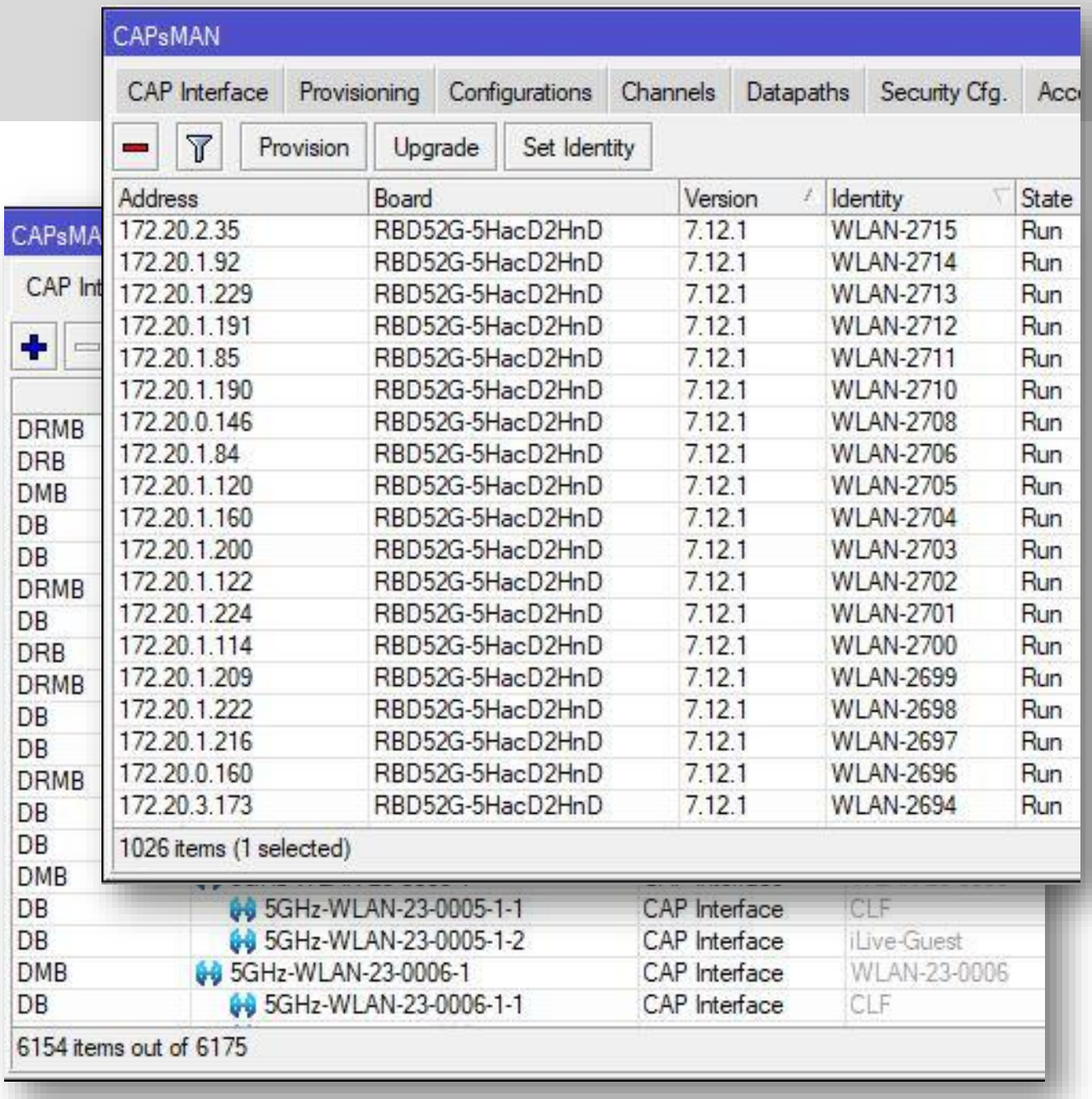
See Training Schedule

MikroTik Consulting, Support and Projects

- Consulting, support, projects all over the world
- Robots, roller coasters, cruise vessels, flight simulators, you name it …
- Large networks
  - ISPs
  - IoT/M2M projects
  - Municipals
  - Large enterprise customers

Experience & Tools

- Staging and pre configuration environment
- > 10.000 devices / year
- Experience in network design
- Operation of large networks



Motivation – Why sould you care?

Autoconfiguration, Monitoring, Visualisation

Motivation

- Faster implementation
  - Time to market
- Better service quality
- Improved security
- Less resources
  - Implementation & Operation
  - Cost & manpower
- Scalibility

Tools – What can we use?

Protocols and Software

Available and unavailable Protocols

AVAILABLE

- SNMP (Simple Networks Management Protocol)
- TR069
- API
  - “Old” API
  - REST API
- Trafficflow (Netflow 9)
- Syslog
- MNDP (MikroTik Neighbor Discovery)
- LLDP (Link Layer Discovery Protocol)

UNAVAILABLE

- No Netconf/Yang support (used in modern SDN setups)
- No TR369 support

Third Party Tools

- NMS
  - Monitoring
  - Alarms
  - Visualization
- ACS (TR069 Autoconfiguration Server)
  - Update and configuration of devices
  - Usually rule based

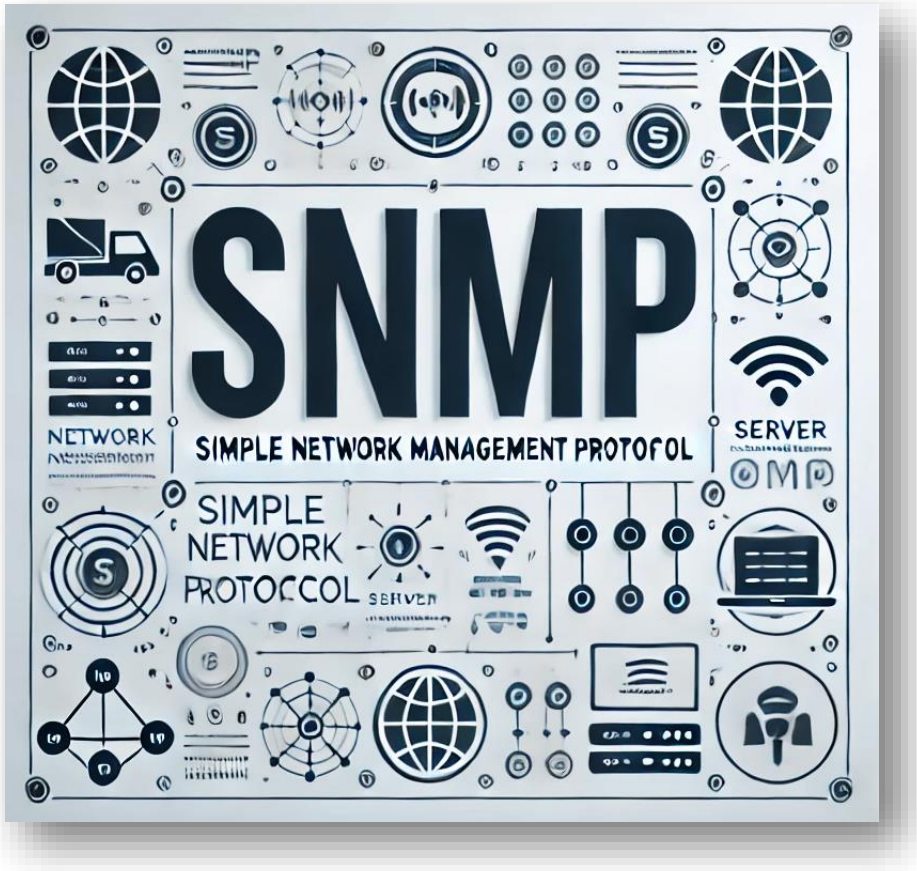
POSTMAN

SNMP

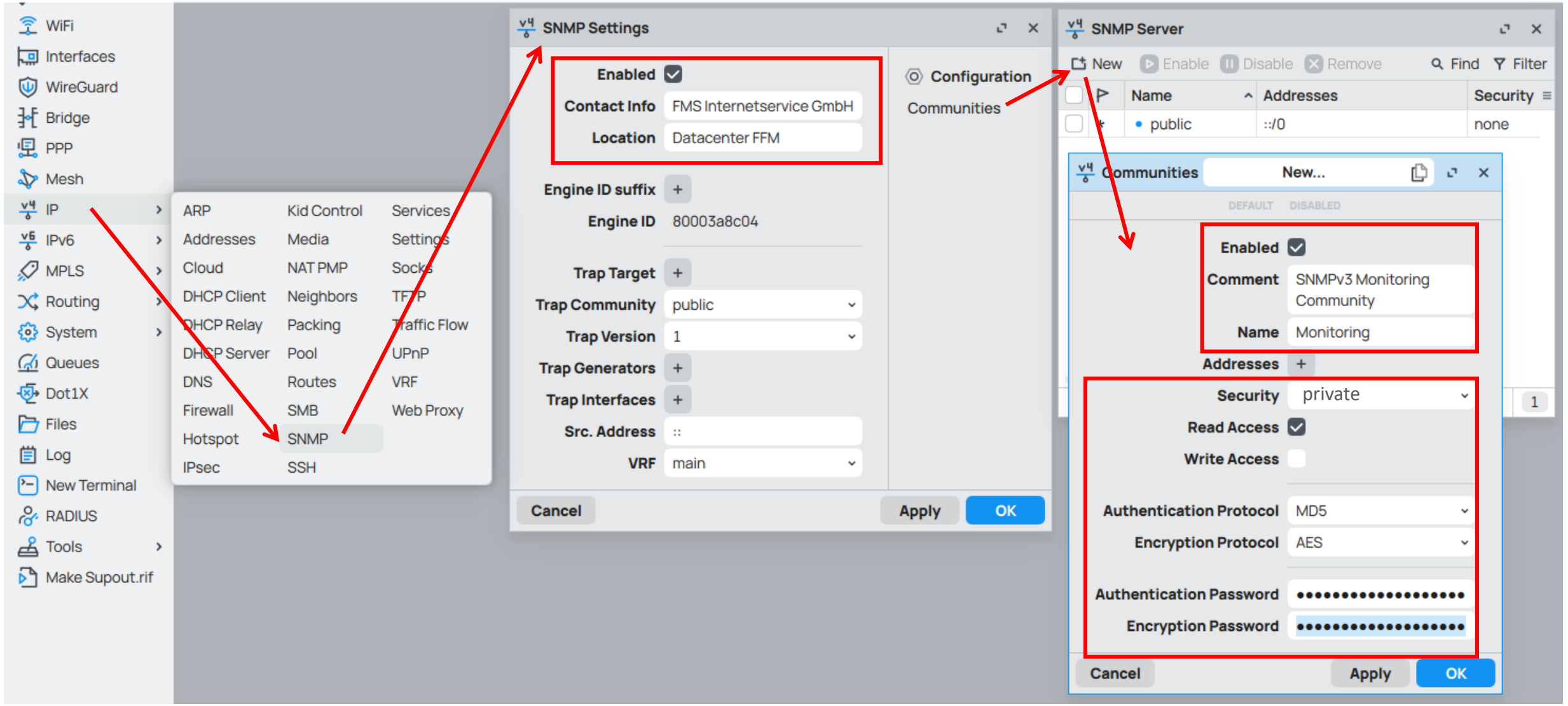
- Use v3
- Need of an individual engine id
- Set engine id by script

- MIB is not extensive
- Few traps

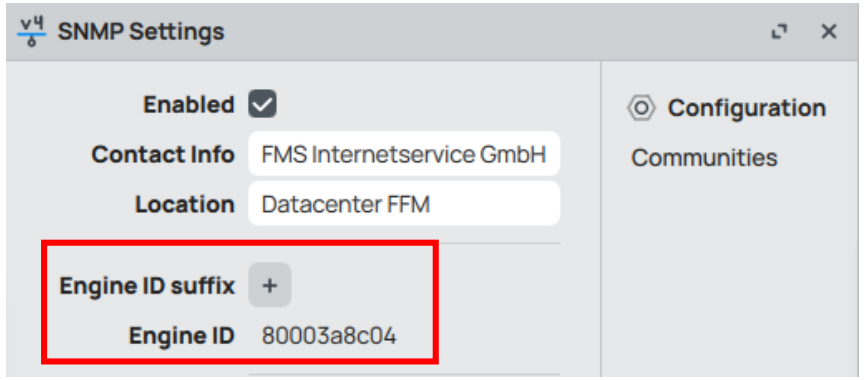
- /print oid

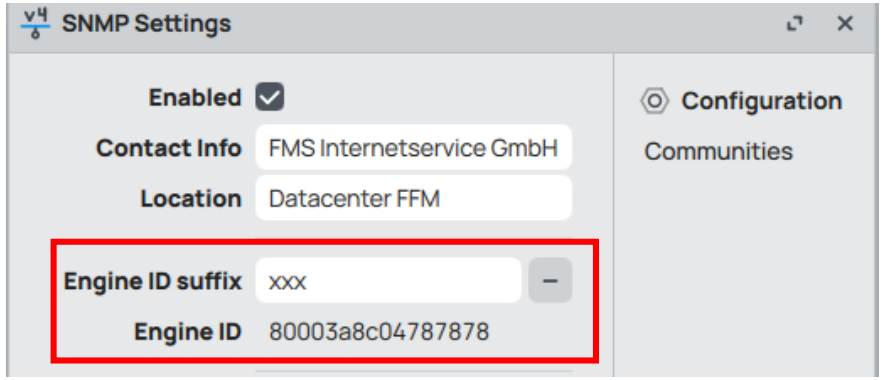


SNMP Configuration



SNMP Configuration





Set Engine Id suffix to receive a unique Engine Id

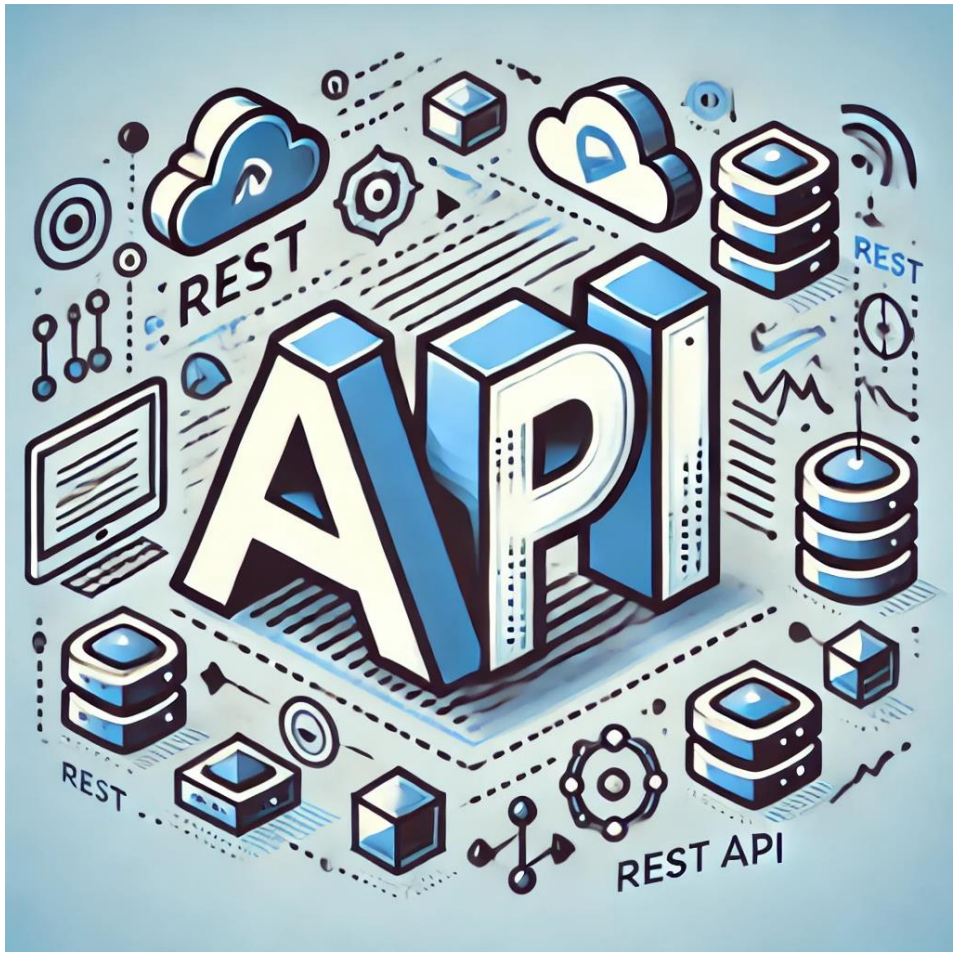
RouterOS 7.x on MikroTik hardware
/snmp/set enabled=yes engine-id-suffix=[/system/routerboard/get serial-number]

