

IPv6 network management

Dakar, Sénégal
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Philippe.Bereski@alcatel.fr

Simon.Muyal@renater.fr

Bernard.Tuy@renater.fr



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Contributions

- Simon Muyal, RENATER
- Bernard Tuy, RENATER
- Jérôme Durand, RENATER
- Ralf Wolter, Cisco
- Patrick Grossetête, Cisco
- Munechika Sumikawa, Hitachi
- Patrick Paul, 6WIND



Agenda

- Introduction
- Retrieving information from routers
 - TELNET/SSH/TFTP/FTP...
 - SNMP/MIBs and IPv6
 - Netflow
- Management platforms
- Management tools
 - 6NET work
 - Recommendations (LAN, WAN...)
 - Examples
- Conclusion & Demo



Introduction

- IPv6 networks deployed:
 - Most are dual stack
 - LANs (campuses, companies, ...)
 - MANs
 - WANS - ISPs (Géant, NRENS, IJ, NTT/Verio, Abilene, ...)
 - IX's
- Testbed, pilot networks, production networks
 - Management tools/procedures are needed
- What applications are available for managing these networks ?
 - Equipment, configurations, ...
 - **IP services** (servers : DNS, FTP, HTTP, ...)



Introduction

- Different types of networks
 - Dual stack IPv6 & IPv4 networks
 - IPv6 only networks (few of them)
- Important to keep in mind
 - Dual stack is not for ever
 - One IP stack should be removed... one day
 - No reasons for network admins to face twice the amount of work



Dual Stack IP networks

- Part of the monitoring via IPv4
 - Connectivity to the equipment
 - Tools to manage it (inventory, configurations, «counters», routing info, ...)
- Remaining Part needs IPv6
 - MIBs IPv6 support
 - NetFlow (v9)



IPv6 only networks

- Topology discovery (LAN, WAN ?)
- IPv6 SNMP agent
- SNMP over IPv6 transport

=> Need to identify the missing parts





SSH/TELNET/TFTP ...

Basic requirements to manage a
network



SSH/TELNET/TFTP...

- All routers support IPv6 connections (SSH, TELNET)
 - Periodic scripts can retrieve information from the routers over IPv6
- TFTP/IPv6 as well supported on every equipment
 - Images can be downloaded over IPv6
- FTP/IPv6 not supported on CISCO routers

