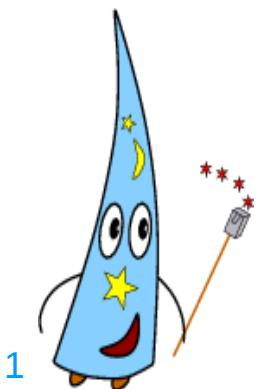


Managing your network with Netmagis

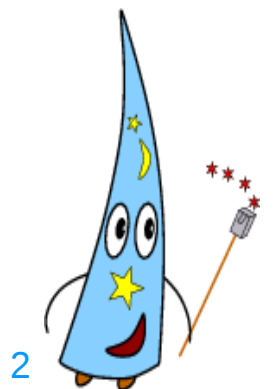
Jean Benoit, Pierre David, Sébastien Boggia
Université de Strasbourg

Campus Network Monitoring Workshop
April 24-25 2012



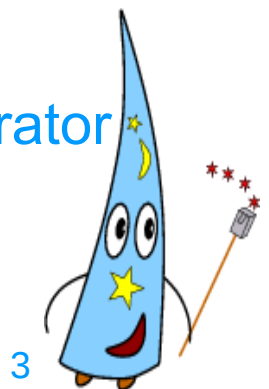
Managing your network with Netmagis

- ▶ What is Netmagis ?
- ▶ The topology module
- ▶ Netmagis and other network management tools



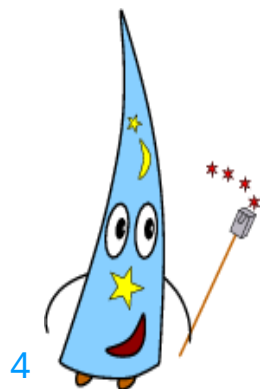
What is Netmagis?

- ▶ Netmagis = NETwork MAnaGement Information System
- ▶ Open Source, BSD license
- ▶ Context: Osiris, a large campus network
 - 1500 network equipments, 400 subnets, 200 contacts
- ▶ Not Osiris-specific
 - A tool for any network, large or small
- ▶ Web application
- ▶ Manages the Network Information System
 - Central repository of all objects managed by the network operator
 - Processes
 - Consistency, exhaustivity, documentation, automation...



Some functions of Netmagis

- ▶ Managing hosts: names, IPv4 and IPv6 addresses
 - **Automatic** generation of DNS zones, DHCP configurations...
- ▶ Topology: VLAN, links between equipments
 - **Automatic** generation of network maps
 - Setting a VLAN
 - **Multi-vendor environment** (Cisco, HP, Juniper)
- ▶ Metrology: traffic graphs
 - **Automatic** generation (RRD database, SNMP polling)
- ▶ Mac: locate a host by its IP address
 - Find the MAC address and the interface/equipment
- ▶ **Delegate** all these functions to other people



Add host or alias

Add host

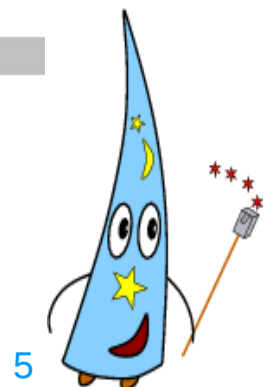
| | | | | |
|------------------------------------|--|--------------|--|--------------|
| Name | <input type="text" value="myhost01"/> | . | <input type="text" value="mydomain.org"/> | |
| IP address | <input type="text" value="2001:db8:1:1::1"/> | TTL | <input type="text"/> | (in seconds) |
| MAC address | <input type="text" value="08:00:01:02:03:04"/> | DHCP profile | <input type="text" value="debian-netinstall"/> | |
| Host type | <input type="text" value="PC/Unix"/> | Use SMTP | <input type="checkbox"/> | |
| Comment | <input type="text" value="Example host"/> | | | |
| Responsible (name) | <input type="text" value="John Doe"/> | | | |
| Responsible (mail) | <input type="text" value="jdoe@mymaildomain.org"/> | | | |
| <input type="button" value="Add"/> | | | | |

Search for an IPv4 block

| | |
|---|---|
| IPv4 network | <input type="text" value="172.16.1.0/24 2001:db8:1:1::/64 (Backbone)"/> |
| Address count | <input type="text" value="1"/> |
| <input type="button" value="Search"/> or <input type="button" value="Consult map"/> | |

Add alias

| | | | |
|------------------------------------|----------------------|---|--|
| Alias name | <input type="text"/> | . | <input type="text" value="netmagis.maquette"/> |
| Host | <input type="text"/> | . | <input type="text" value="netmagis.maquette"/> |
| <input type="button" value="Add"/> | | | |



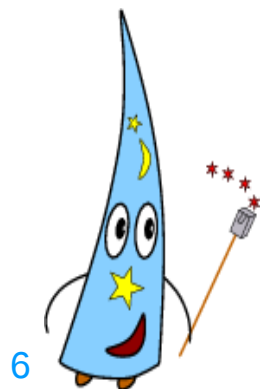
IPv4 address map

List at 04/02/2012 11:36:25.

| | |
|---|--|
| | address not allowed |
| | available address |
| | declared address |
| | non-declared address within a DHCP range |

237 available addresses / 256 total[\[Detail\]](#)

| | | | | | | | | | | | | | | | | |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 172.16.1.0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 172.16.1.16 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 172.16.1.32 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| 172.16.1.48 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |
| 172.16.1.64 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
| 172.16.1.80 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 |
| 172.16.1.96 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 |
| 172.16.1.112 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 |
| 172.16.1.128 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 |
| 172.16.1.144 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 |
| 172.16.1.160 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 |
| 172.16.1.176 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 |
| 172.16.1.192 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 |
| 172.16.1.208 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 |
| 172.16.1.224 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 |
| 172.16.1.240 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 |