RouterOS 7.x on CHR
/snmp set enabled=yes engine-id-suffix=[/system/license/get system-id]

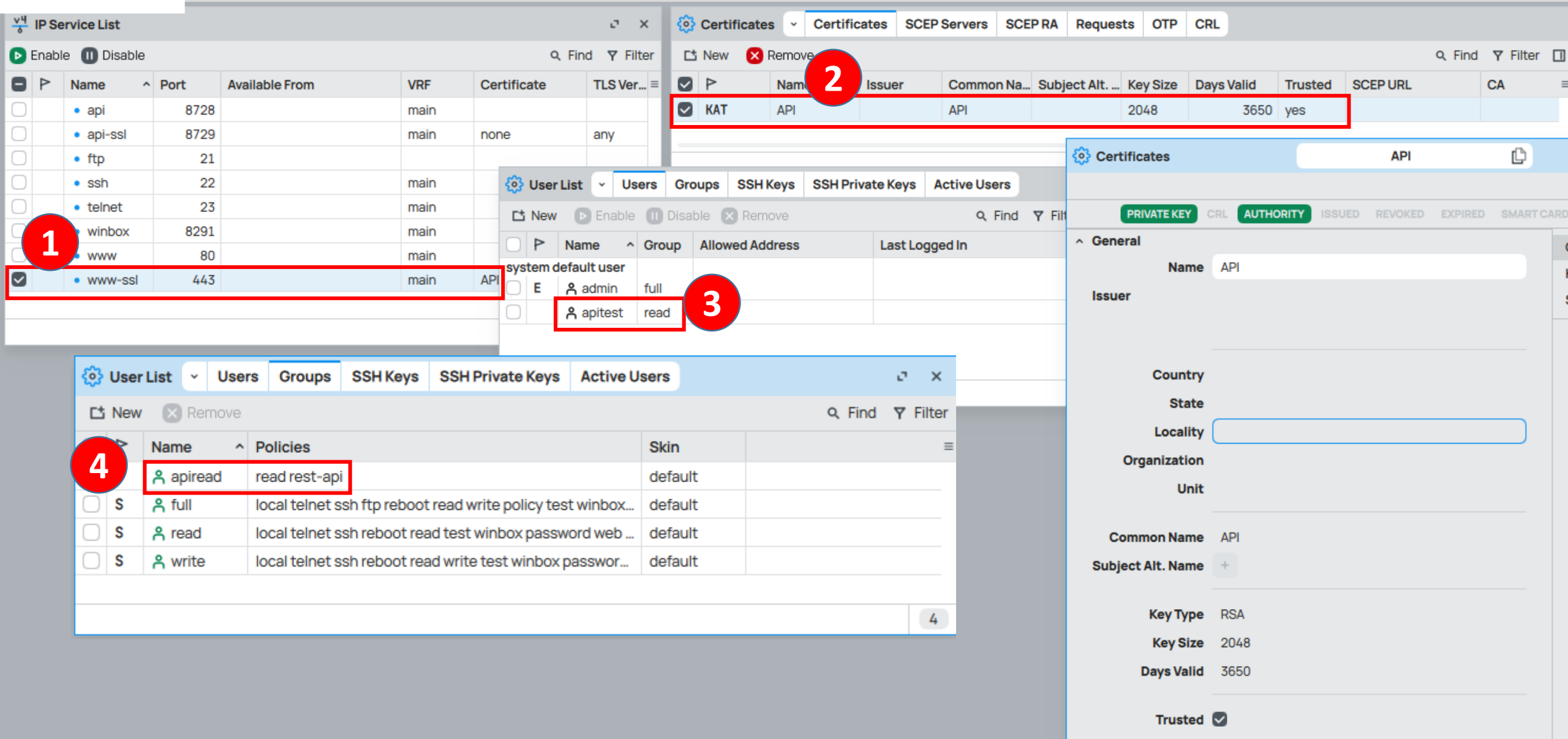
RouterOS 6.x on CHR
/snmp set enabled=yes engine-id=[/system license get system-id]

API

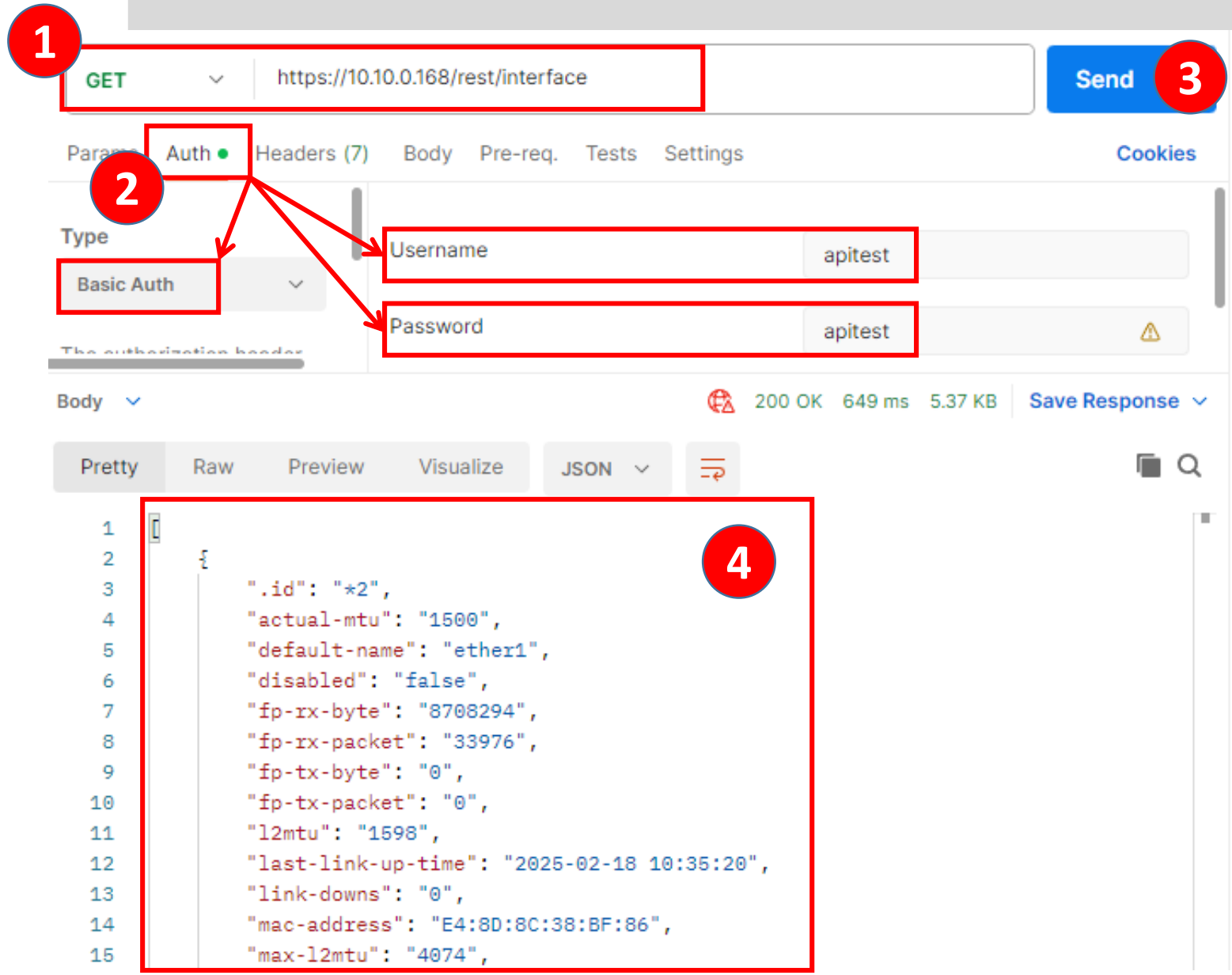
- Prefer REST API over old API
- SNMP is more efficient than API



REST API Configuration



Test REST API with Postman



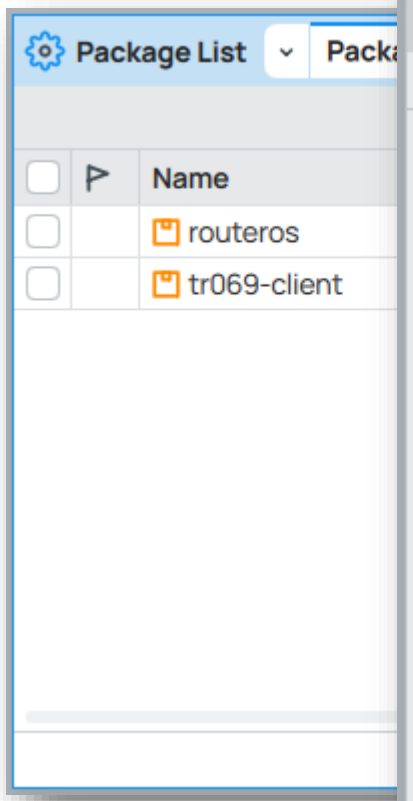
POSTMAN

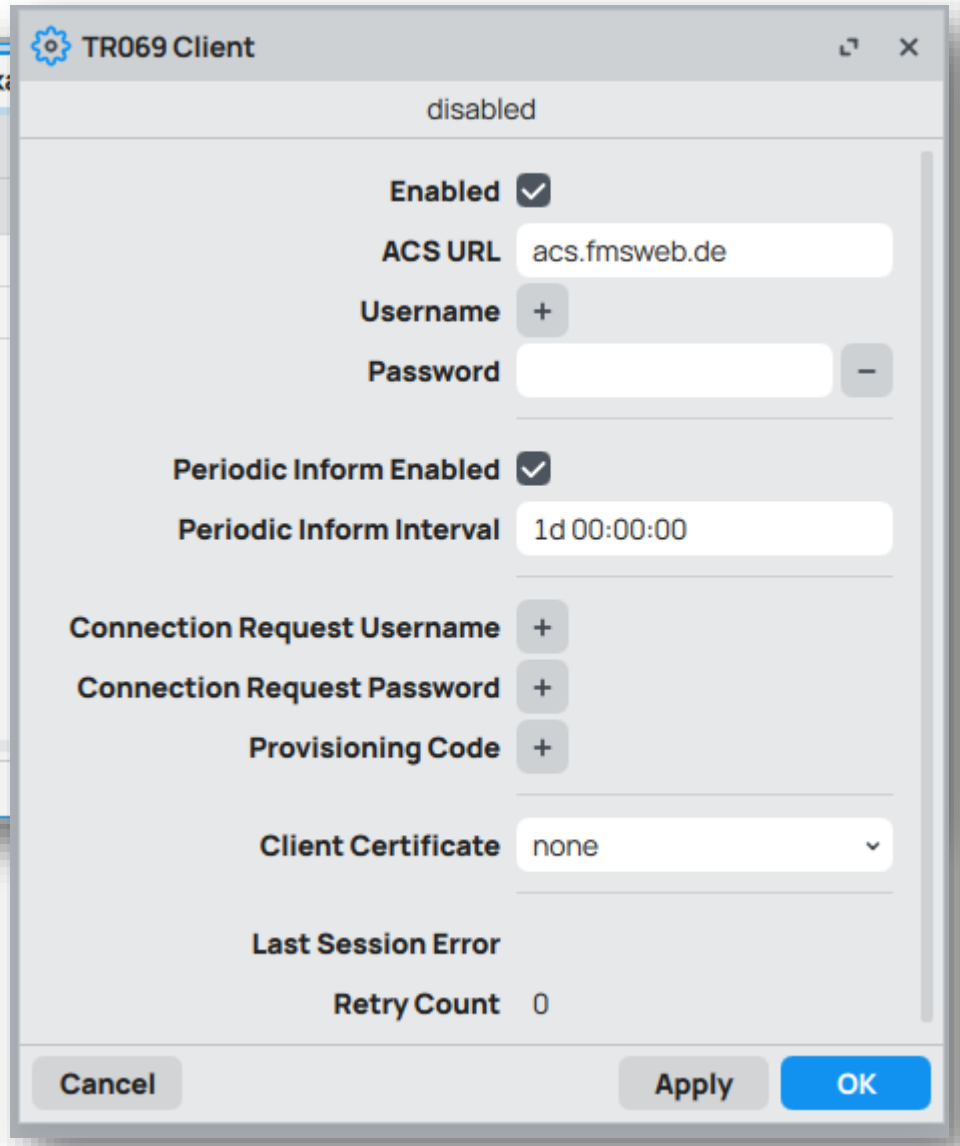
https://www.postman.com/

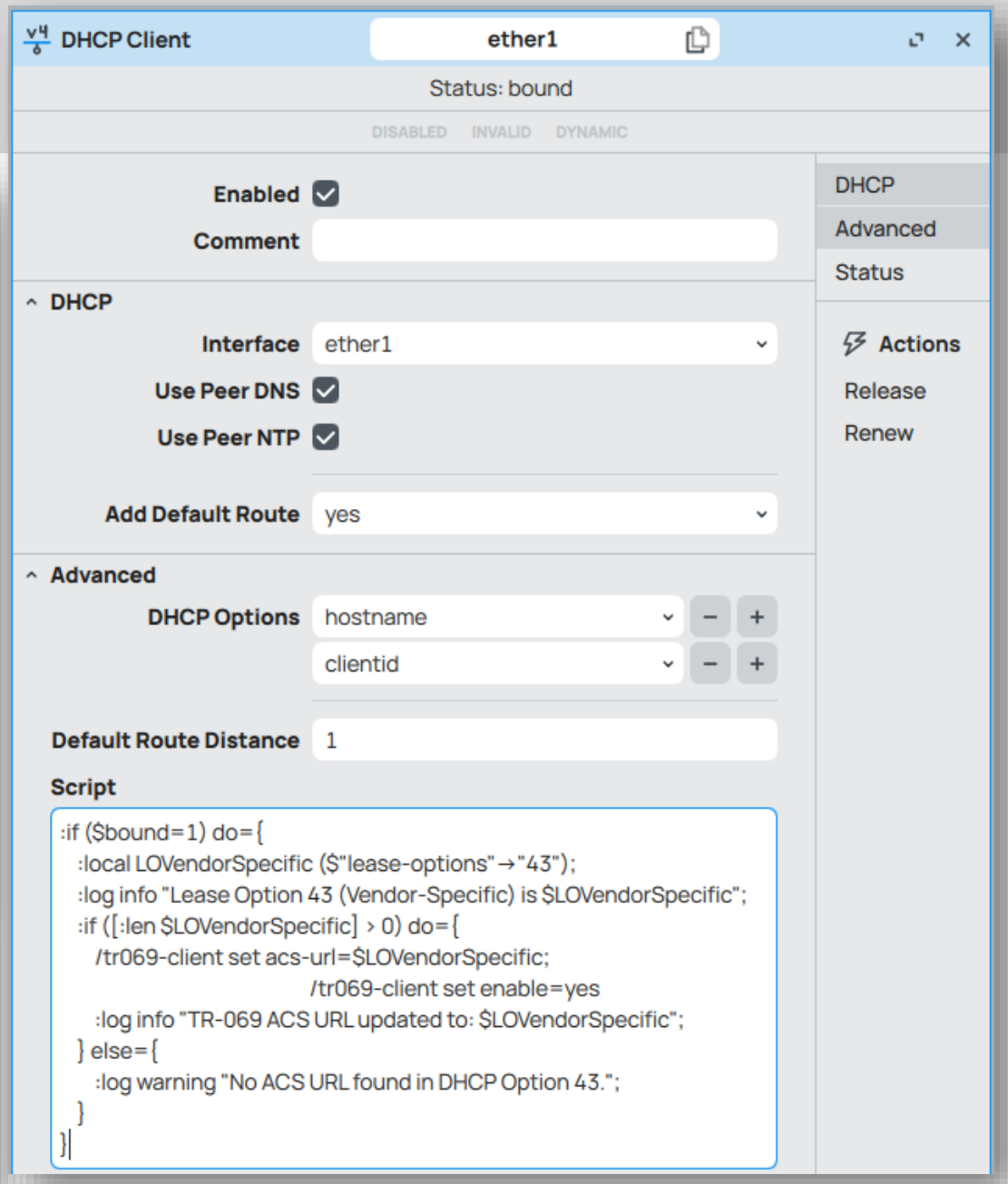
TR069

- CWMP (CPE WAN Management Protocol)
  - Monitoring and configuration of TR069 attributes
  - Firmware upgrades
- Extra package is needed
- Data model without 802.11ax
- No ACS server from DHCP43 option
  - Use a script to achieve this behavior