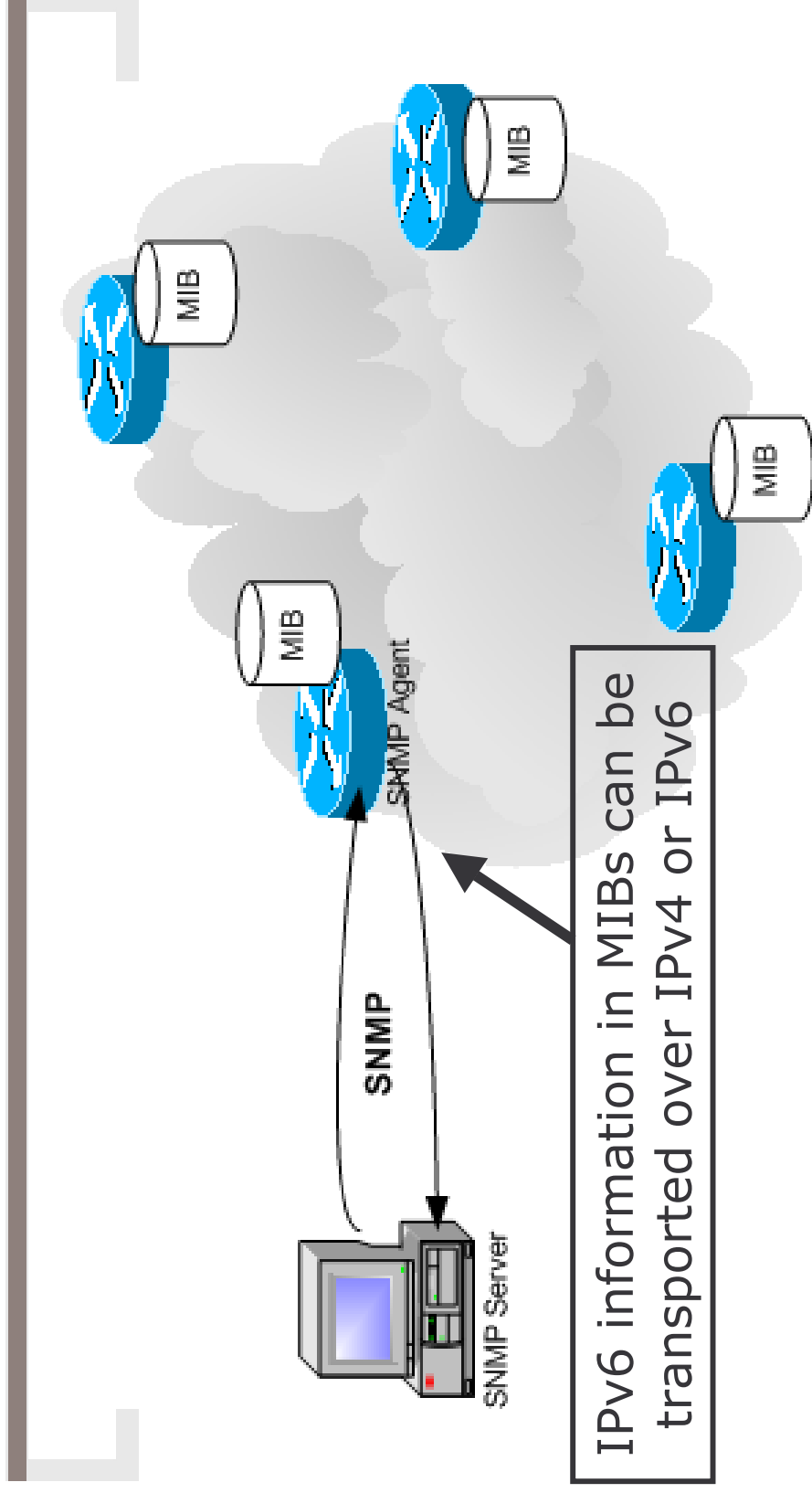


SNMP/MIBs and IPv6

- SNMP and IPv6
- IPv6 MIBs status
- Manufacturers implementations



SNMP model



SNMP over IPv6

- Cisco:
 - SNMP over IPv6 is available in 12.0(27)S and 12.3(14)T
 - IOS 12.4 & 12.4T too
 - More features available from 12.0(30)S
- Juniper, Hitachi, 6wind:
 - SNMP over IPv6 is available