Topology: L2

Enter an equipment

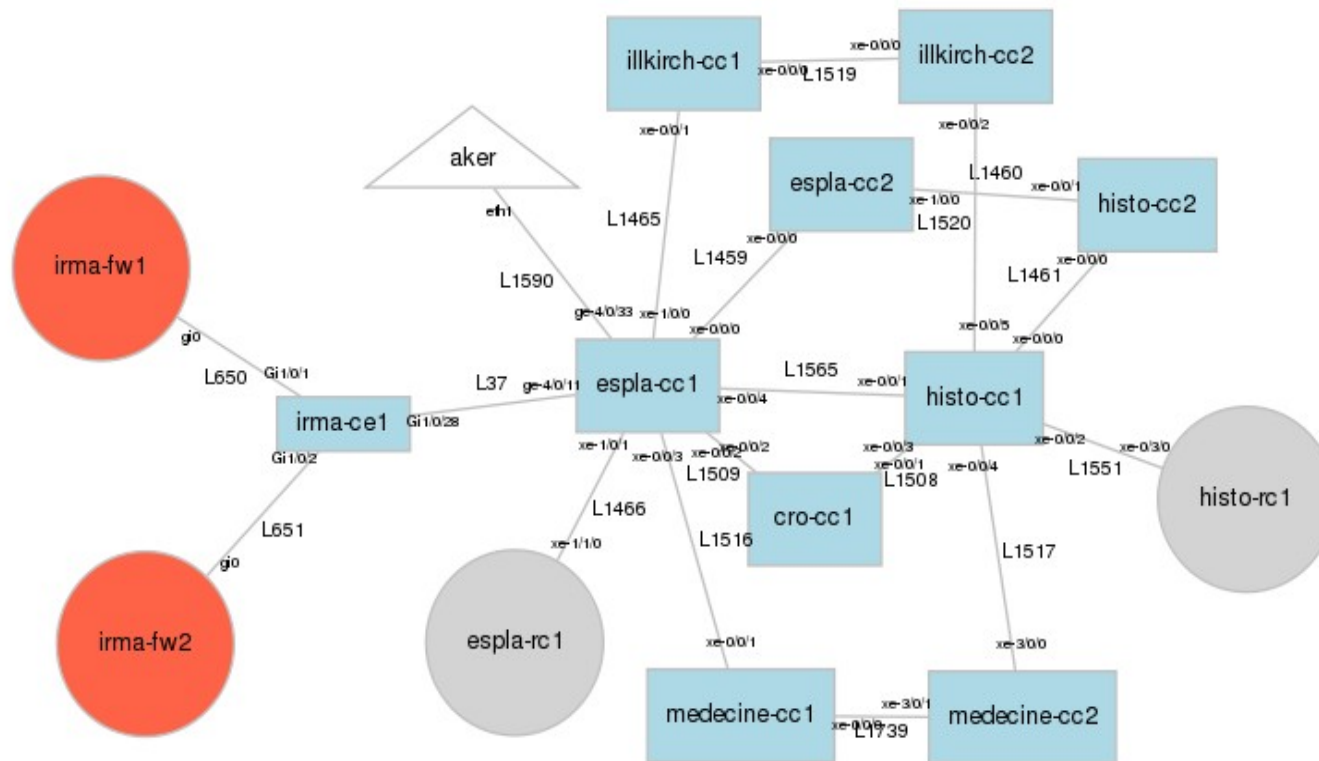
Display

Enter a VLAN

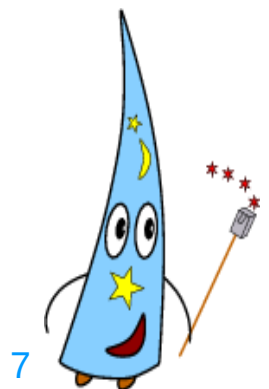
Display

Enter an IP address

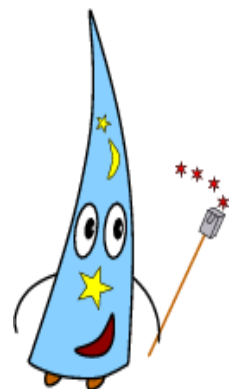
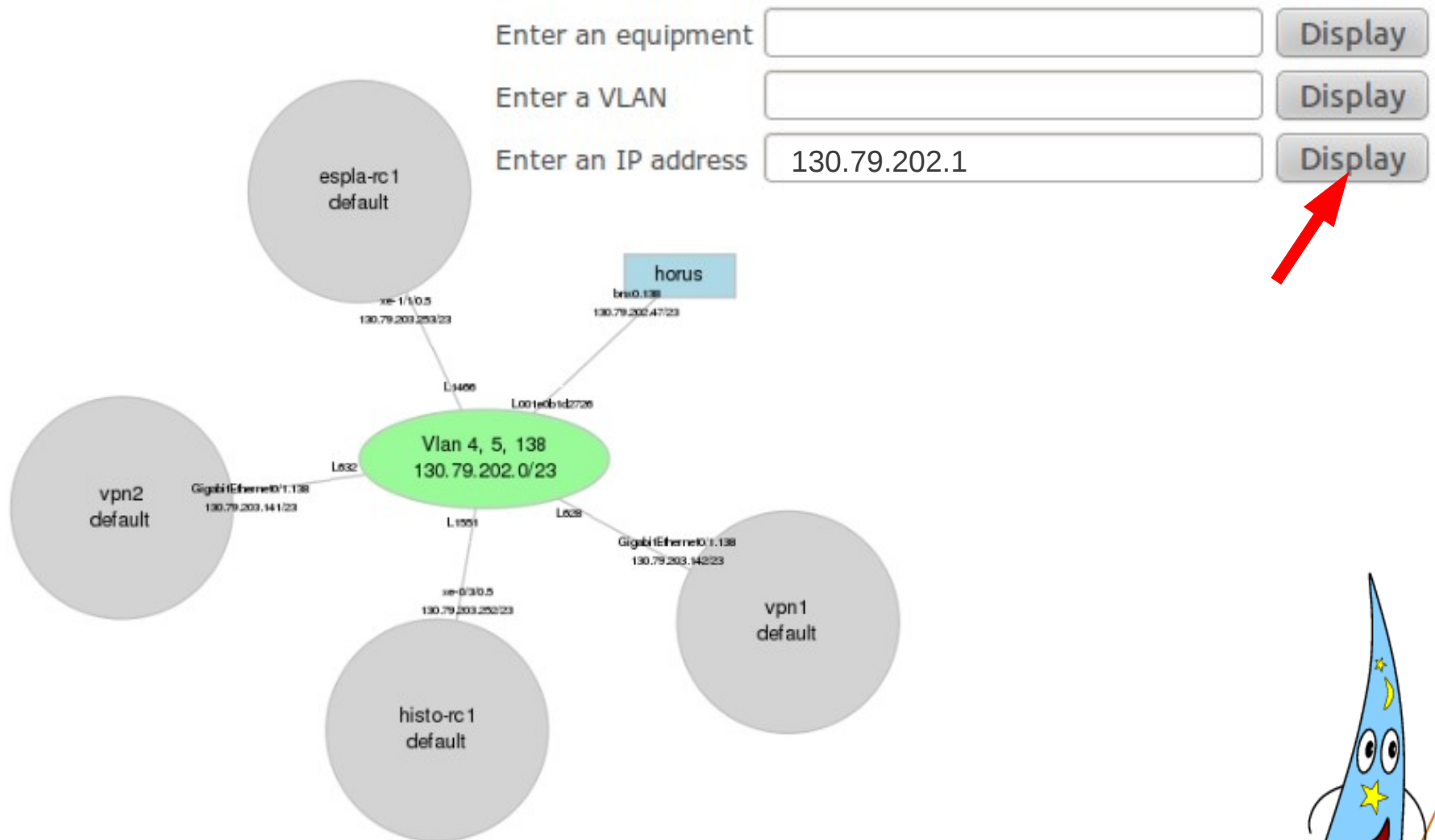
Display