TR069 Configuration







MikroTik's TR069 Data Model

Device.IP.	-	IP object that contains the Interface, ActivePort, and Diagnostics objects.	6.39
InterfaceNumberOfEntries Device.IP.InterfaceNumberOfEntries	-	The number of entries in the *Interface* table. *type:* uint32	6.39
Device.IP.Interface.{i}.	W	IP interface table (a stackable interface object as described in [TR-181i2]). This table models the layer 3 IP interface.	
Enable Device.IP.Interface.{i}.Enable	W	Enables or disables the interface (regardless of *IPv4Enable* and *IPv6Enable*). This parameter is based on "ifAdminStatus" from [RFC2863]. *type:* bool , *default:* "false"	6.39
Status Device.IP.Interface.{i}.Status	-	The current operational state of the interface (see [TR-181i2]). This parameter is based on "ifOperStatus" from [RFC2863]. • Up • Down • Unknown • Dormant • NotPresent • LowerLayerDown • Error	6.39

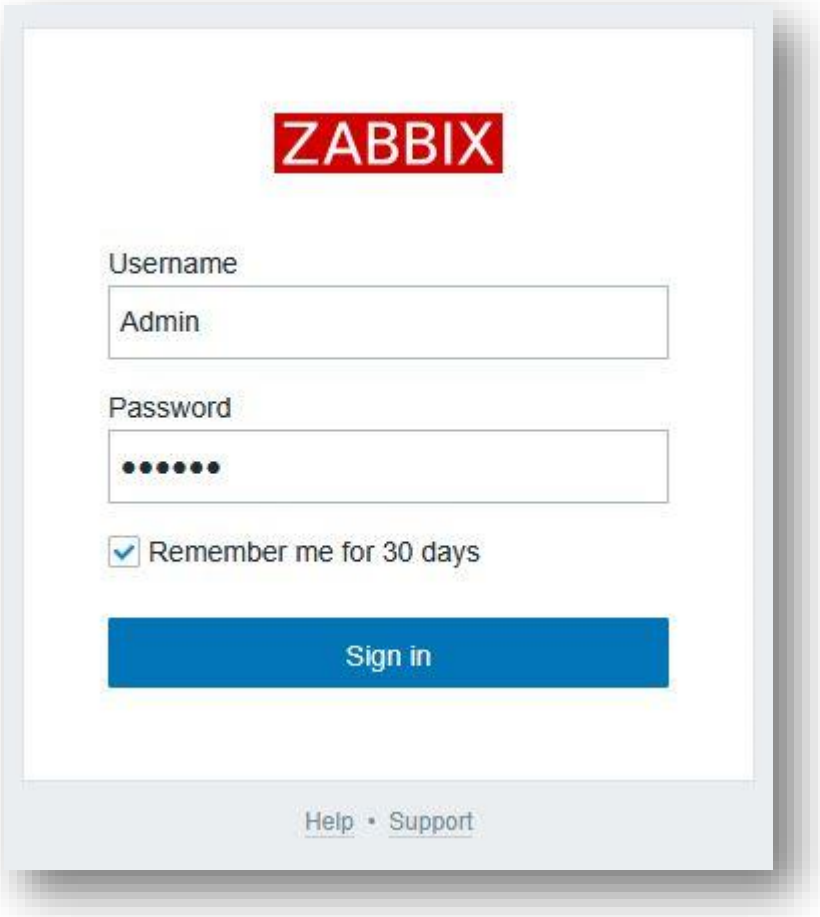
NMS

Dude	LibreNMS	Zabbix
easy to setup visualisation	easy to setup	good MikroTik support
extended MikroTik support	good MikroTik support	good visualisation features
old fashioned	limited visualisation	powerful dashboards
slow development	limited dashboards	great REST API integration
not made for long term statistics		excellent configuration options
no dashboards		steep learning curve
		can be overhelming

$ sudo -s

Zabbix Installation

- Straight forward, well documented
- www.zabbix.com

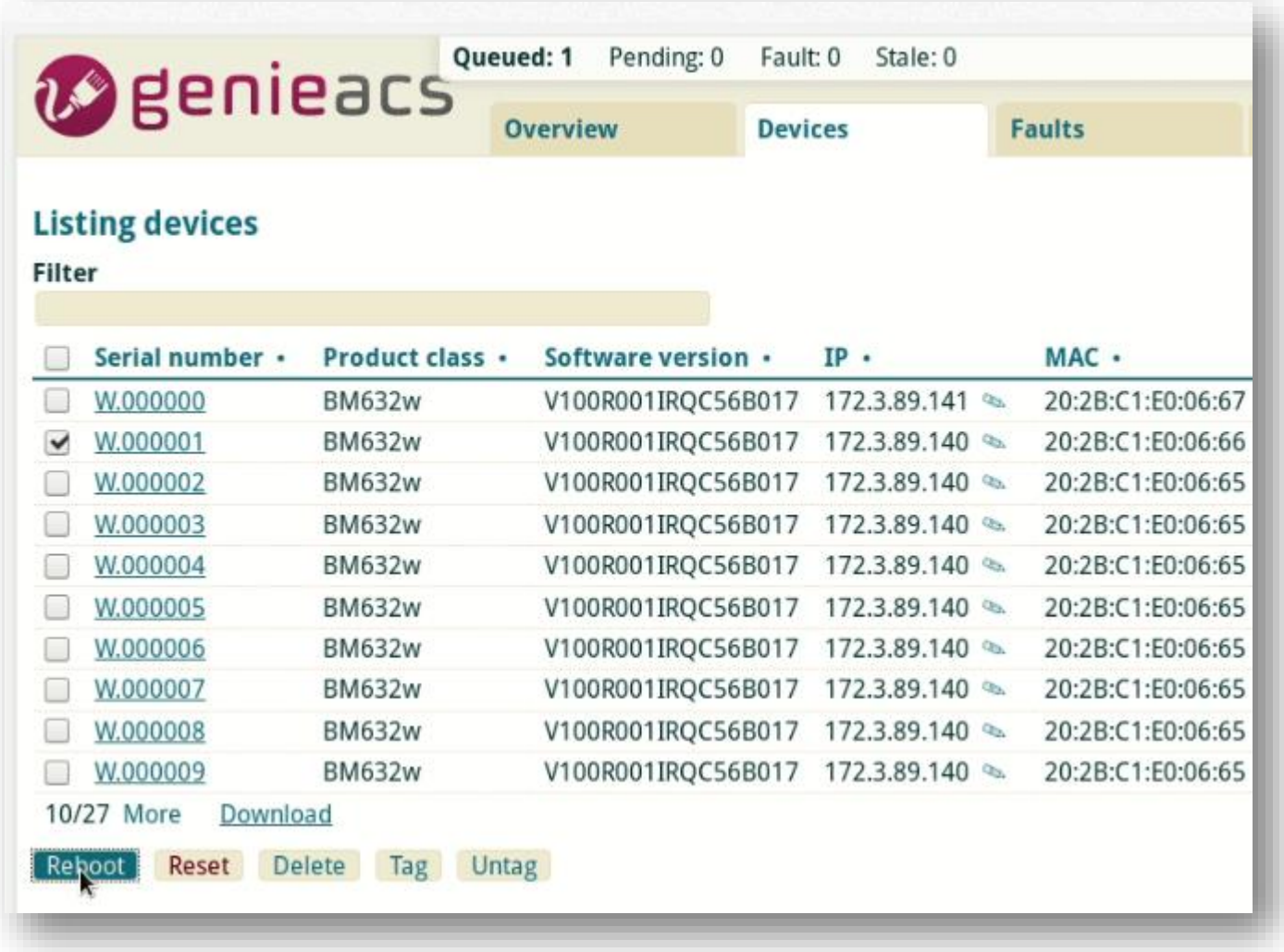


ACS

- Purpose of an ACS
- Compatible ACS

https://help.mikrotik.com/docs/spaces/ROS/pages/9863195/TR-069

- GenieACS



Examples – What will it do for me?

Enhance your MikroTik experience

CAPsMAN Dashboard

Visualise your WIFI Controller

CAPsMAN Dashboard

- Most competing vendors offer graphical UI

- Make the CEO happy ;-)
- Fast overview for first level support
- In depth information to debug and optimize an existing WIFI network

- Tools: SNMP, REST, NMS

Elements

- Number of clients
  - Total
  - Per SSID
  - Per WIFI standard
  - Per frequency
  - Per access point
- Bandwidth
  - Total
  - Per SSID
  - Per access point
- Optimization
  - worst clients
  - worst access points
  - max. user/ap
  - max. bandwidth/ap

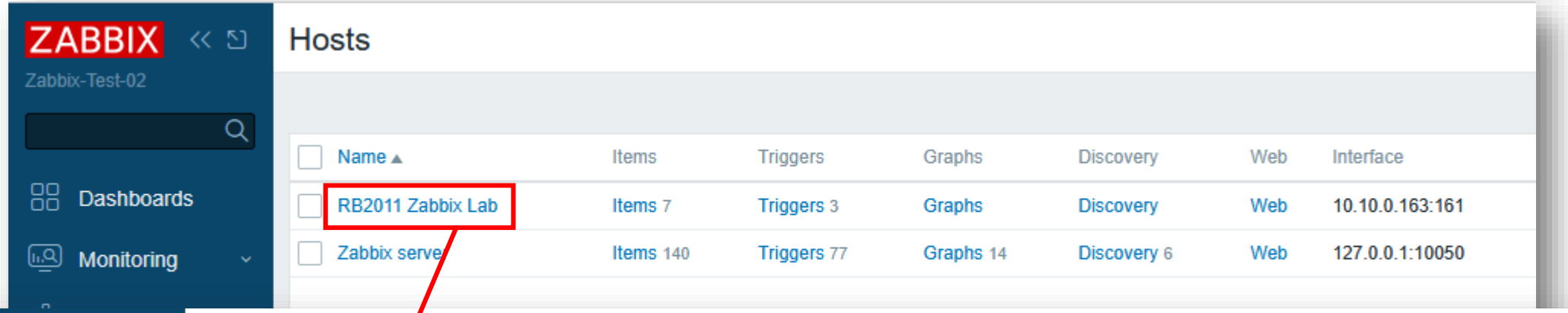
Zabbix and MikroTik

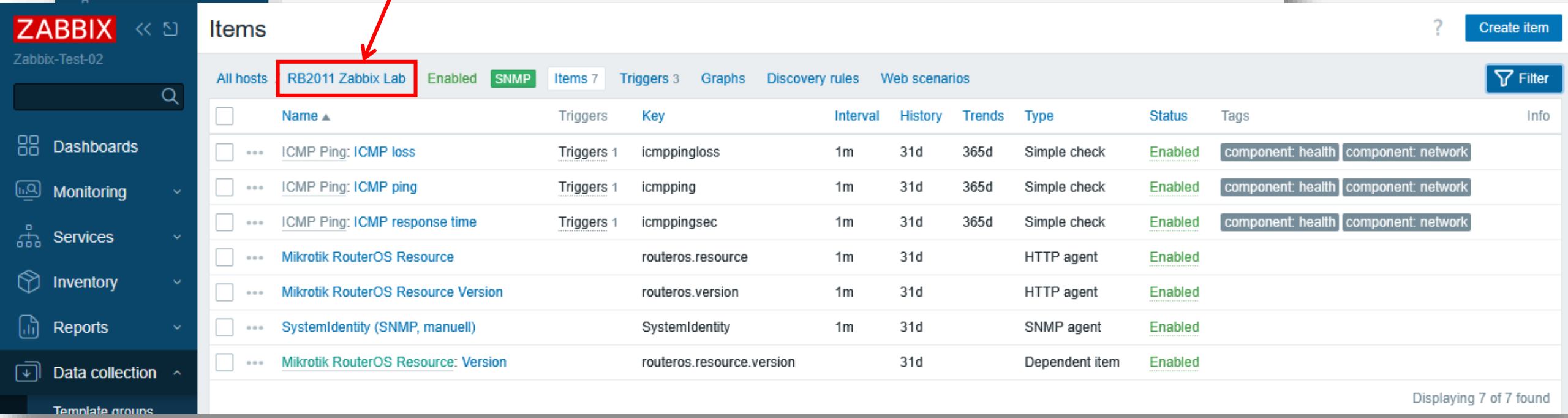
- Limited SNMP information (especially for CAPsMAN)
- REST integration is mandatory

- Just basic examples during the presentation

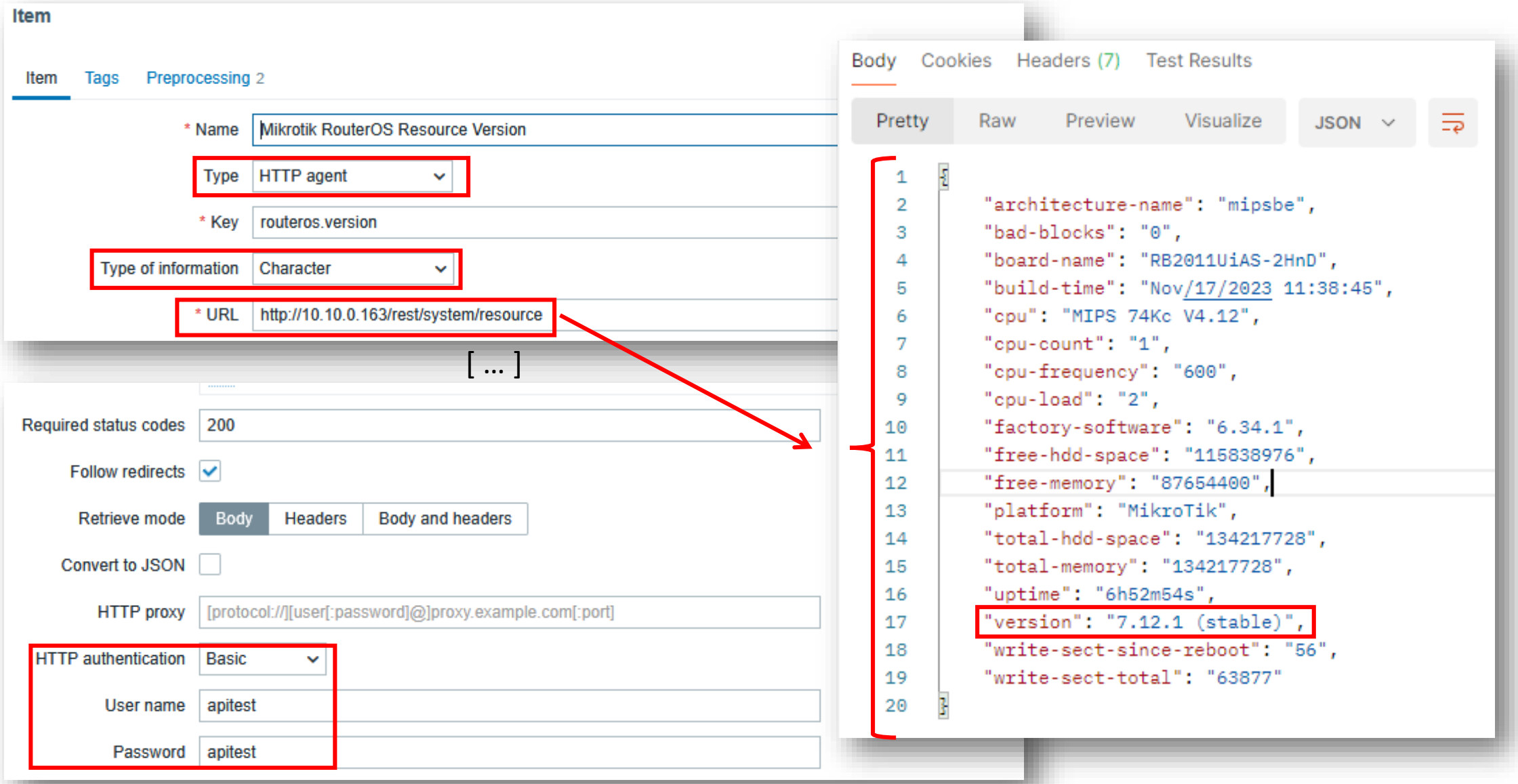
- Important to employ advanced features to avoid time consuming manual processes, bad NMS performance and high load on the CAPsMAN