IPv6 MIBs Status



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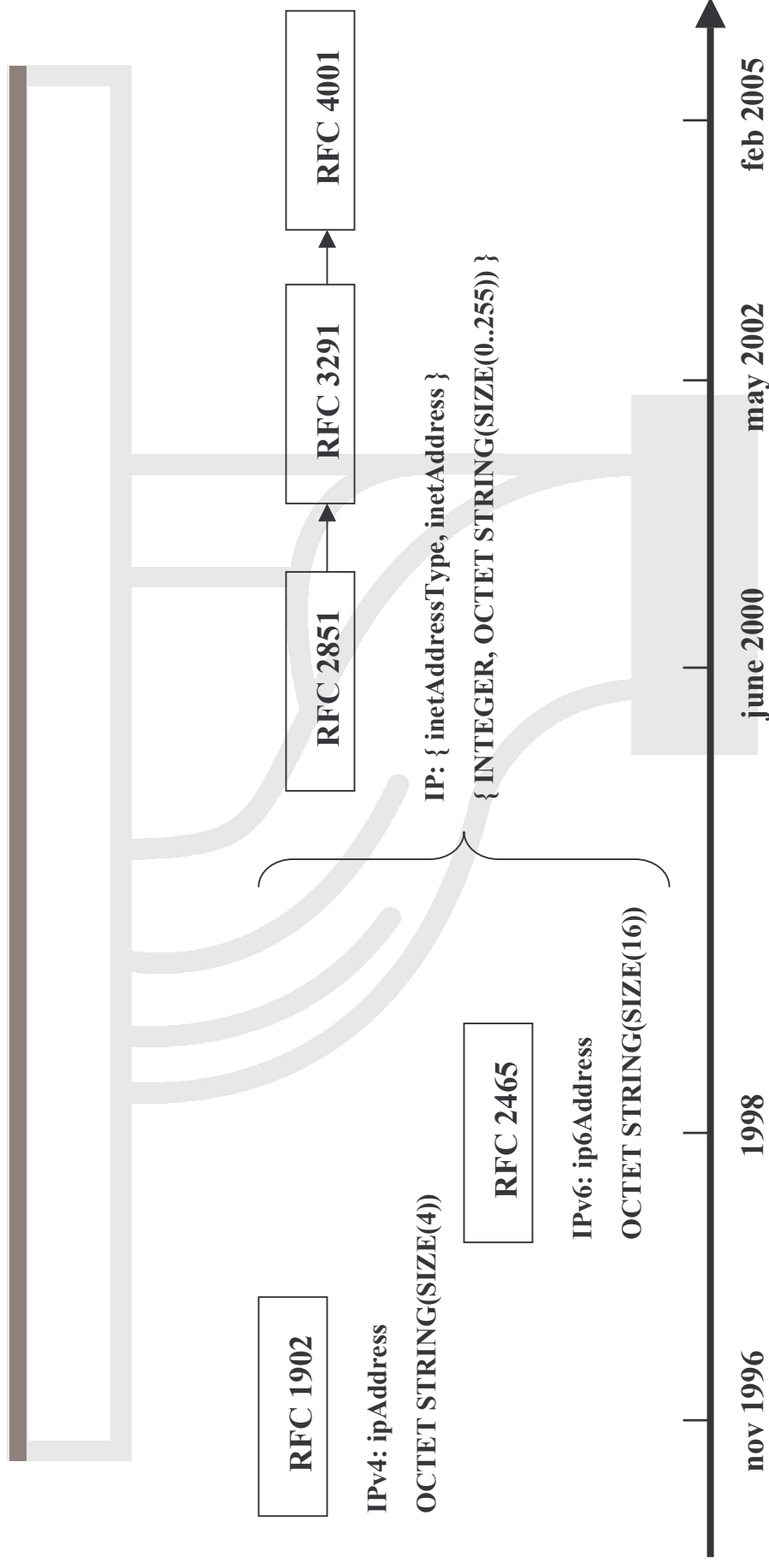
IPv6 MIBs /2

- Standardization status at IETF:
 - At the beginning:
 - IPv4 and IPv6 MIBs dissociated

	IPv4	IPv6	Remarks
Textual Conventions	RFC1902	RFC2465	Definition of IP address format
IP MIB	RFC2011		
ICMP MIB		RFC2466	
TCP MIB	RFC2012	RFC2452	
UDP MIB	RFC2013	RFC2454	