Vlan 33 : rch ulp irma



Topology: L3



Topology: network equipments

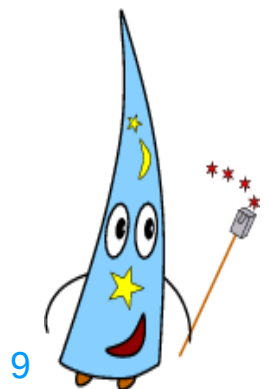
Enter an equipment

Enter a VLAN

Enter an IP address

Equipment cnetmaq cisco WS-C2960-24TT-L [\[Edit interfaces\]](#)

- FastEthernet0/1 Ether [\[Edit\]](#)
Vlan [2000 \(management vlan\)](#) (native vlan)
- FastEthernet0/2 Ether [\[Edit\]](#)
Vlan [2000 \(management vlan\)](#) (native vlan)
- FastEthernet0/3 Ether [\[Edit\]](#)
Vlan [1 \(default\)](#) (native vlan)
- FastEthernet0/4 Ether [\[Edit\]](#)
Vlan [1 \(default\)](#) (native vlan)
- GigabitEthernet0/1 [\[Traffic\]](#) Trunk L1 to [jnetmaq ge-0/0/0](#)
Vlan [2000 \(management vlan\)](#)



Topology: interface modification

Edit interface FastEthernet0/4 on cnetmaq

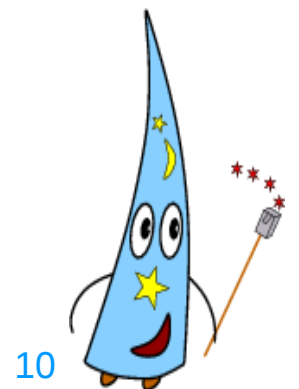
Description

VLAN

Sensors

You can also [edit more than one interfaces](#) simultaneously

- ▶ Works on Cisco, HP and Juniper equipments
- ▶ Can be delegated to other admins



Topology: traffic on an interface

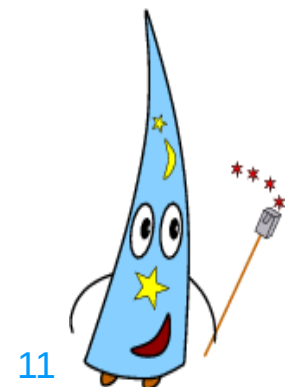
Enter an equipment

Enter a VLAN

Enter an IP address

Equipment cnetmaq cisco WS-C2960-24TT-L [\[Edit interfaces\]](#)

- FastEthernet0/1 Ether [\[Edit\]](#)
Vlan [2000 \(management vlan\)](#) (native vlan)
- FastEthernet0/2 Ether [\[Edit\]](#)
Vlan [2000 \(management vlan\)](#) (native vlan)
- FastEthernet0/3 Ether [\[Edit\]](#)
Vlan [1 \(default\)](#) (native vlan)
- FastEthernet0/4 Ether [\[Edit\]](#)
Vlan [1 \(default\)](#) (native vlan)
- GigabitEthernet0/1 [\[Trafic\]](#) trunk L1 to [inetmaq ge-0/0/0](#)
Vlan [2000 \(management vlan\)](#)