Creating Manual Items

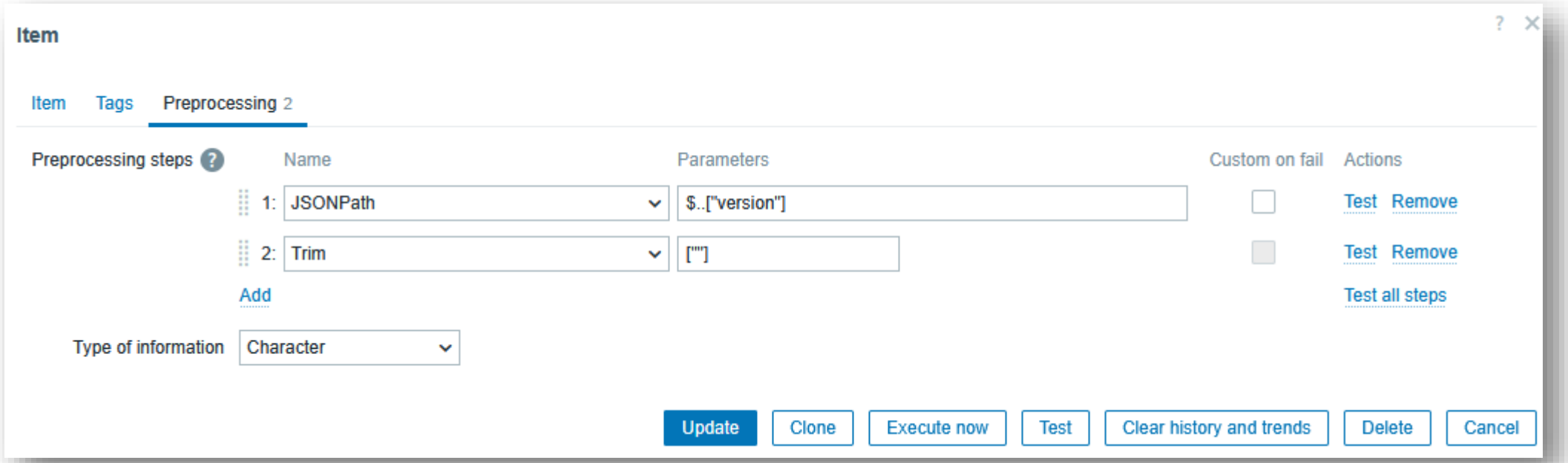




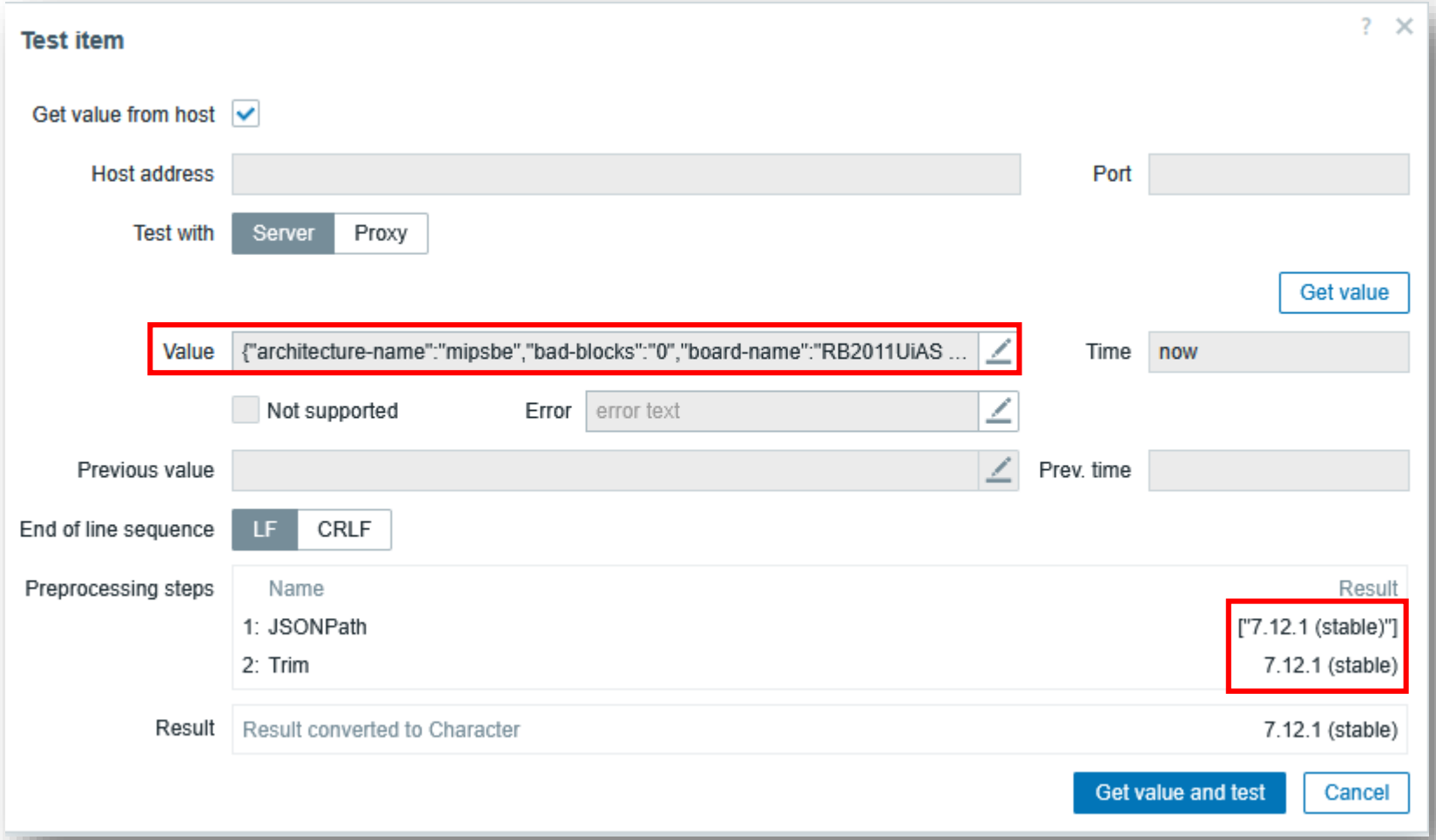
Creating Manual Item for REST API



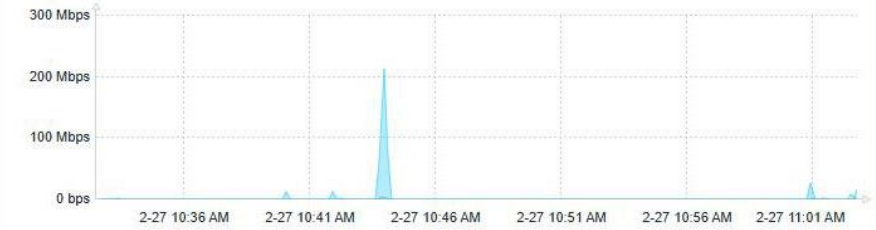
Use Preprocessing



Test Item

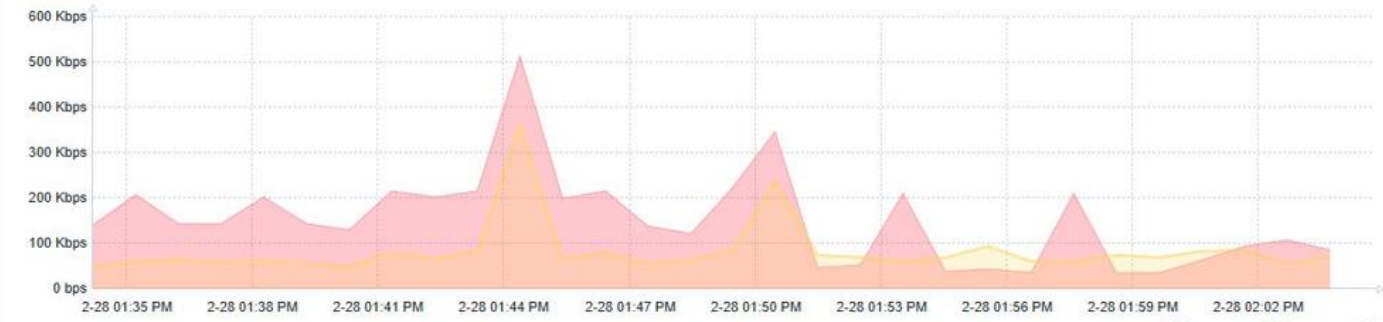

Test item
Get value from host
Host address
Port
Test with
Server
Proxy
Get value
Value
{"architecture-name":"mipsbe","bad-blocks":"0","board-name":"RB2011UiAS ...
Time
now
Not supported
Error
error text
Previous value
Prev. time
End of line sequence
LF
CRLF
Preprocessing steps
Name
Result
1: JSONPath
["7.12.1 (stable)"]
2: Trim
7.12.1 (stable)
Result
Result converted to Character
7.12.1 (stable)
Get value and test
Cancel

Traffic WAN



	min	avg	max
server_cap_dhcp: Interface ether1 RX Speed	97.11 Kbps	2.8 Mbps	214.88 Mbps
server_cap_dhcp: Interface ether1 TX Speed	53.5 Kbps	749.37 Kbps	8.61 Mbps

Traffic AP



	min	avg	max
Summ WI-FI RX	37.6 Kbps	154.13 Kbps	513.92 Kbps
Summ WI-FI TX	51.2 Kbps	85.56 Kbps	365.28 Kbps

CAPsMAN Information

AP
3

Clients (all SSID)
30

Wi-Fi Interface
6

Clients per SSID

Clients (SSID Guest)
12

Clients (SSID IoT)
No Clients (0)

Clients (SSID VIP)
18

Clients per Band

	Value
Clients for 2GHz	6 Clients
Clients for 5GHz	24 Clients

Clients for 2GHz

	min	avg	max
Clients for 2GHz-AX	0	0	0
Clients for 2GHz -N	6	6	6

Clients for 5GHz

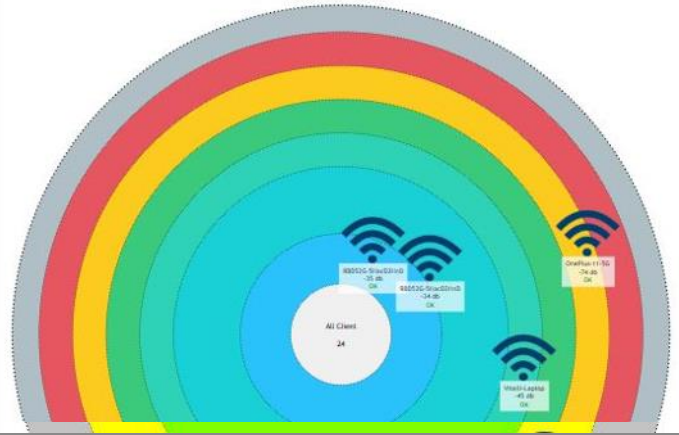
	min	avg	max
Clients for 5GHz-AC	12	13	18
Clients for 5GHz-AX	0	0.6	6

AVG Signal per Clients

AVG Signal 2GHz
-45.4 db

AVG Signal 5GHz
-45.4 db

Map



Access points with the worst average client signal quality

CAP Interface	Signal AVG	Mix Signal 12Hour
5GHz-hAP_AX2-V	-75 db	-79 db
2GHz-hAP_AX2-V	-46 db	-57 db
2GHz-hAP_AX2-V2	-35 db	-37 db

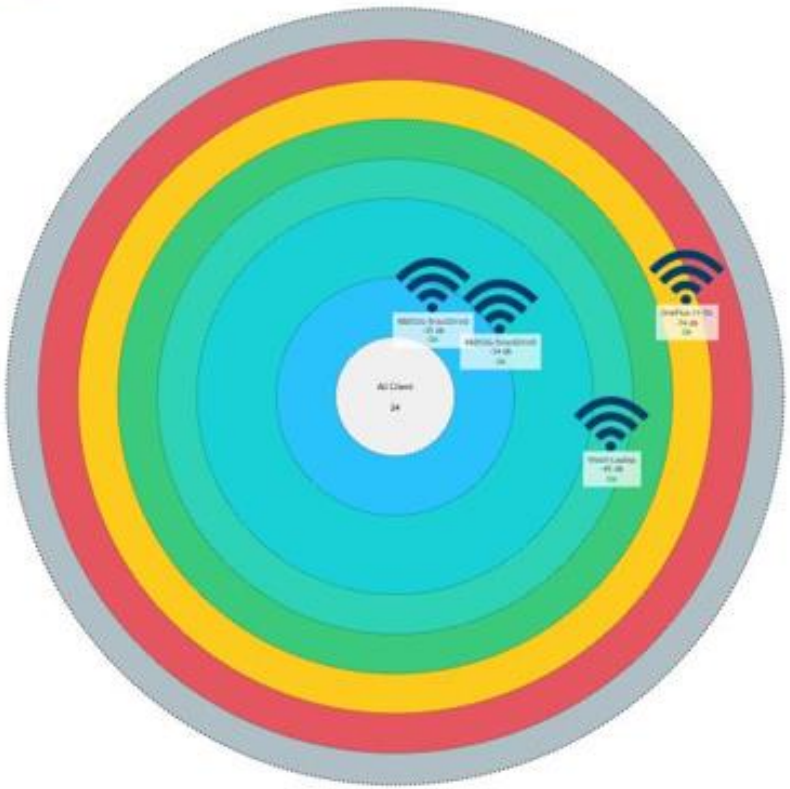
Access points with the most clients

CAP Interface	Count Clients	Max Count 12Hour
2GHz-hAP_AX2-V	6	6
2GHz-hAP_AX2-V2	6	6
5GHz-hAP_AX2	6	6

Traffic per Wi-Fi Clients

Host Name	Client Mac	RX	TX	Rx consumed	Tx consumed	AP Interface
RBD52G-5HacD2HnD	74:4D:28:CF:1D:6C	9 Kbps	0 bps	3 MB	15.07 MB	2GHz-hAP_AX2-V2
RBD52G-5HacD2HnD	74:4D:28:CF:1D:6D	7 Kbps	0 bps	3 MB	7.57 MB	5GHz-hAP_AX2
Vitalii-Laptop	74:E5:F9:97:B7:F1	2 Kbps	0 bps	14 MB	1.63 MB	2GHz-hAP_AX2-V