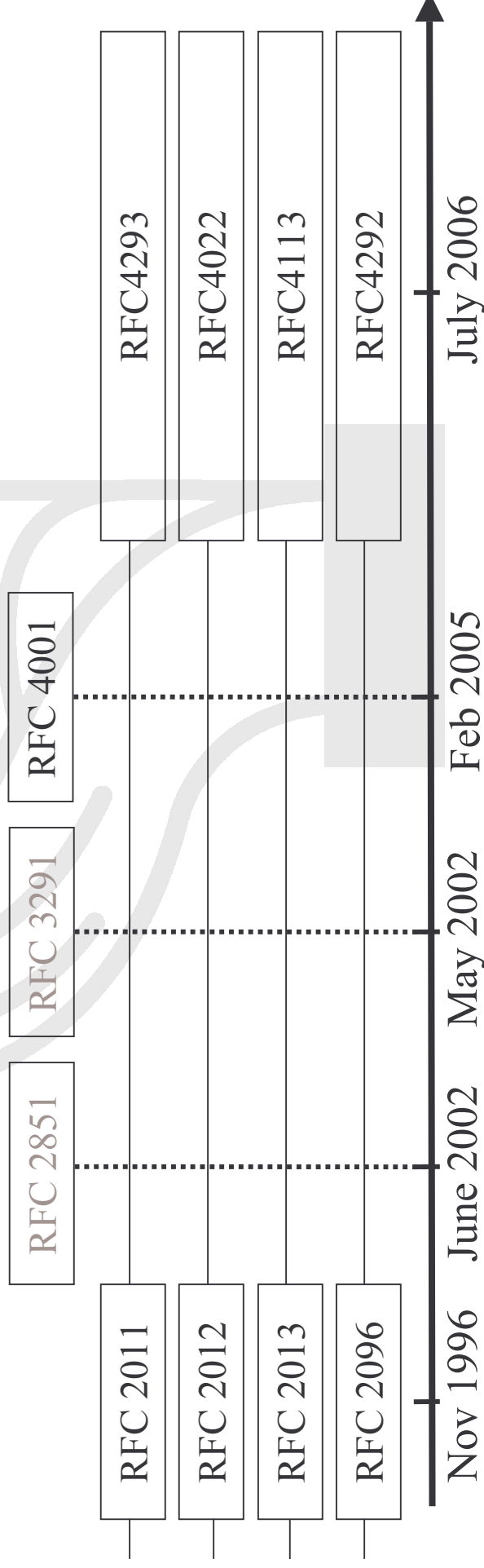
IPv6 MIBs /3



IPv6 MIBs /4

Standardization status at IETF

- Today : **unified MIBs** are on standard track.



IETF MIB Status /6

- BGP MIB v6:
 - draft-ietf-idr-bgp4-mibv2-05.txt (07/2005)
 - Expired

Note that the same people are working on

- draft-ietf-idr-bgp4-mib-15.txt (08/2004)
 - → **RFC 4273**
 - *This draft consider only IPv4 addresses:*
 - « **IMPORTS IpAddress** » → 32 bits



IPv6 MIBs implementations



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IPv6 MIBs implementation/1

- Cisco
 - Private Cisco MIBs implement RFC 2011 (IP) & 2096 (Forwarding) updated drafts
 - Work on implementing the new standards
 - No distinction between IPv4 and IPv6 traffic at the interface level from the MIBs (available when new IETF MIB get implemented)
- Information available from CLI
 - `show interface accounting`
 - ...



Cisco: IPv6 CLI

“show interface accounting”

- Differentiate IPv4/IPv6 counters at the interface level for all Cisco routers, except for :

–Catalyst 6500 / Cisco 7600 supervisor engine 720:

Counts only for packets that are software switched, not the hardware switched packets.

–GSR:

- ‘show interface counters’ correctly counts IPv6 traffic and separates ingress and egress traffic
- Engine 3:
 - * OUTPUT IPv6 traffic is counted under IPv6 (correct)
 - * INPUT IPv6 traffic is counted under IP (will get corrected)



IPv6 MIBs implementation/2

- Juniper
 - MIB based on (old) RFC 2465
 - with different counters for IPv4 and IPv6 traffic
 - Or based on filters to collect IPv6 traffic:
 - Ex: Geant monitoring

=> Expected : unified MIBs implementation



IPv6 MIBs implementation/3

- Hitachi
 - Routers (GR2000/GR4000) and Switches (GS4000) support IPv6 standard MIBs:
 - RFC 2452: TCP/IPv6
 - RFC 2454: UDP/IPv6
 - RFC 2465: IPv6
 - RFC 2466: ICMPv6
 - The unified MIBs are not implemented yet.