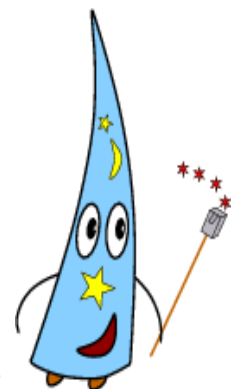
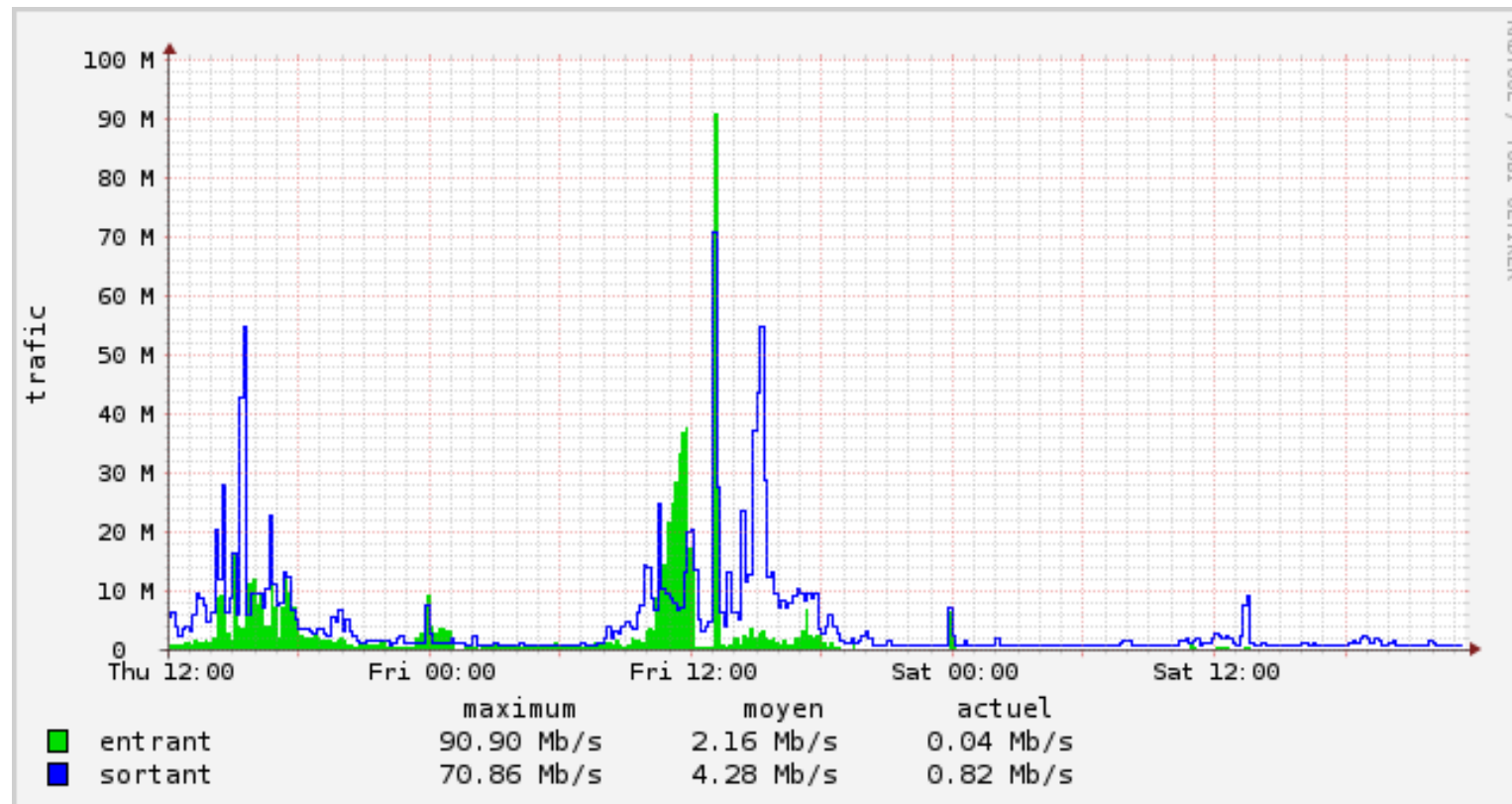


Topology: traffic on an interface

Traffic on interface GigabitEthernet0/1 of cnetmaq

Display data between at h and at h

Traffic on interface GigabitEthernet0/1 of cnetmaq

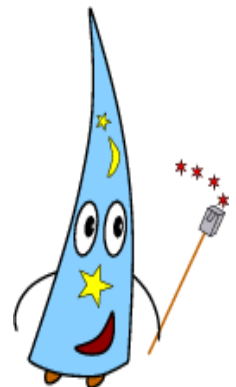


MAC: locate an IP address

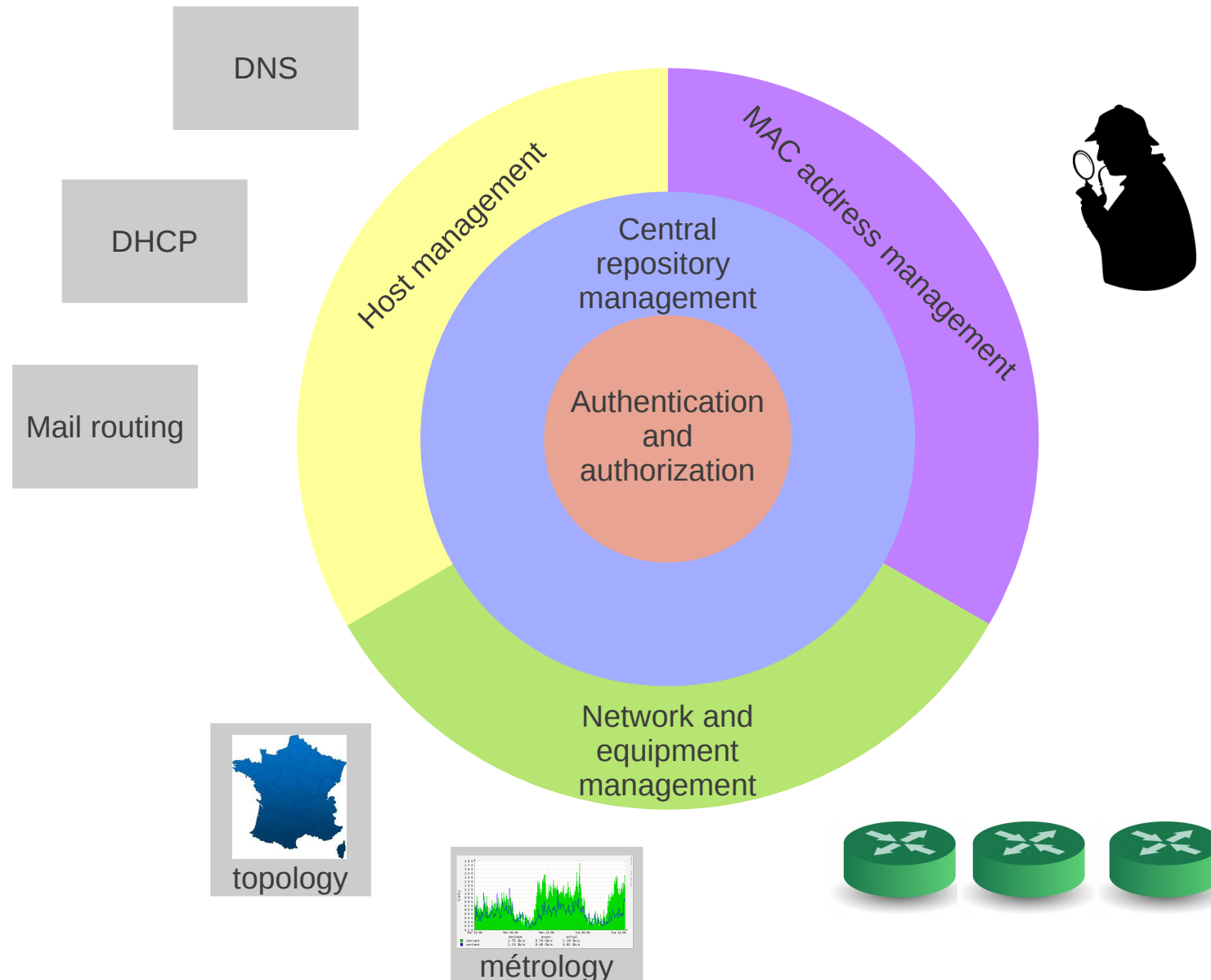
Search result for IP address 130.79.6.1

1 MAC-IP address associations found for 130.79.6.1:

| Sessions | IP address | MAC address | Last occurrence |
|-------------------------|--|---|---------------------|
| Details | 130.79.6.1 (res-a.u-strasbg.fr.) | 00:16:76:b7:ec:eb (Intel Corporation) | 04/04/2012 17:45:04 |