Map



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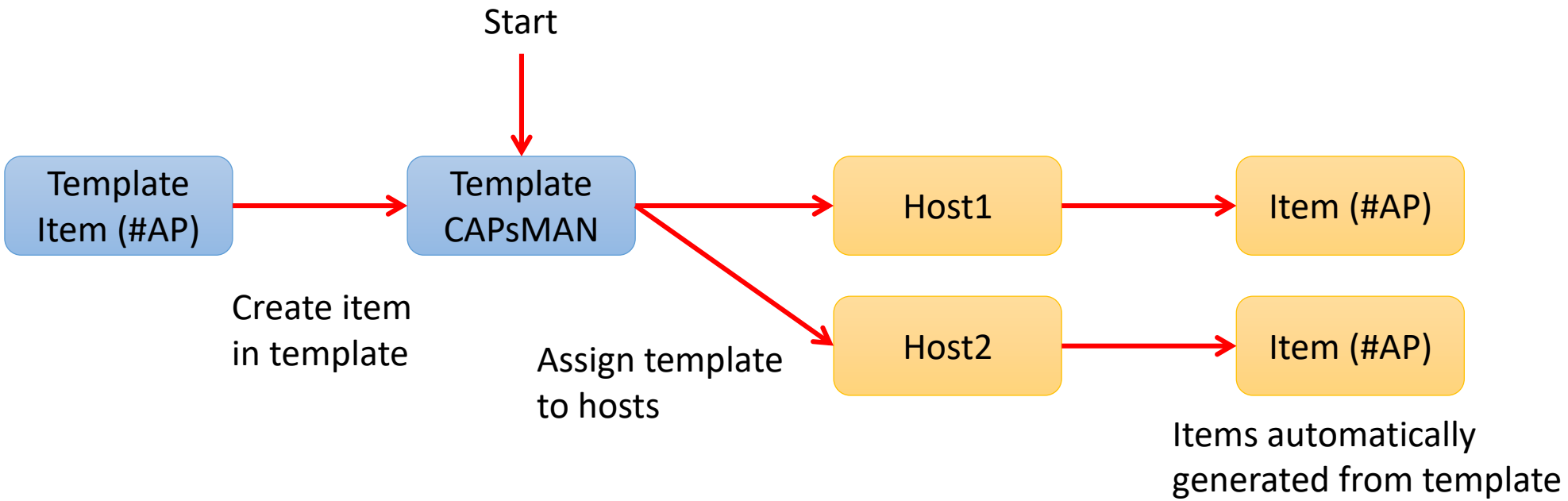
RBD52G-5HacD2HnD	74:4D:28:CF:1D:6D	7 Kbps	0 bps	3 MB	7.57 MB	5GHz-hAP_AX2
Vitalii-Laptop	74:E5:F9:97:B7:F1	2 Kbps	0 bps	14 MB	1.63 MB	2GHz-hAP_AX2-V
OnePlus-11-5G	5E:EE:2B:30:54:0A	0 bps	0 bps	10 MB	77.64 MB	5GHz-hAP_AX2-V

Worst customer signal quality

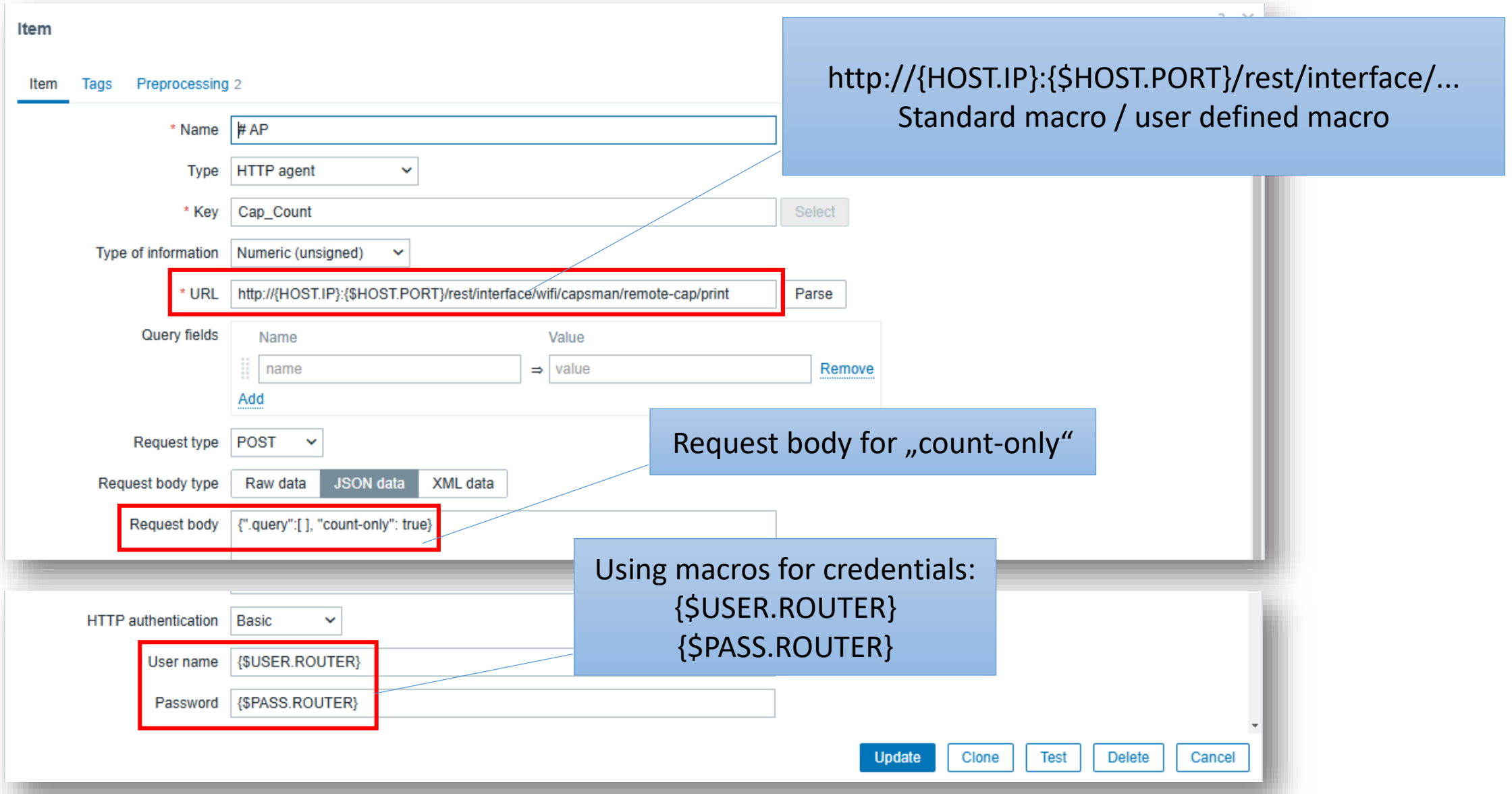
Host Name	Client Mac	Signal db	Mix Signal 12Hour	AP Interface
OnePlus-11-5G	5E:EE:2B:30:54:0A	-74 db	-89 db	5GHz-hAP_AX2-V
Vitalii-Laptop	74:E5:F9:97:B7:F1	-45 db	-58 db	2GHz-hAP_AX2-V
RBD52G-5HacD2HnD	74:4D:28:CF:1D:6C	-35 db	-37 db	2GHz-hAP_AX2-V2
RBD52G-5HacD2HnD	74:4D:28:CF:1D:6D	-34 db	-35 db	5GHz-hAP_AX2

Get Number of Access Points by using a Template

- Source: /caps-man/remote-cap/print count-only
- Not available by SNMP
- REST Call

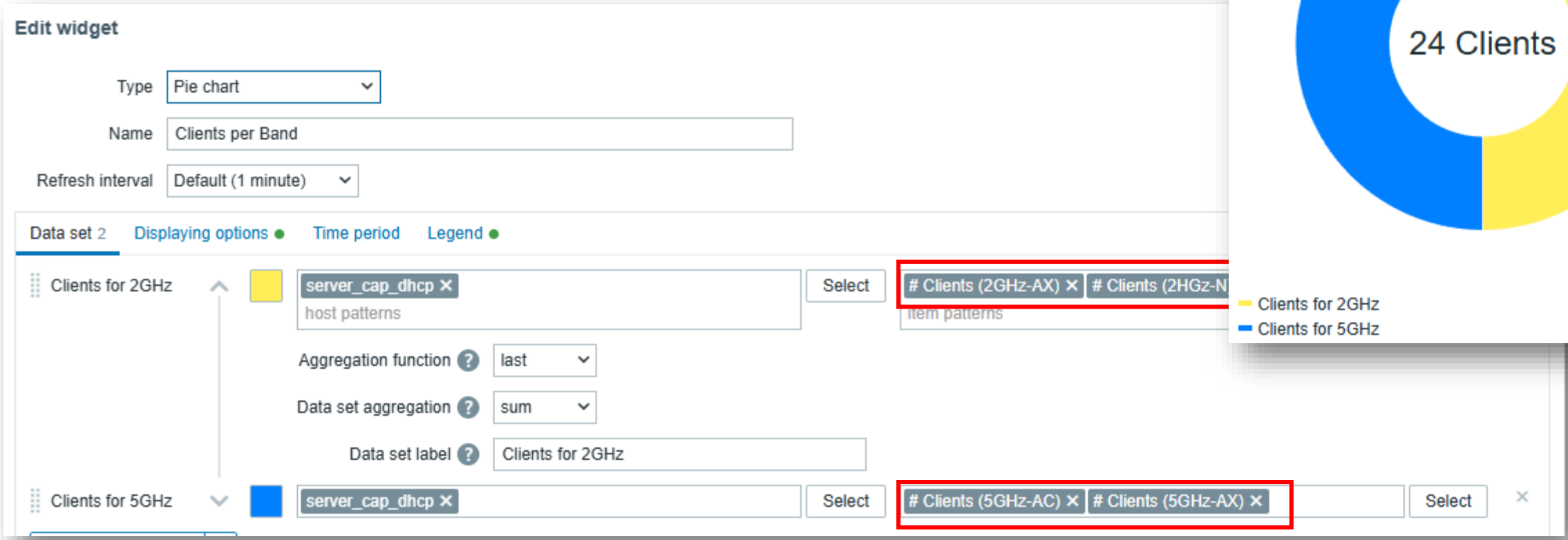


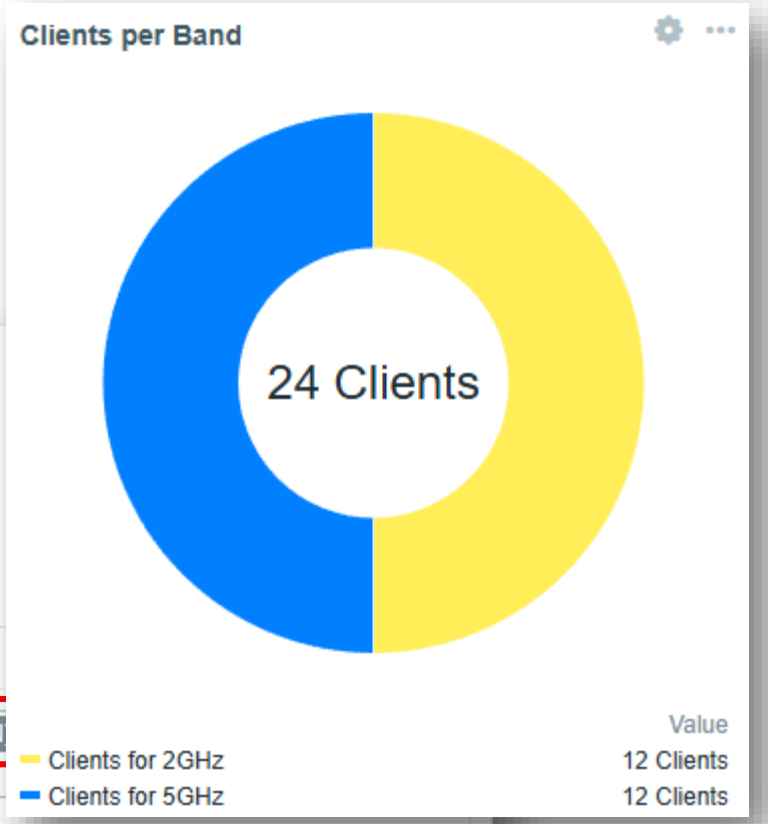
Get Number of Access Points by using a Template



Get Number of Clients per Frequency Band

- Source: /caps-man/remote-cap/print count-only
- Multiple items per data set

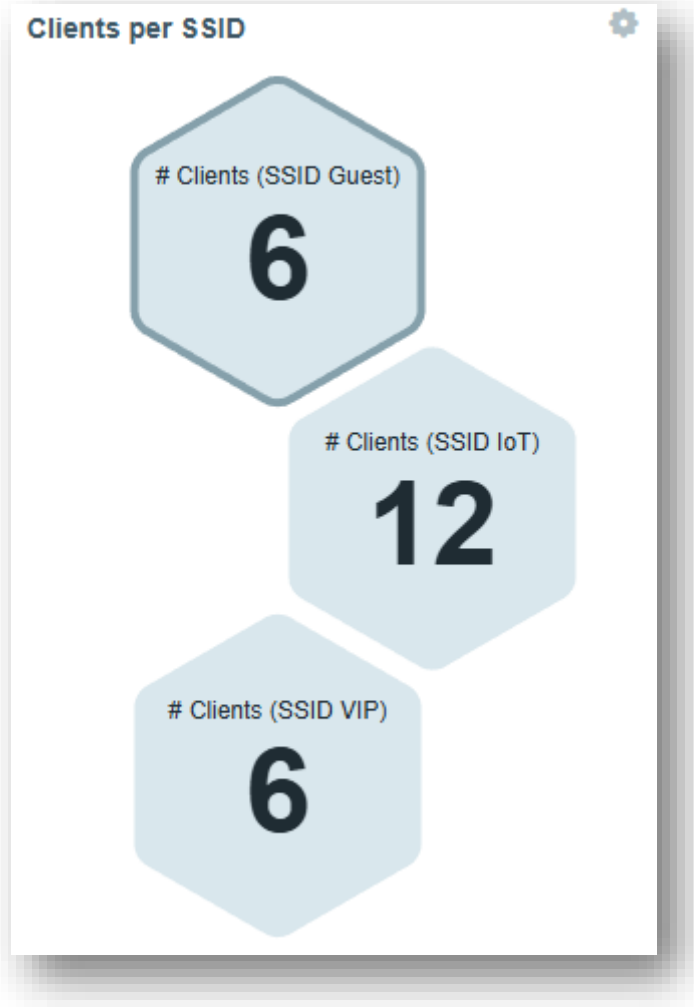




Get Number of Clients per SSID

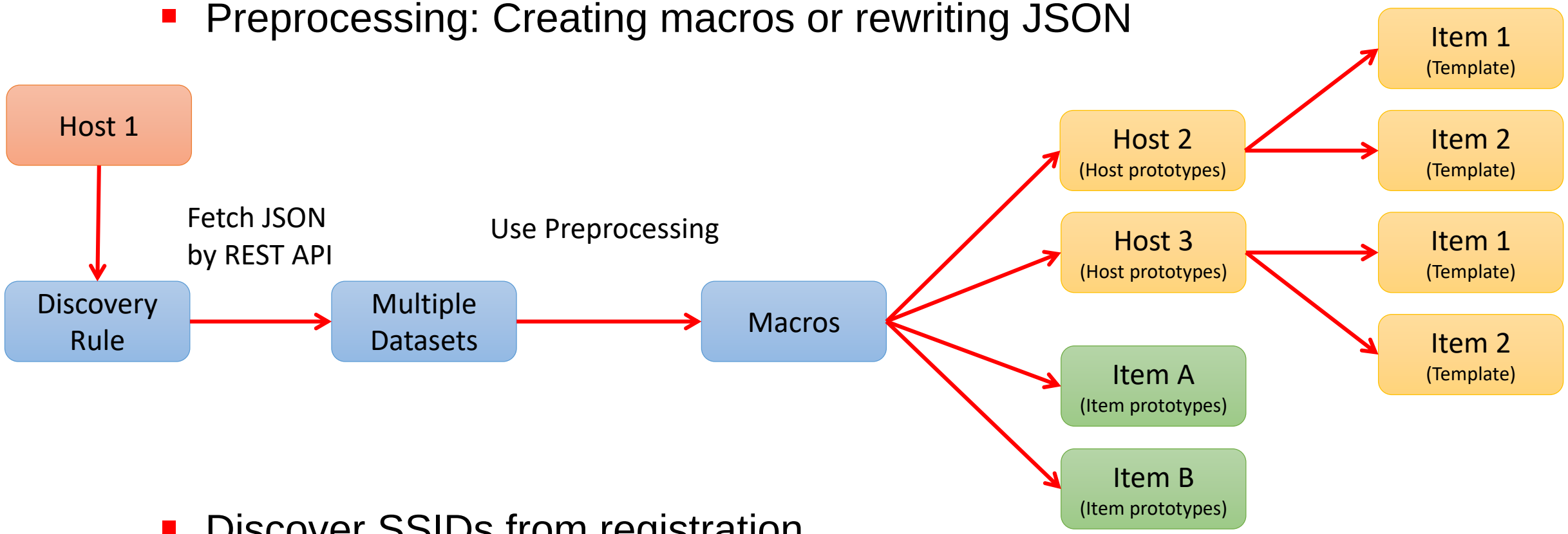
- Could be done the same way
- Would require manual creation of an item per new SSID

- Here comes some Zabbix Magic
  - Discovery rules
  - Script based preprocessing
  - Item prototypes
  - Host prototypes