IPv6 MIBs implementation/5

- Net-SNMP (Carnegie Mellon Univ)
 - <http://net-snmp.sourceforge.net/>
 - IPv6 support from version 5.0
 - RFC 2452: TCP/IPv6
 - RFC 2454: UDP/IPv6
 - RFC 2465: IPv6
 - RFC 2466: ICMPv6
 - RFC 3291: (new) textual convention for representing Internet Addresses

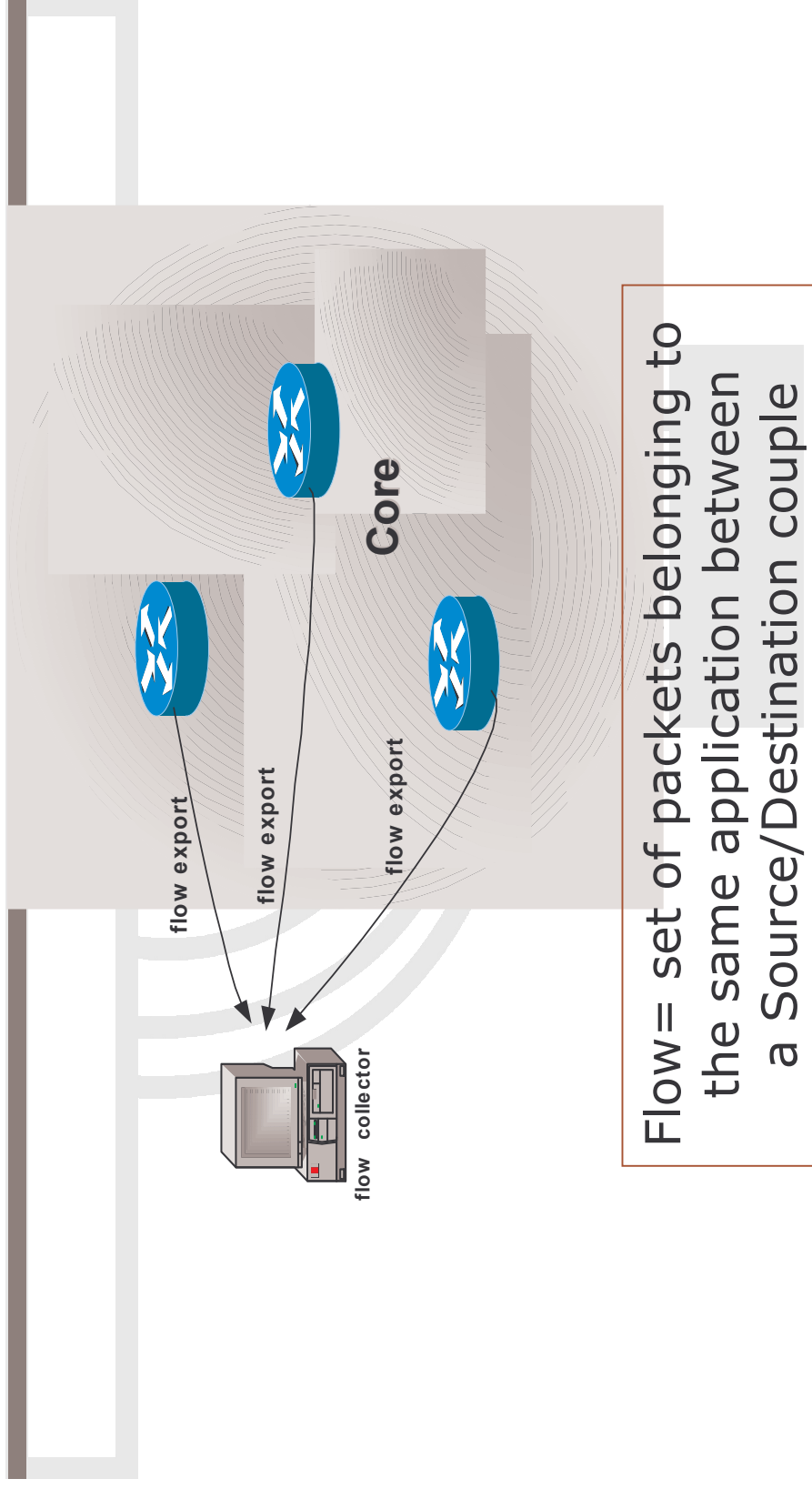


IPv6 flow monitoring



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Netflow & IPFIX model





NetFlow Version 9



NetFlow Version 9

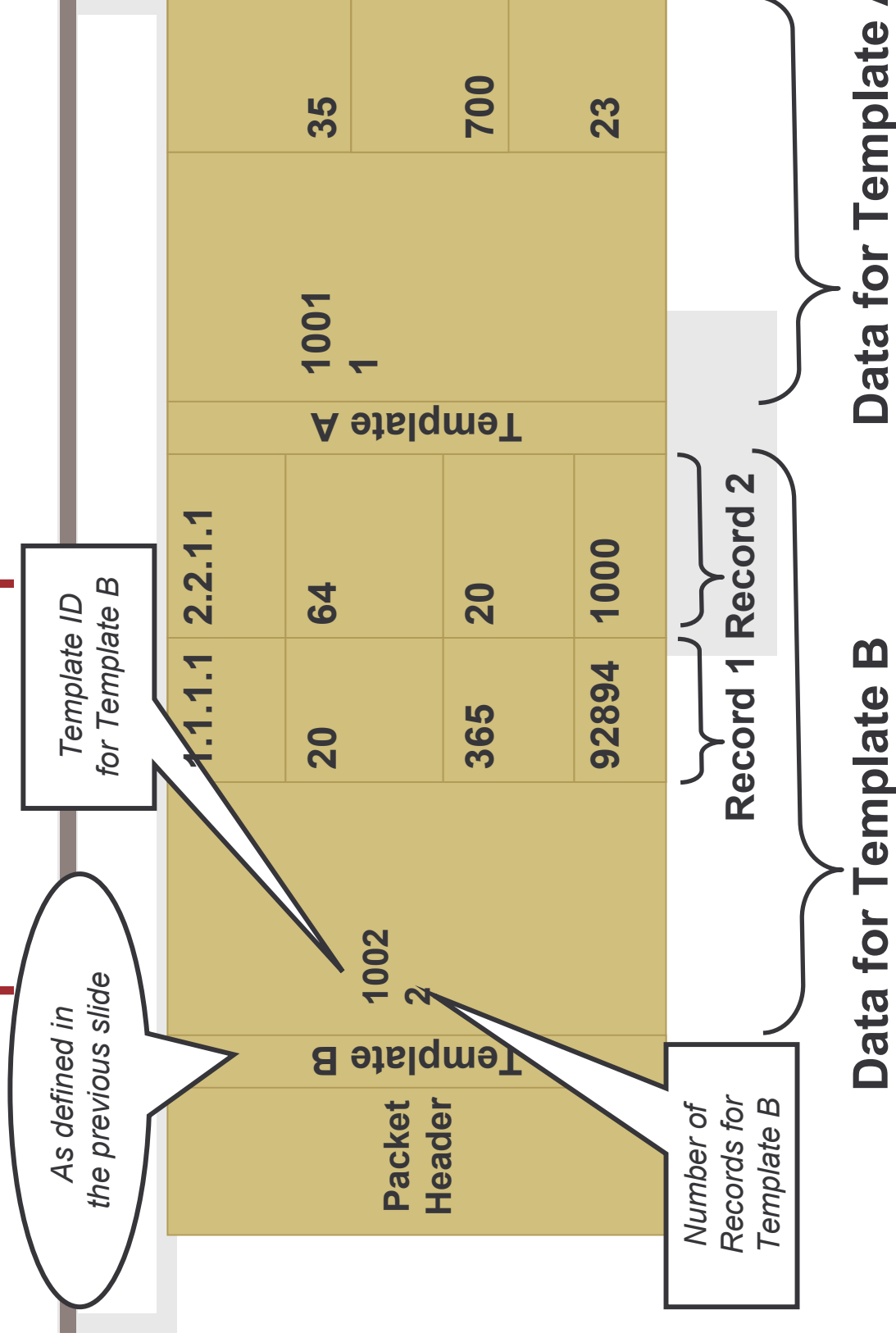
Example for Template Definition

Template A	
Flow Set ID (0 for Template)	
Length of Template Structure	1001
(Template ID)	
(# of Fields)	3
SRC_AS_NUMBER	2
DST_AS_NUMBER	2
L4_PROTOCOL	2

Template B	
Flow Set ID (0 for Template)	
Length of Template Structure	1002
(Template ID)	
(# of Fields)	4
SRC_IP_PREFIX	4
SRC_AS_NUMBER	2