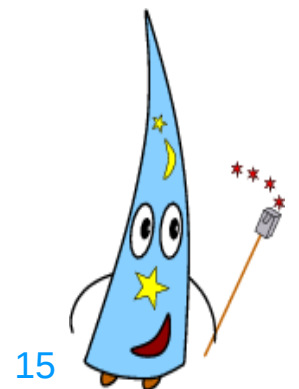


Functional domains

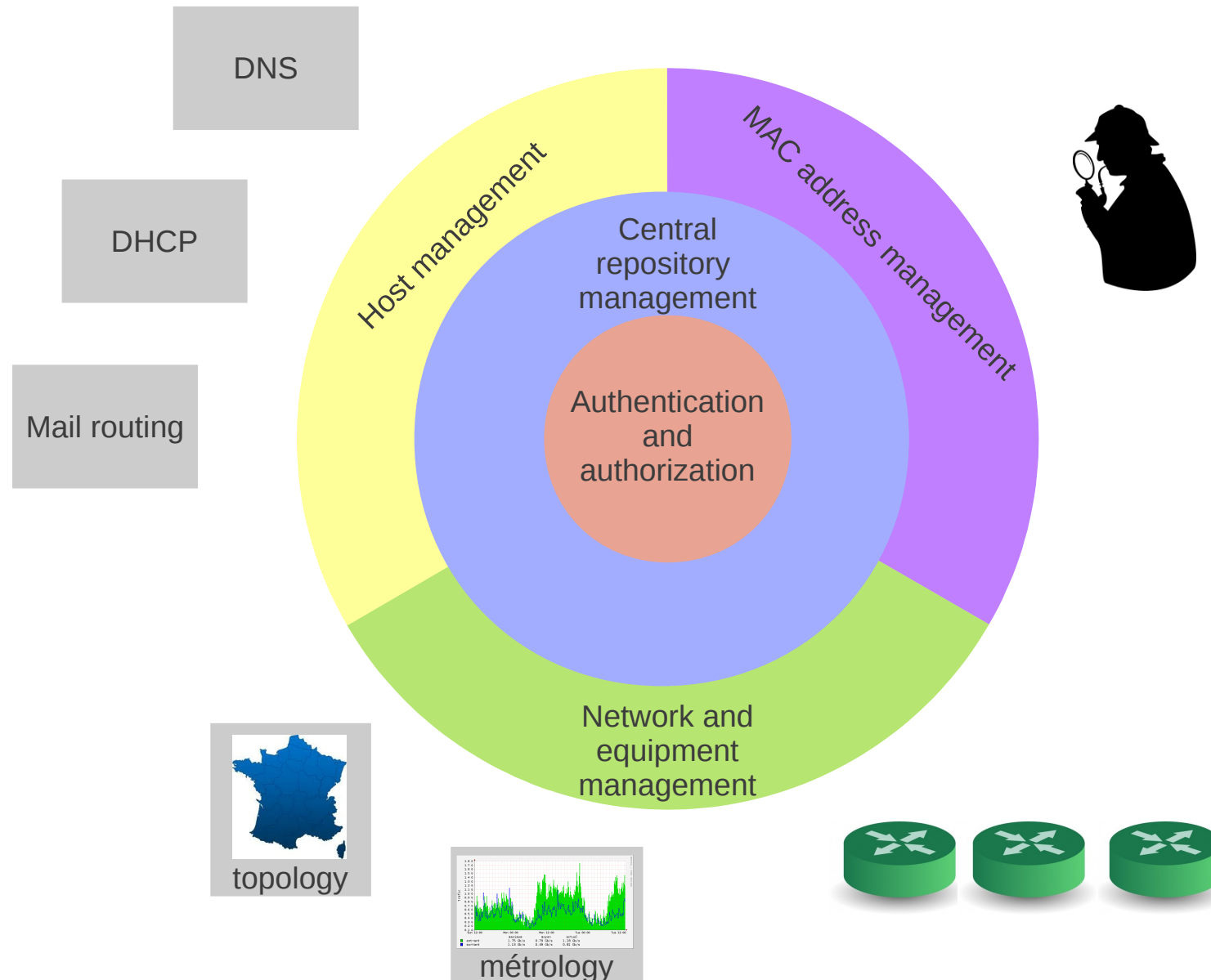


Managing your network with Netmagis

- ▶ What is Netmagis ?
- ▶ The topology module
- ▶ Netmagis and other network management tools



Functional domains

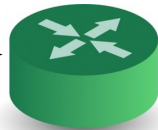


Configuration-driven automation

Network administrator

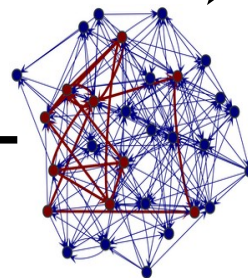
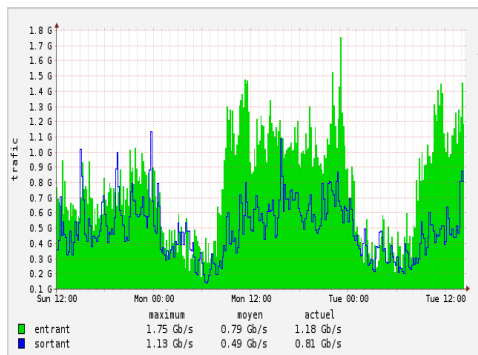


Configuration
modification

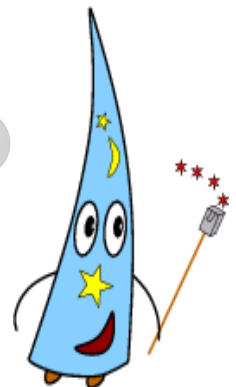
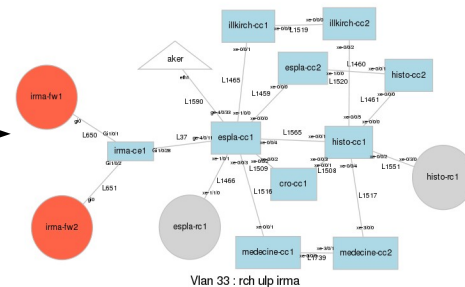