Discovery and Prototypes

- Discovery & prototypes: One item/host per JSON dataset
- Preprocessing: Creating macros or rewriting JSON



- Discover SSIDs from registration
- Create “count-only” items per SSID from prototype (on registration)

Automatic Monitoring and Visualisation

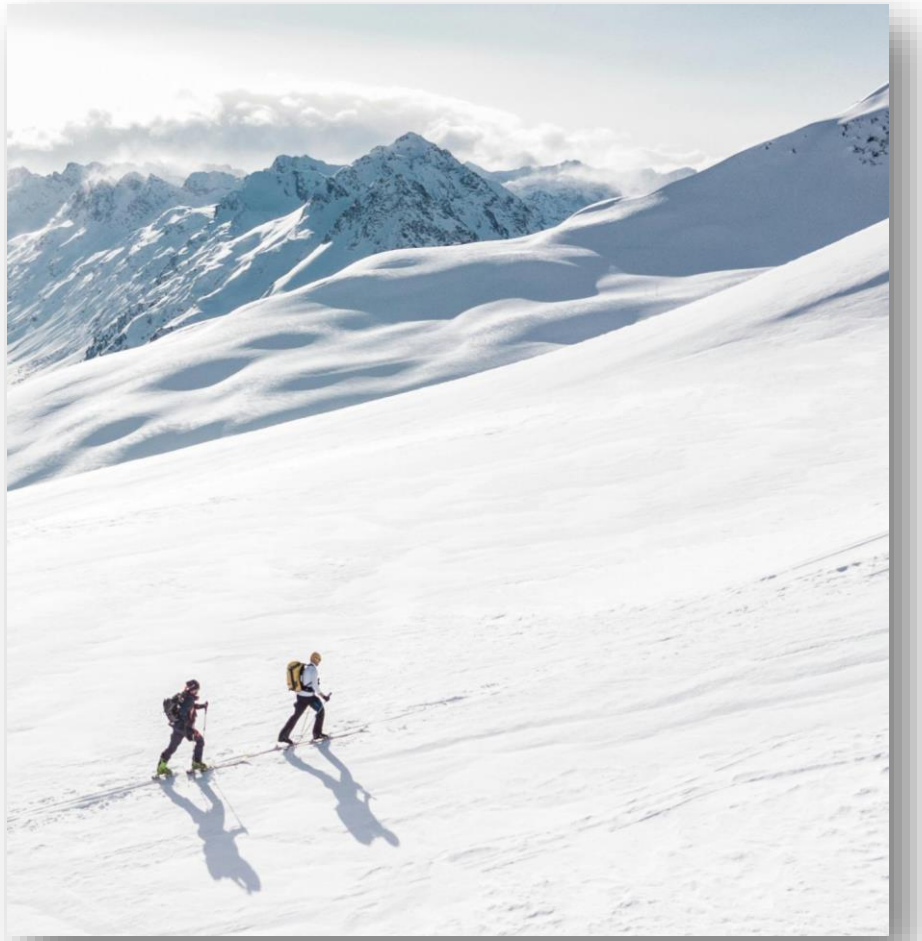
P2P Access with MikroTik Switches

Objectives

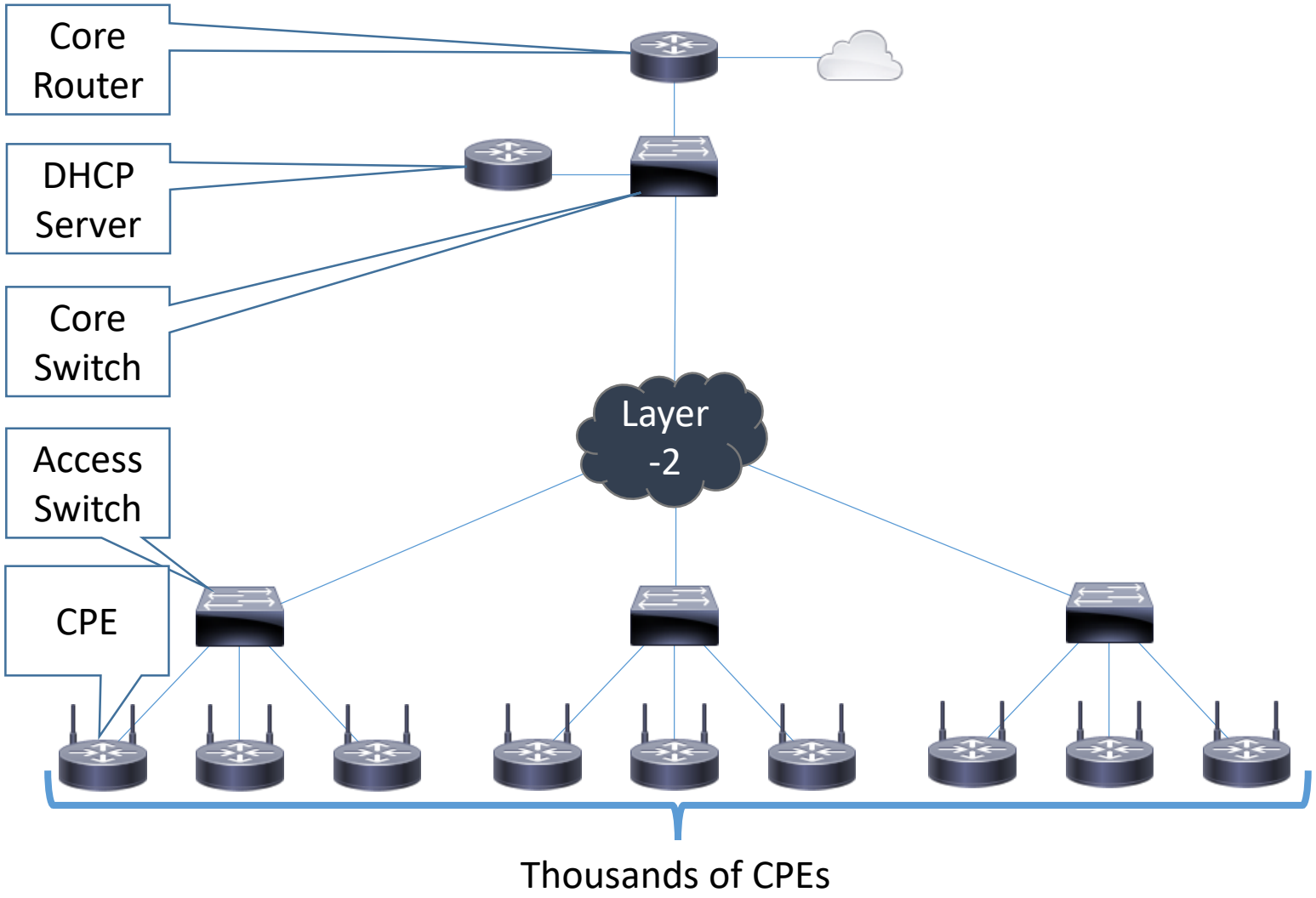
- Know the switch and port ISP clients (CPEs) are connected to
- Automatically provide suitable monitoring for each CPE after first connect
- Automatically provide network maps of the access network including visualization of switch and port a CPE is connected to

Steps to Take

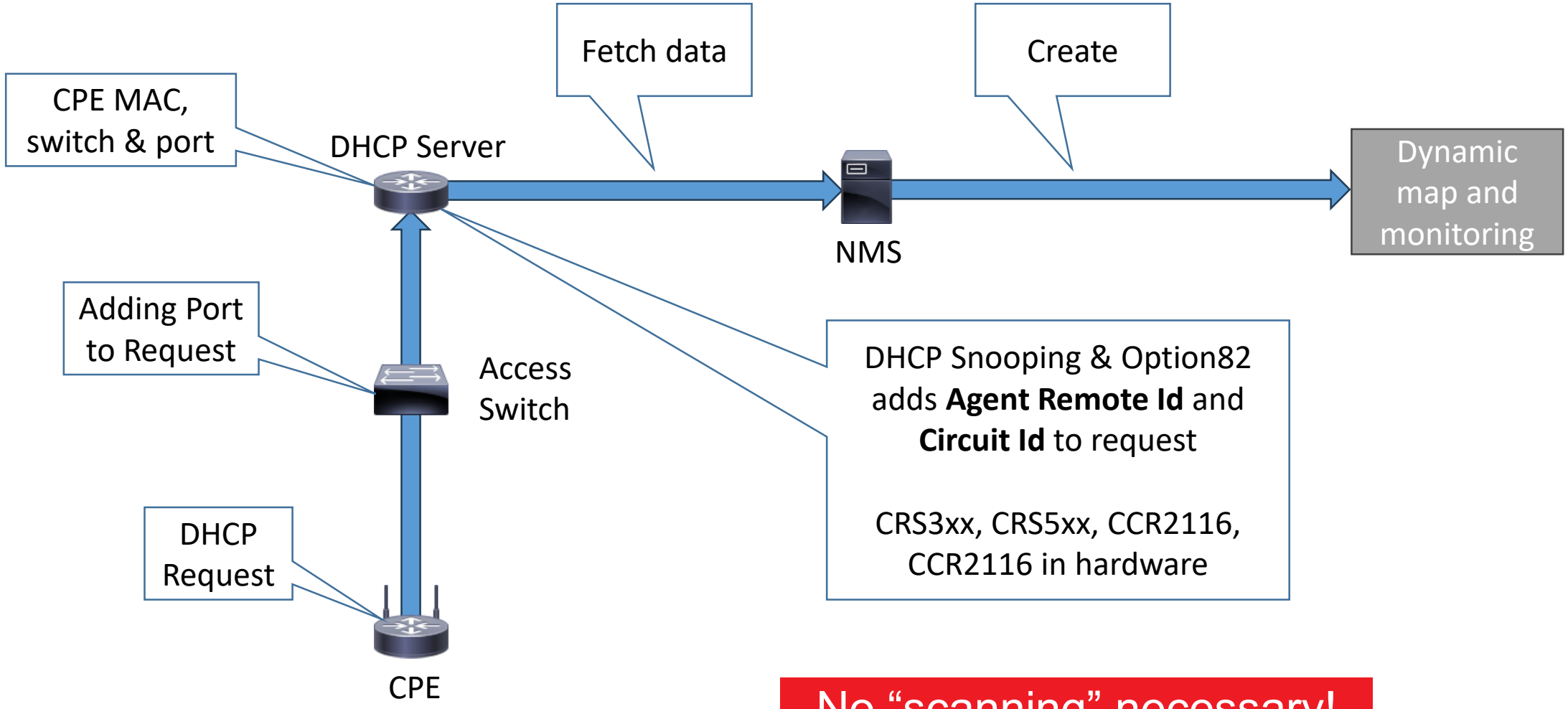
- Determine switch and port for each CPE
- Make information accessible for NMS
- Create hosts and items to monitor
- Create visualisation



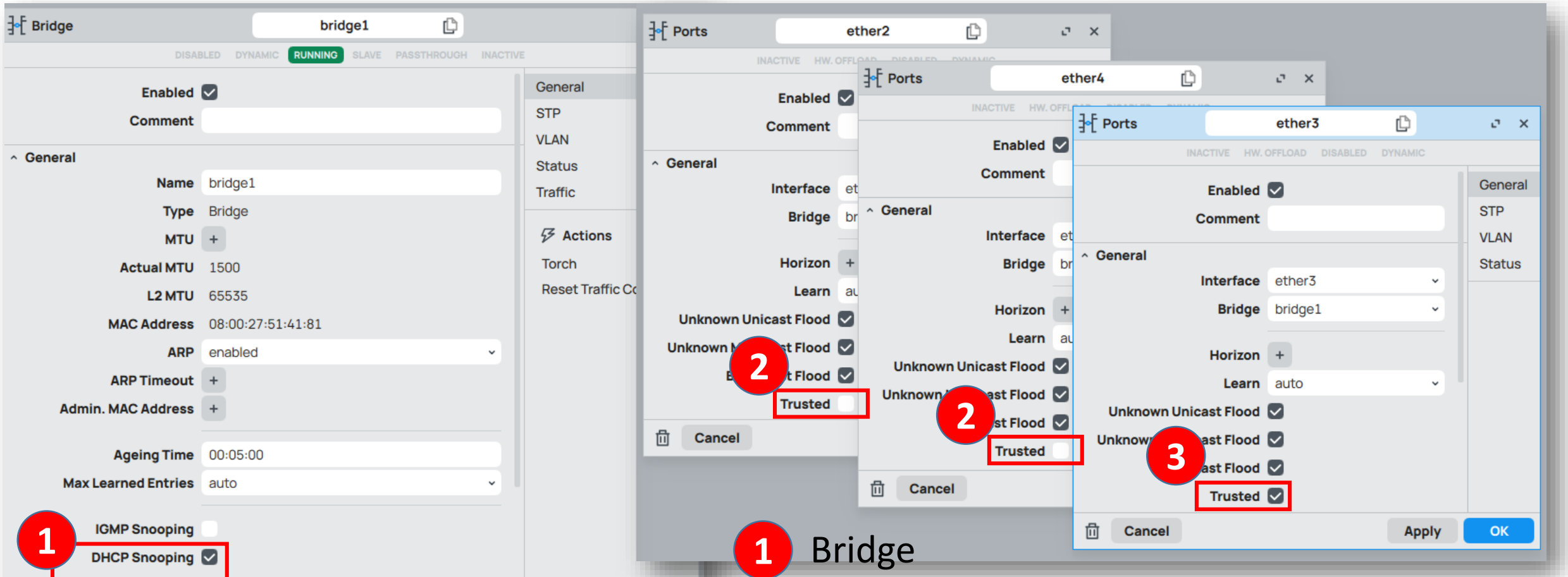
ISP P2P Access – Network Overview



General Approach



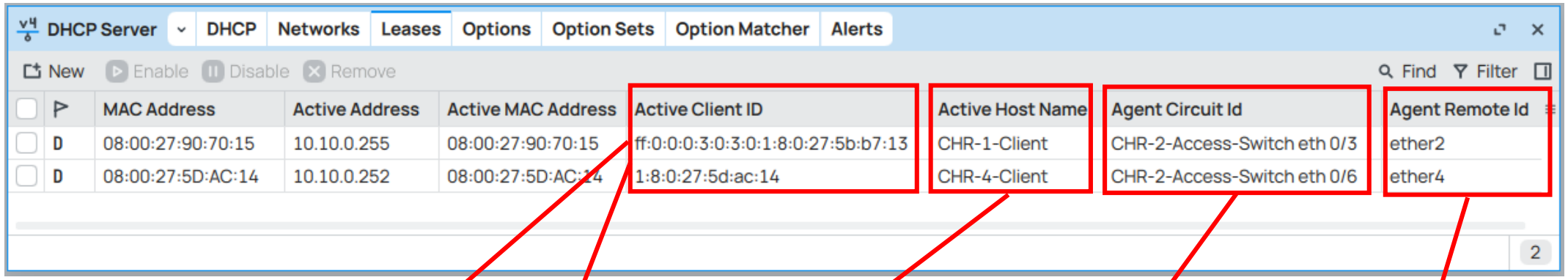
Switch: Snooping and Option 82

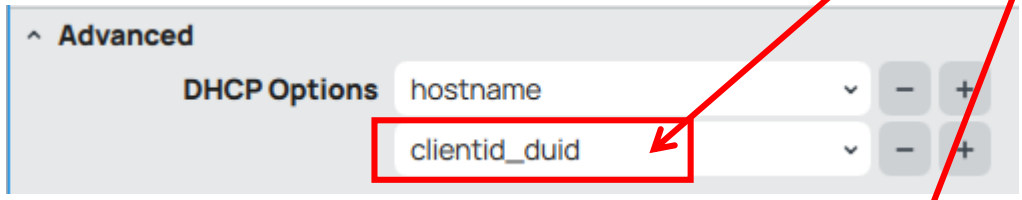


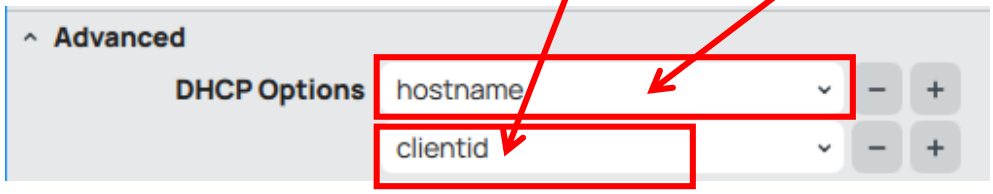
1. Bridge
2. Access ports
3. Up-/downstream ports