PACKET_COUNT	2
BYTE_COUNT	2



Example for Export Packet



IPv6 flow monitoring /1

- Cisco
 - Available in IOS 12.3(7)T and later version
 - IPv6 packets captured (**needs IPv6 CEF**)
 - Export done with *Netflow v9*
 - Still uses *IPv4 transport*
 - Need to update your own Netflow Collector
 - Cisco NFC v5.0 available
 - Other collectors are available as well
 - » <http://supervision-ipv6.renater.fr/Portail/>
 - » Netflow v9 collector : Renater's collector (**Renetcol**)



IPv6 flow monitoring /2

- Hitachi
 - Support **Sflow** RFC 3176 (<http://www.sflow.org/>)
 - and Netflow is on the roadmap ?
- 6WIND:
 - Not available
- Juniper:
 - **Cflowd** (#Netflow)



Commercial Management platforms



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Commercial platforms

Commercial ISPs use to have integrated management platforms (NRENs mainly use GPL or home-made tools)

- **HP-OV** proposes a version with IPv6 features: NNM 7.0 (sept 2003). Need some hack for automatic IPv6 discovery of CISCO routers.
- **Ciscoworks**: IPv6 version for
 - LMS 2.5 : LAN Management solution
 - Includes a set of functionalities (Campus Manager 4.0, Ciscoview 6.1, ...)
 - CNR 6.2 : Cisco Network Registrar (Naming & addressing services)

Application note on IPv6 management

- **Tivoli Netview** doesn't propose any IPv6 features
- **Infovista** : « no IPv6 plan at the moment »



Cisco: LMS Application supports IPv6

LMS: LAN Management Solution version 2.5

- Includes :
 - Campus Manager 4.0
 - Resource Manager Essential
 - CiscoView version 6.1
 - Cisco Network Registrar (CNR 6.2)
 - Device Fault Manager
 - Internet Performance Monitor
 - Common services