Download

Topology server



Model of the
network



Configuration-driven automation

A simple modification in the configuration of a network equipment:

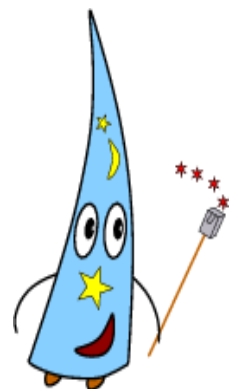
add <link number sensor number> in the interface description:



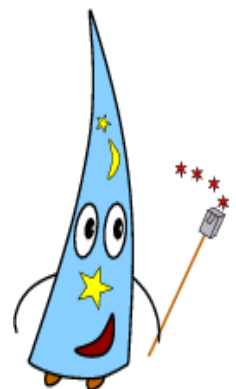
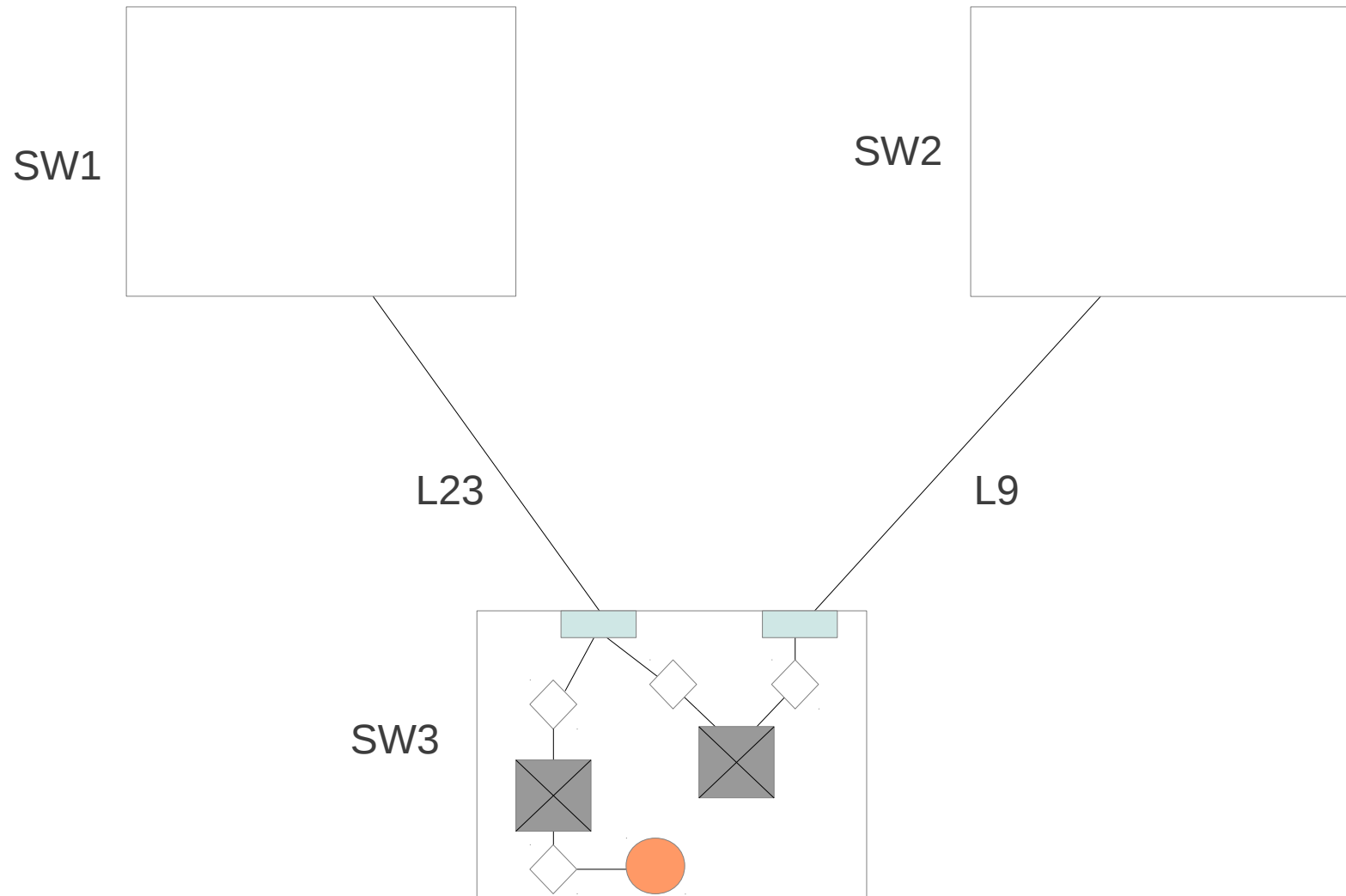
```
interface Gi0/23  
description <L23 M23>
```

The modification is detected ; it triggers a chain of actions:

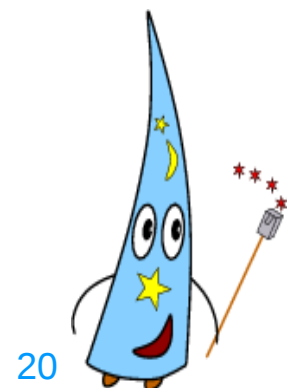
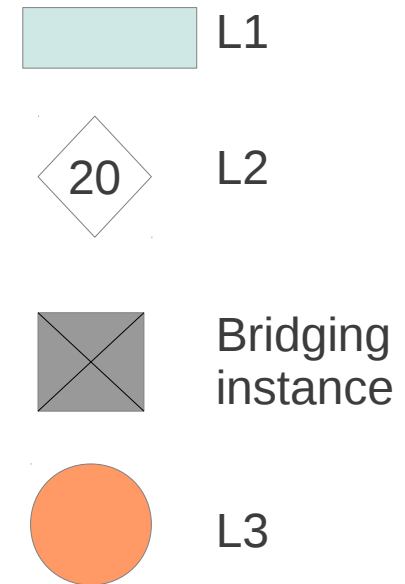
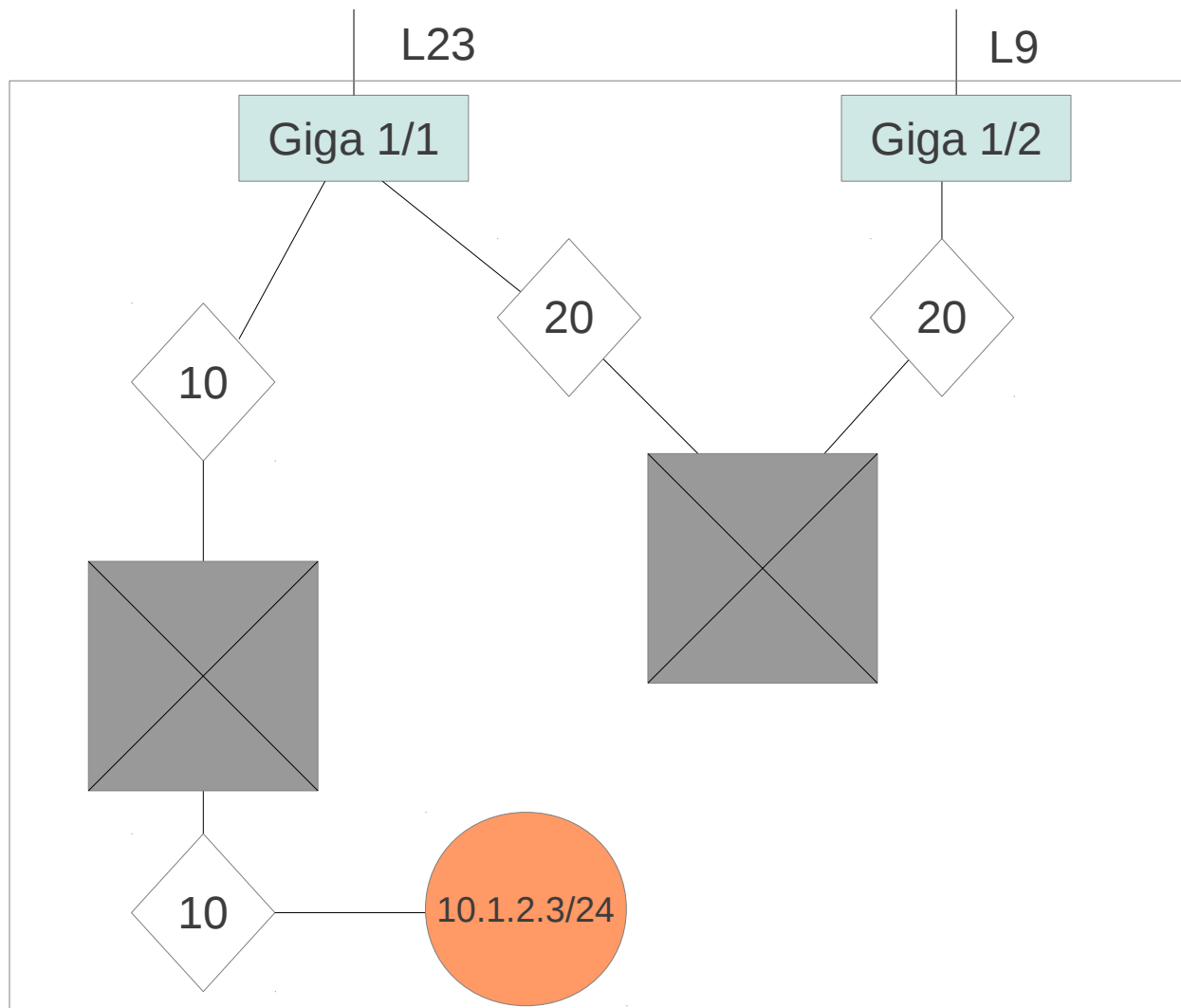
- Analysis of the configuration
- Matching identical link numbers
- Building of a (highly detailed) network model
- Automatic generation of traffic sensors
- SNMP polling and creation of an RRD database



Network model

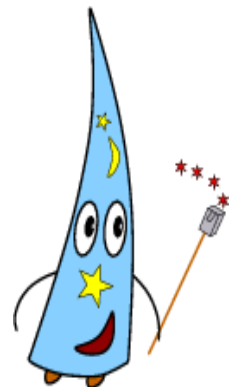


Network model



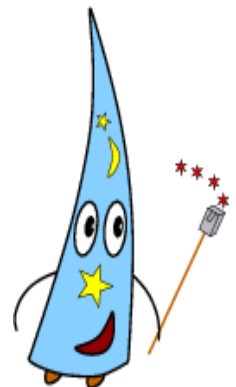
Using the topology graph

- ▶ Detailed network model → many possibilities
- ▶ 1. generate the network graphs (L2 & L3)
 - No network model → no map
- ▶ 2. Topology anomalies/inconsistencies detection
 - Non-contiguous VLAN
 - Graph building process sends a report email after each run
- ▶ 3. Informed MAC address collection
 - MAC module: locate a host on an switch port
 - Fetch forwarding table of all switches and record it into a database
 - Must **not** collect MAC address on backbone ports
 - Must only collect MAC addresses on the **network edge**
 - Edge ports extracted from the network model
 - Collect process is informed of which port should be recorded



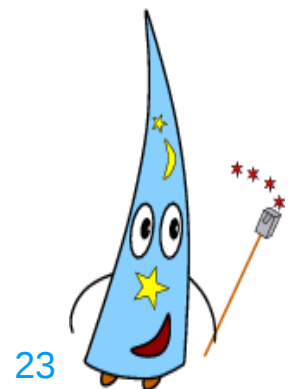
Using the topology graph

- ▶ 3. VLAN provisioning along a path
 - Perl script (not included in Netmagis distribution)
 - Given a VLAN ID, origin and destination equipment
 - The graph is explored, paths are selected and the configurations lines are generated for each equipment
 - The configurations are pushed with Rancid
- ▶ 4. Parent/child relationships generation
 - Perl script (not included in Netmagis distribution)
 - For each network equipment in the graph:
 - Find parent equipment
 - Set parent in Nagios for this equipment