Server & Client: DHCP Options

Option 61 Option 12 Option 82





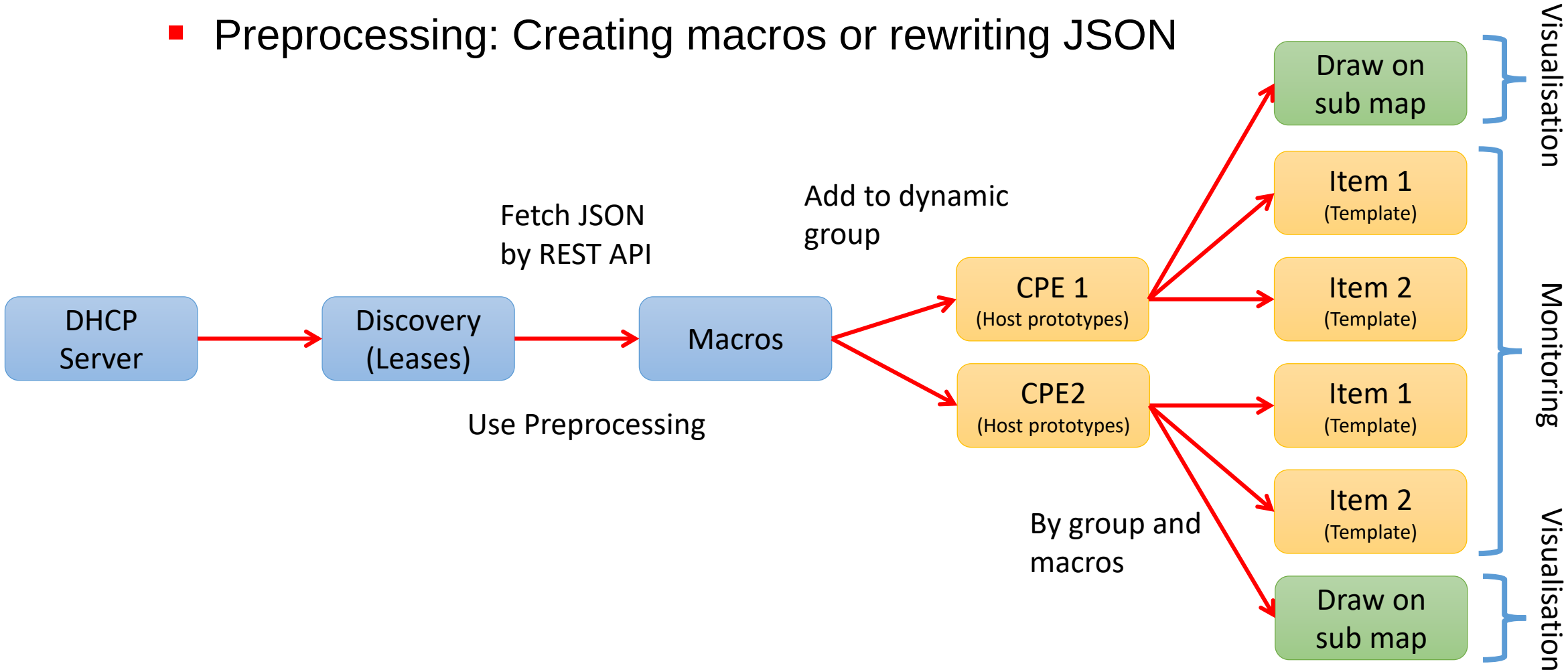


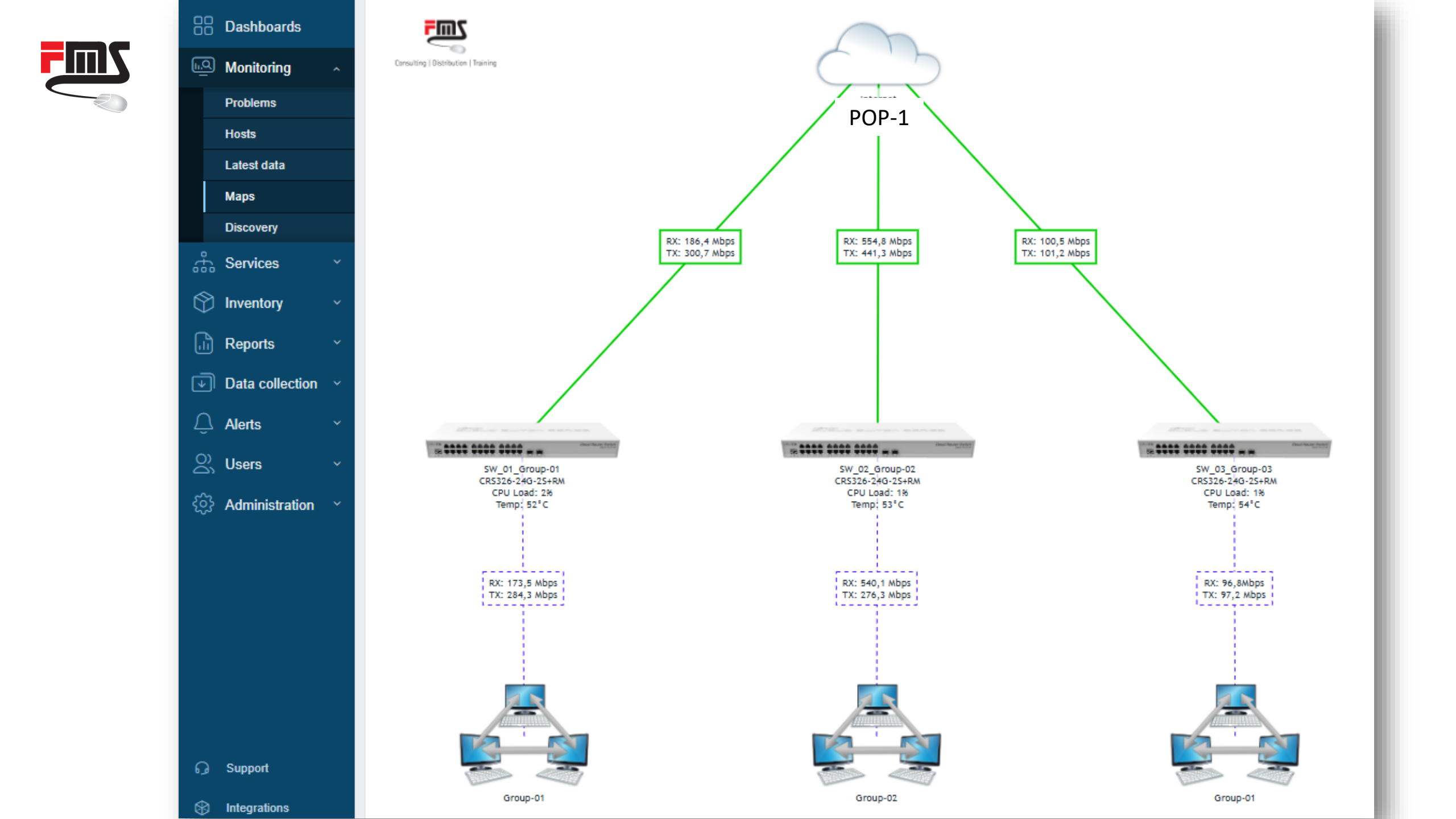
System Identity of access switch

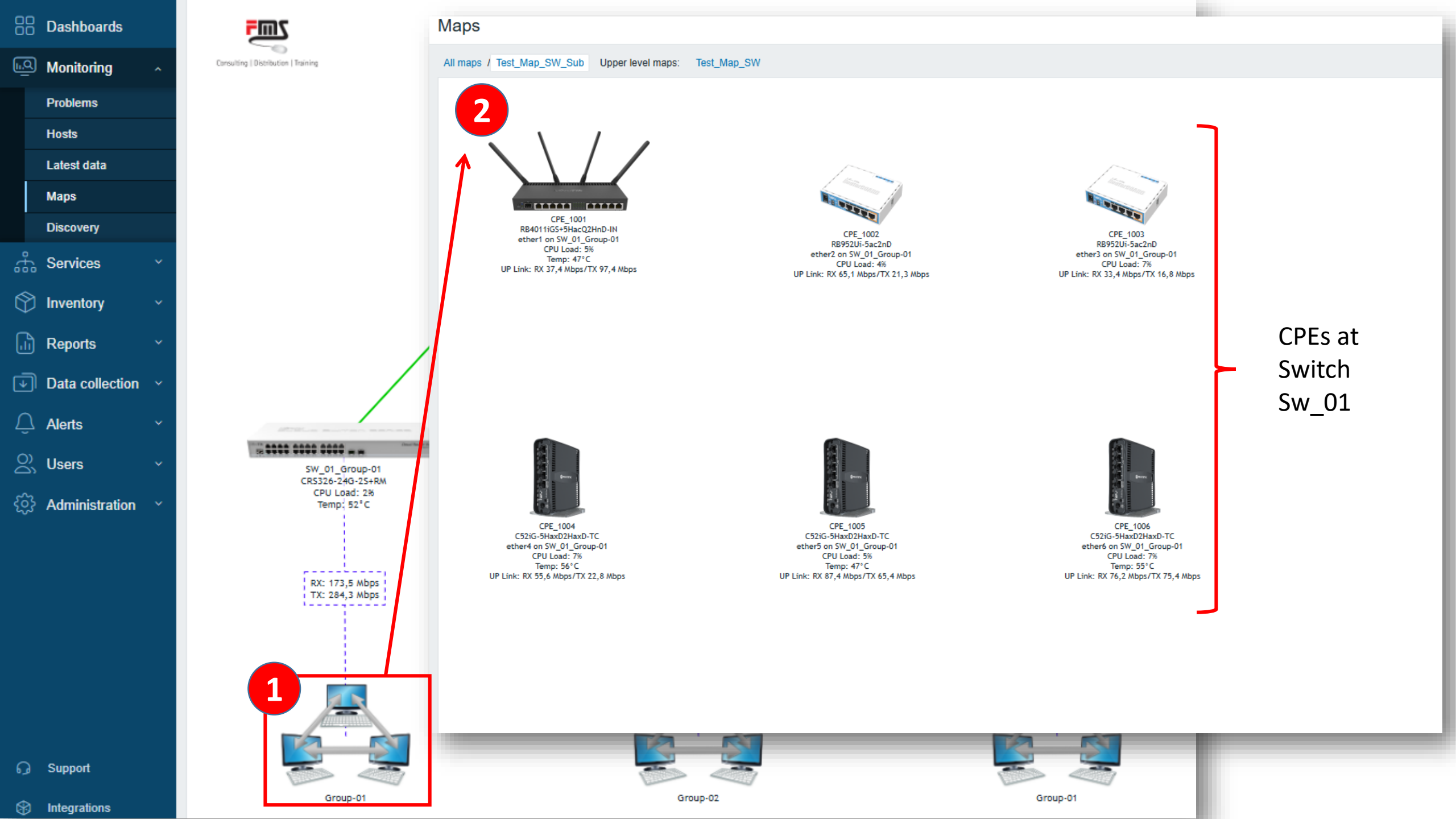
Access switch port number this client is connected to

Process

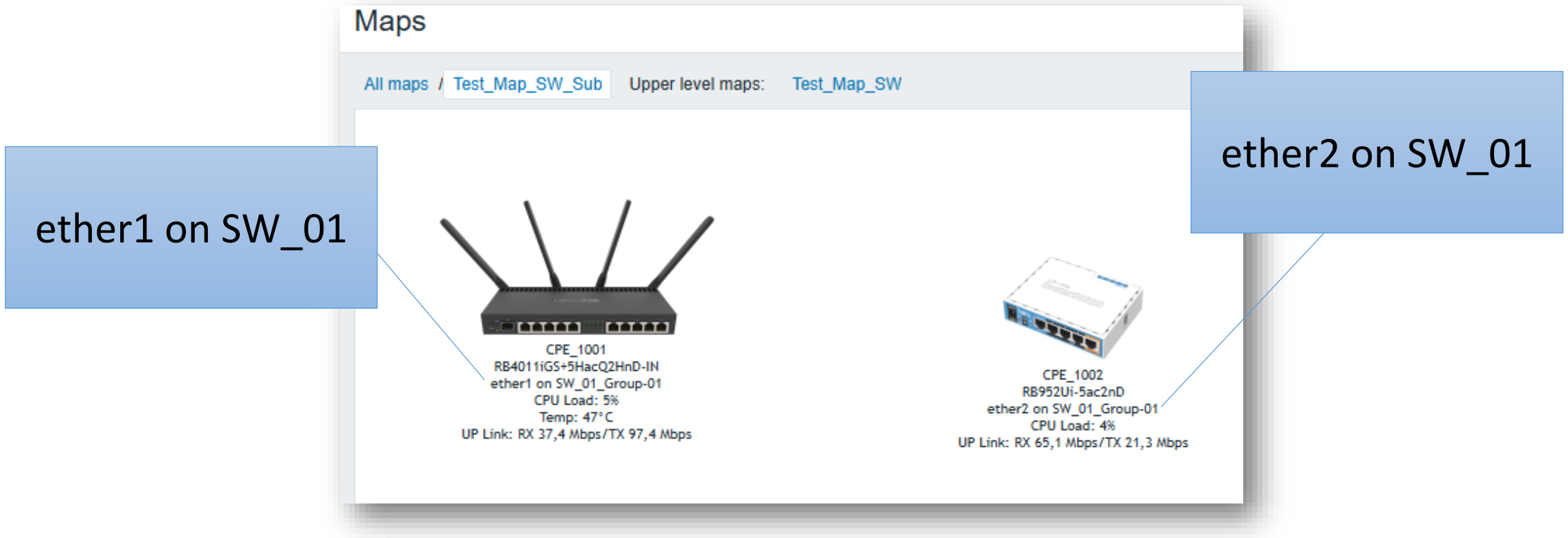
- Discovery & host prototypes: One host per JSON dataset
- Preprocessing: Creating macros or rewriting JSON




Dashboards
Monitoring
Problems
Hosts
Latest data
Maps
Discovery
Services
Inventory
Reports
Data collection
Alerts
Users
Administration
Support
Integrations
Consulting | Distribution | Training
POP-1
RX: 186,4 Mbps
TX: 300,7 Mbps
RX: 554,8 Mbps
TX: 441,3 Mbps
RX: 100,5 Mbps
TX: 101,2 Mbps
SW_01_Group-01
CRS326-24G-2S+RM
CPU Load: 2%
Temp: 52°C
SW_02_Group-02
CRS326-24G-2S+RM
CPU Load: 1%
Temp: 53°C
SW_03_Group-03
CRS326-24G-2S+RM
CPU Load: 1%
Temp: 54°C
RX: 173,5 Mbps
TX: 284,3 Mbps
RX: 540,1 Mbps
TX: 276,3 Mbps
RX: 96,8Mbps
TX: 97,2 Mbps
Group-01
Group-02
Group-01


Dashboards
Monitoring
Problems
Hosts
Latest data
Maps
Discovery
Services
Inventory
Reports
Data collection
Alerts
Users
Administration
Support
Integrations
Consulting | Distribution | Training
Maps
All maps / Test_Map_SW_Sub
Upper level maps: Test_Map_SW
2
CPE_1001
RB4011iGS+5HacQ2HnD-IN
ether1 on SW_01_Group-01
CPU Load: 5%
Temp: 47°C
UP Link: RX 37,4 Mbps/TX 97,4 Mbps
CPE_1002
RB952Ui-5ac2nD
ether2 on SW_01_Group-01
CPU Load: 4%
UP Link: RX 65,1 Mbps/TX 21,3 Mbps
CPE_1003
RB952Ui-5ac2nD
ether3 on SW_01_Group-01
CPU Load: 7%
UP Link: RX 33,4 Mbps/TX 16,8 Mbps
CPE_1004
C52iG-5HaxD2HaxD-TC
ether4 on SW_01_Group-01
CPU Load: 7%
Temp: 56°C
UP Link: RX 55,6 Mbps/TX 22,8 Mbps
CPE_1005
C52iG-5HaxD2HaxD-TC
ether5 on SW_01_Group-01
CPU Load: 5%
Temp: 47°C
UP Link: RX 87,4 Mbps/TX 65,4 Mbps
CPE_1006
C52iG-5HaxD2HaxD-TC
ether6 on SW_01_Group-01
CPU Load: 7%
Temp: 55°C
UP Link: RX 76,2 Mbps/TX 75,4 Mbps
CPEs at Switch Sw_01
SW_01_Group-01
CRS326-24G-2S+RM
CPU Load: 2%
Temp: 52°C
RX: 173,5 Mbps
TX: 284,3 Mbps
1
Group-01
Group-02
Group-01

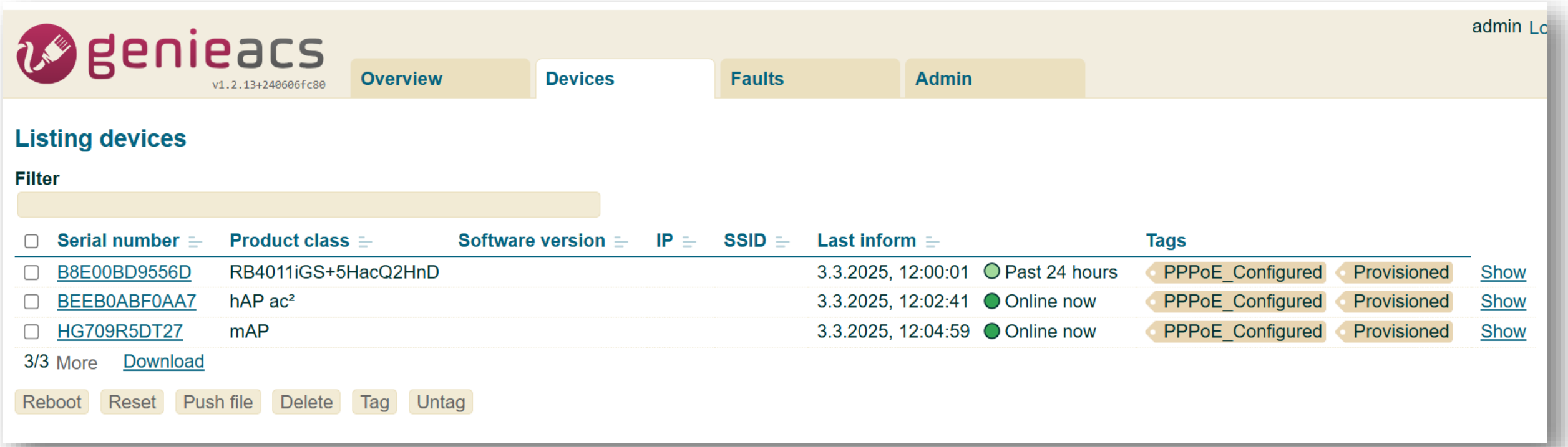
Enlarged Submap



Automatic PPPoE Provisioning

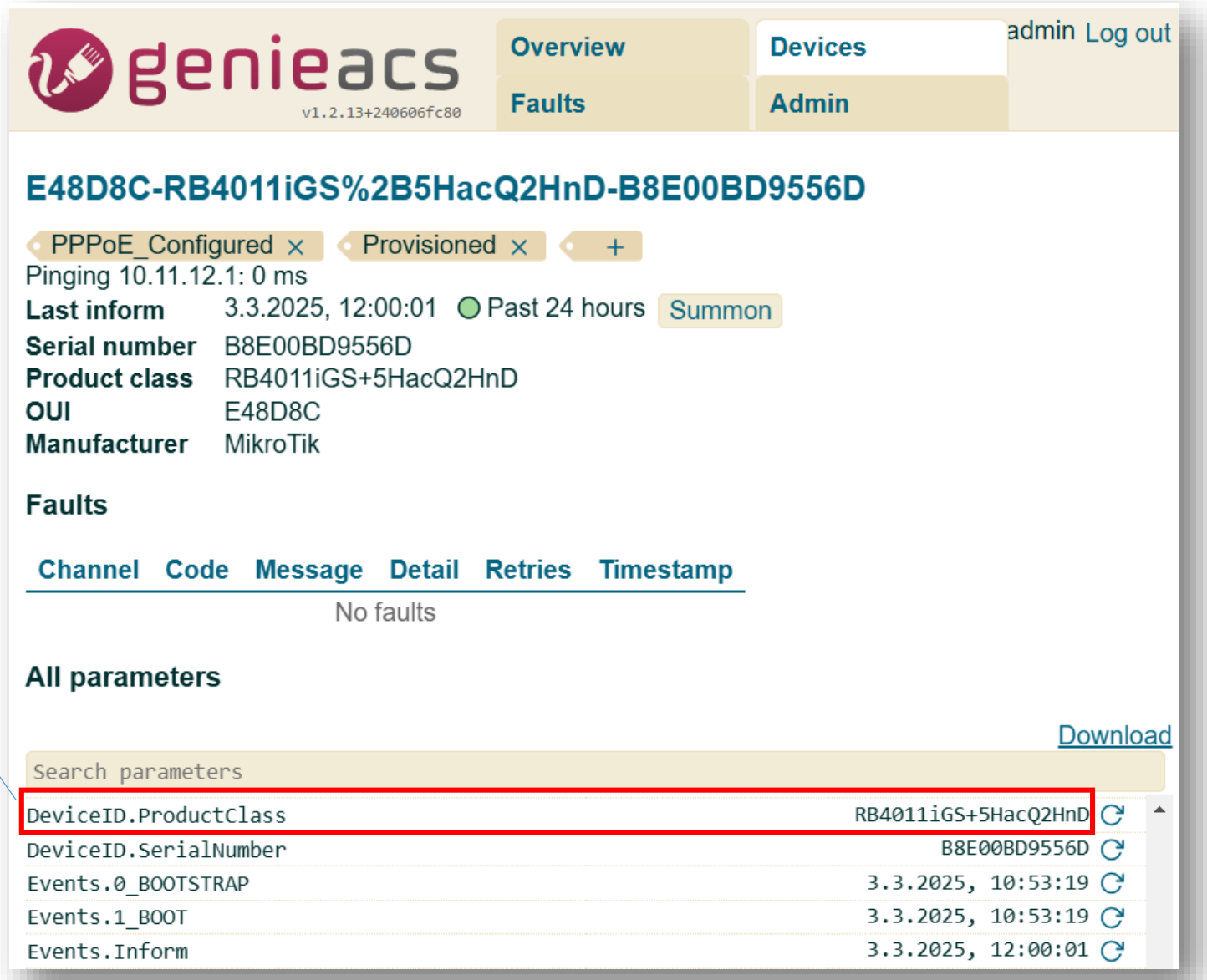
Of MikroTik CPE with ACS

ACS Inventory

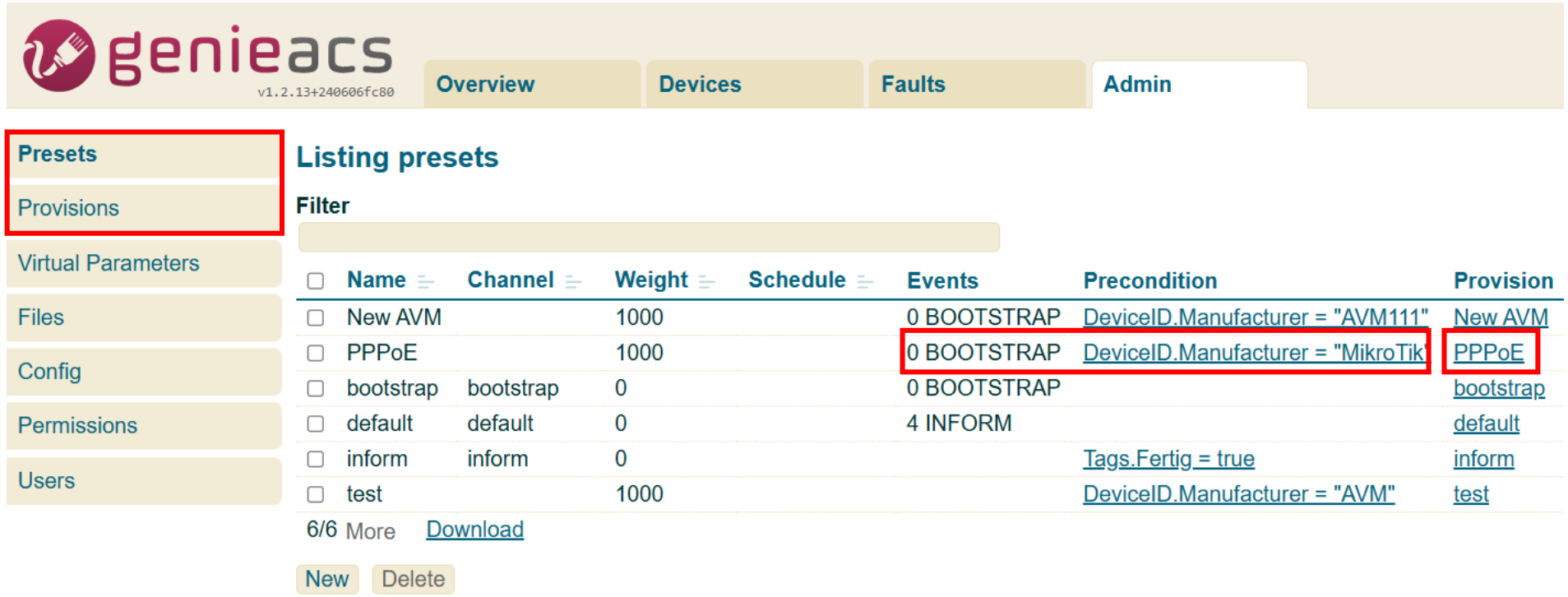


ACS Inventory

DeviceID.ProductClass
=
RB4011iGS+5HacQ2HnD

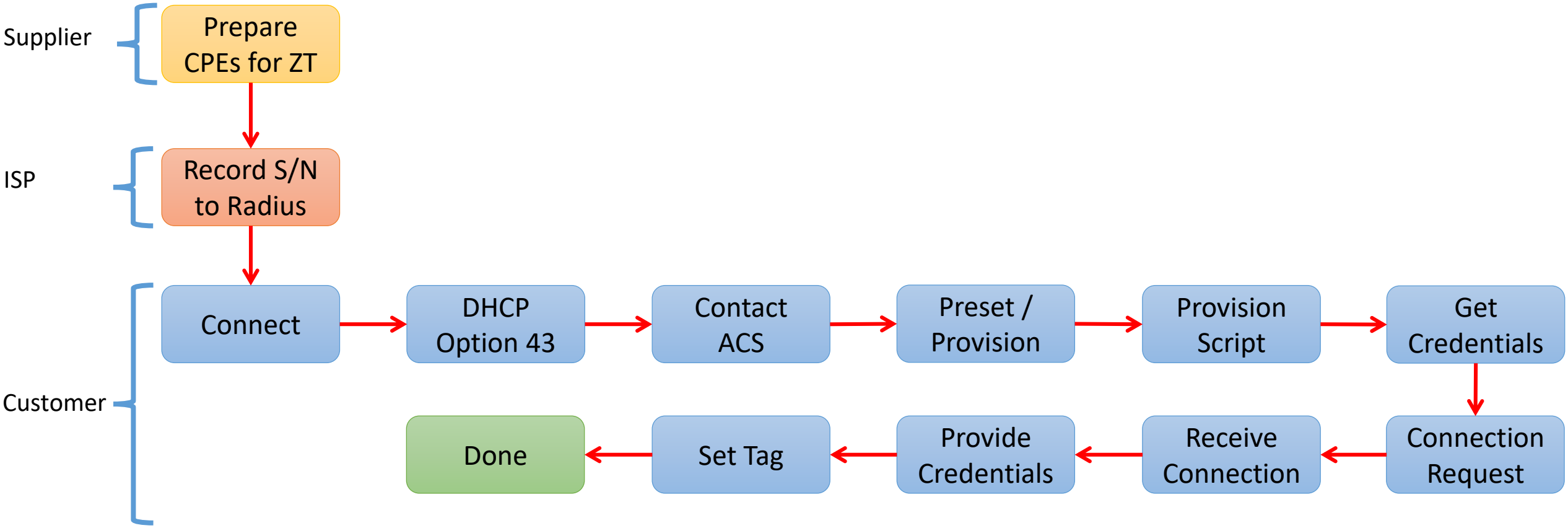


ACS Administration



- Preset: Rules (conditions and weight)
- Provisions: Tasks to complete (scripts)

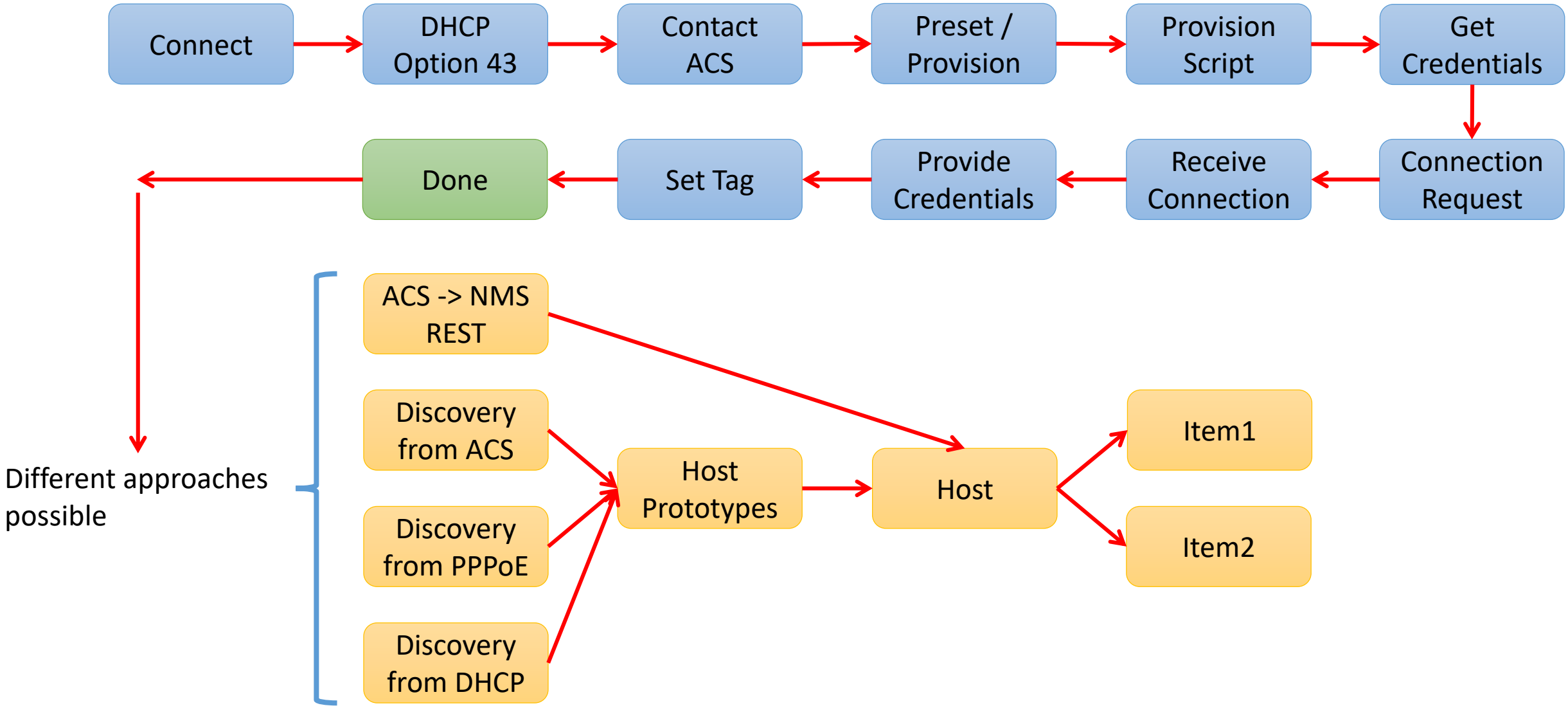
PPPoE Autoconfiguration Process



Automatic Monitoring and Visualisation

Of MikroTik ACS clients

Automatic Monitoring Process



Thank You

Send an inquiry

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