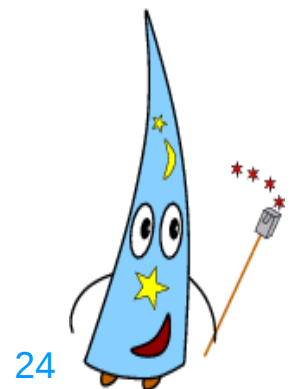
Managing your network with Netmagis

- ▶ What is Netmagis ?
- ▶ The topology module
- ▶ Netmagis and other network management tools



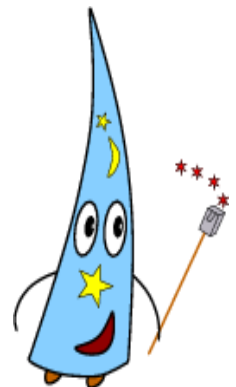
Definition vs. discovery

- ▶ Different approaches
 - User defines every objects (Stanford NetDB)
 - User inputs seed information (subnets) and the Network Management System discovers everything else (Tivoli NetView)
- ▶ Netmagis is definition-oriented
 - Netmagis began as an IPAM (IP Address Management) software
 - Main purpose: store authoritative informations (subnets, hosts, link numbers, rights etc.) and delegate management
 - Network Information System
 - No host discovery, no host availability checking
- ▶ Topology, metrology and MAC modules: later additions
- ▶ Other tools only provide a dynamic view of the network



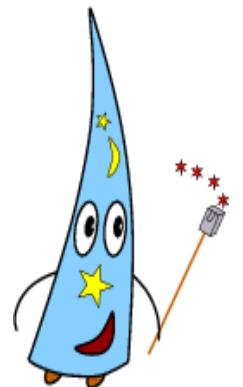
Different design philosophies

- ▶ Is a Network Management System a set of tools or a framework ?
- ▶ Unix: one tool implements one function efficiently
 - eg: grep, sort, uniq etc.
 - Each tool is relatively small
 - It is used stand-alone
 - It is also used as a building block → assembled in a larger system (for example, a document generation system)
- ▶ Emacs
 - The tool becomes a framework (language, libraries)
 - Extend the framework to implement everything
 - Example: a web browser in emacs



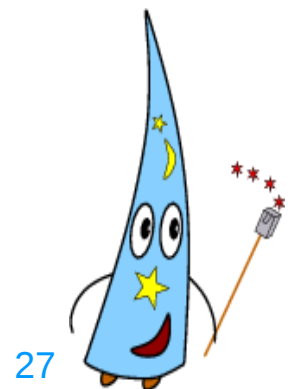
Network management frameworks

- ▶ Abstract model covering many aspects of network management
 - Topology, availability etc.
- ▶ High-learning curve
 - Read documentation, understand the abstractions
- ▶ Configuration non-trivial and time-consuming
 - Display a relevant map of auto-discovered hosts
- ▶ Integrating a new function is hard
- ▶ No single framework will fit all needs
 - There will always be something missing



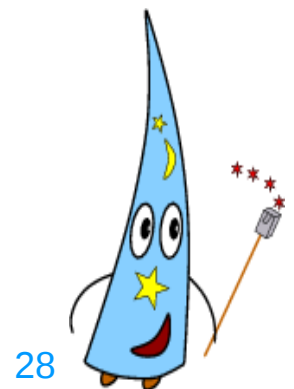
Network Management tool set

- ▶ Each tool has a specific function: traffic monitoring, inventory...
- ▶ Some tools play a key role
 - Tools providing reference data: subnets, hosts, equipments, network topology graph
- ▶ Tools are loosely coupled
- ▶ Flexible and easy to extend
- ▶ But ...
 - No clear functional boundaries, some overlaps
 - Lack of internal consistency
- ▶ User Interface and API should be carefully designed



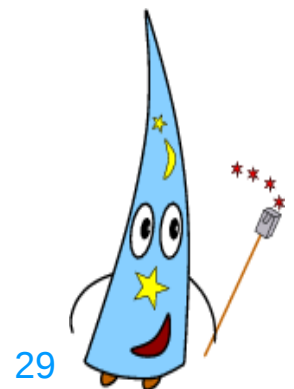
Our toolset 1/2

- ▶ Netmagis follows the tool set approach
- ▶ We integrated several tools to meet our needs
 - Netmagis is central
 - Netmagis plays nicely with others
- ▶ Configuration management:
 - Netmagis: Network reference data (subnets, hosts name and address, VLAN names and ID etc.)
 - Netmagis/Topology:
 - Network maps (L3, L2, equipment view)
 - Some network provisioning (VLANs)
 - Rancid: tracks network equipment configuration changes
 - Fusion (OCS) Inventory: network equipment inventory
 - Network equipment synced with Netmagis Database



Our toolset 2/2

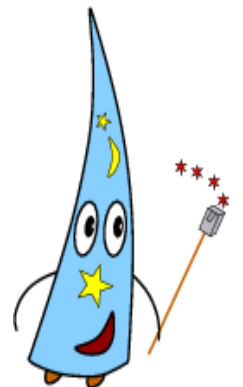
- ▶ Problem and performance management:
 - Netmagis/Metrology: traffic graphs
 - Nagios: availability checking, event management
 - Netmagis/Topology:
 - Pro-actively detects inconsistency in network topology
 - Network map navigation with access to traffic graphs
 - Netmagis/MAC: host tracking
 - RRDTool: traffic graph backend
 - Request Tracker: ticketing system



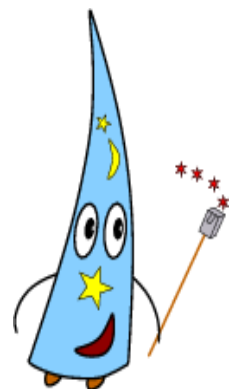
Conclusion

- ▶ Netmagis evolved over many years
- ▶ Maturity: used in production since 2002
- ▶ Packed with functions
 - Modules were developed to answer the management needs of a large campus network
- ▶ The most important tool in our tool set
 - The Network Information System
- ▶ FreeBSD port (v2.1) and Debian package (v2.2)
- ▶ Try it !

<http://netmagis.org/>



Other slides



Under the hood

- ▶ Languages: Tcl, C, Perl
- ▶ Database: PostgreSQL
- ▶ Web Server: any web server implementing CGI
- ▶ Topology: Rancid
- ▶ Metrology: RRDTool
- ▶ Installation
 - V2.1: FreeBSD port , V2.2: Debian Package
- ▶ VCS: <http://github.com/pdav/netmagis>
- ▶ All contributions are welcome!