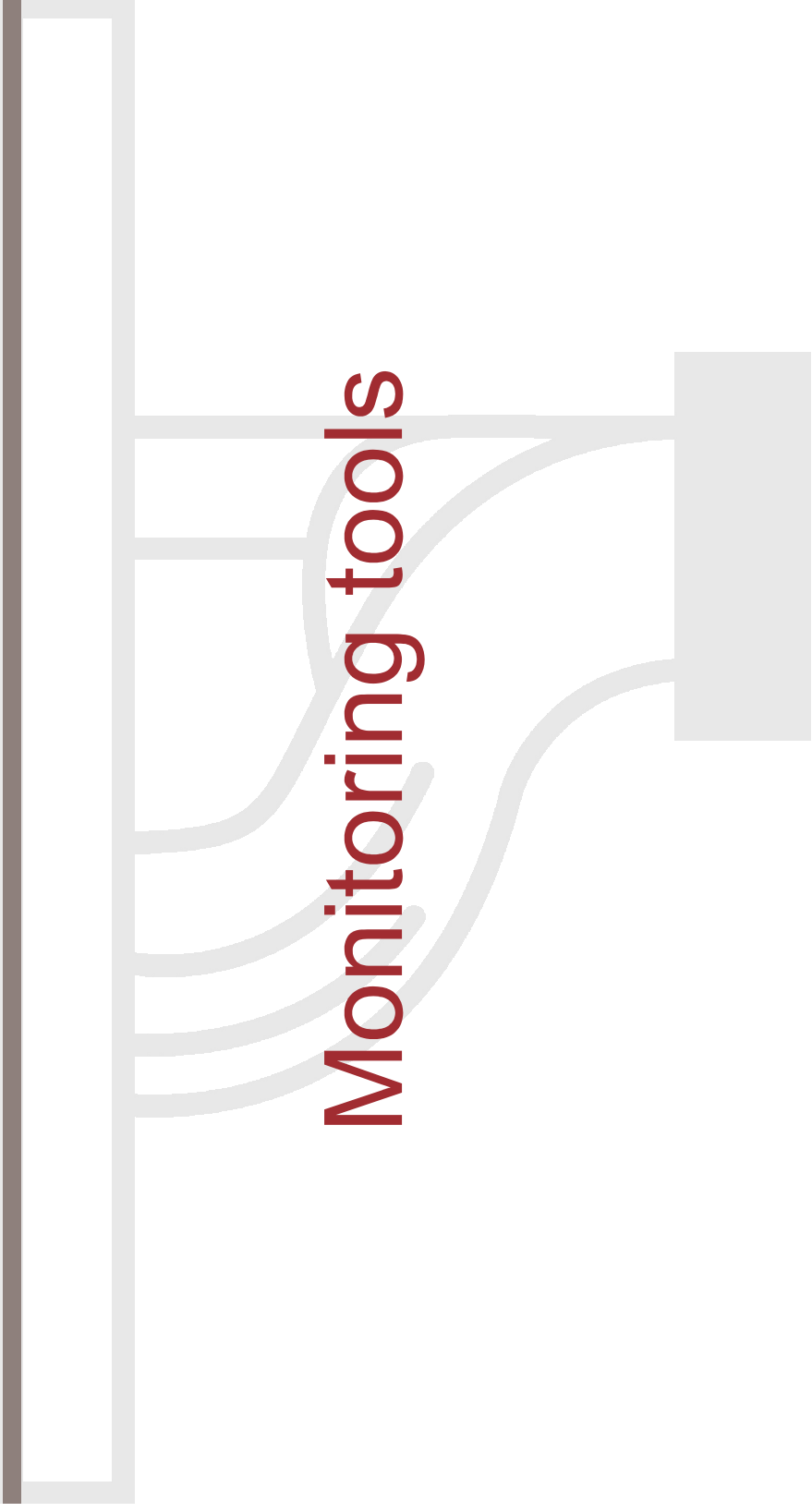
« Top ten » ...

- HP Openview
- Ciscoworks 2000 (LMS 2.5)
- IBM Netview
- Infovista, Tivoli
- ...

IPv6 ready

IPv6 not ready





6Net and IPv6 monitoring tools

- 6Net WP6 : managing large scale IPv6 networks
 - Tests lots of IPv6 ready tools
 - Many others ported to IPv6
- 30+ monitoring tools for IPv6
 - Tested
 - Implemented
 - Documented
- URL: <http://tools.6net.org/>





Argus

- Administration of network:
 - PCs, Switches, Routers
 - Availability
 - Traffic on the network
- Administration of services:
 - http, ftp, dns, imap, smtp...
- Evolution: new features can be easily added





Nagios

- <http://www.nagios.org>
- Very complete tool
 - Services monitoring
 - Network monitoring
- Can be complex for a small network
- Evolution: new features can be added with plug-ins
 - BGP monitoring
 - ...



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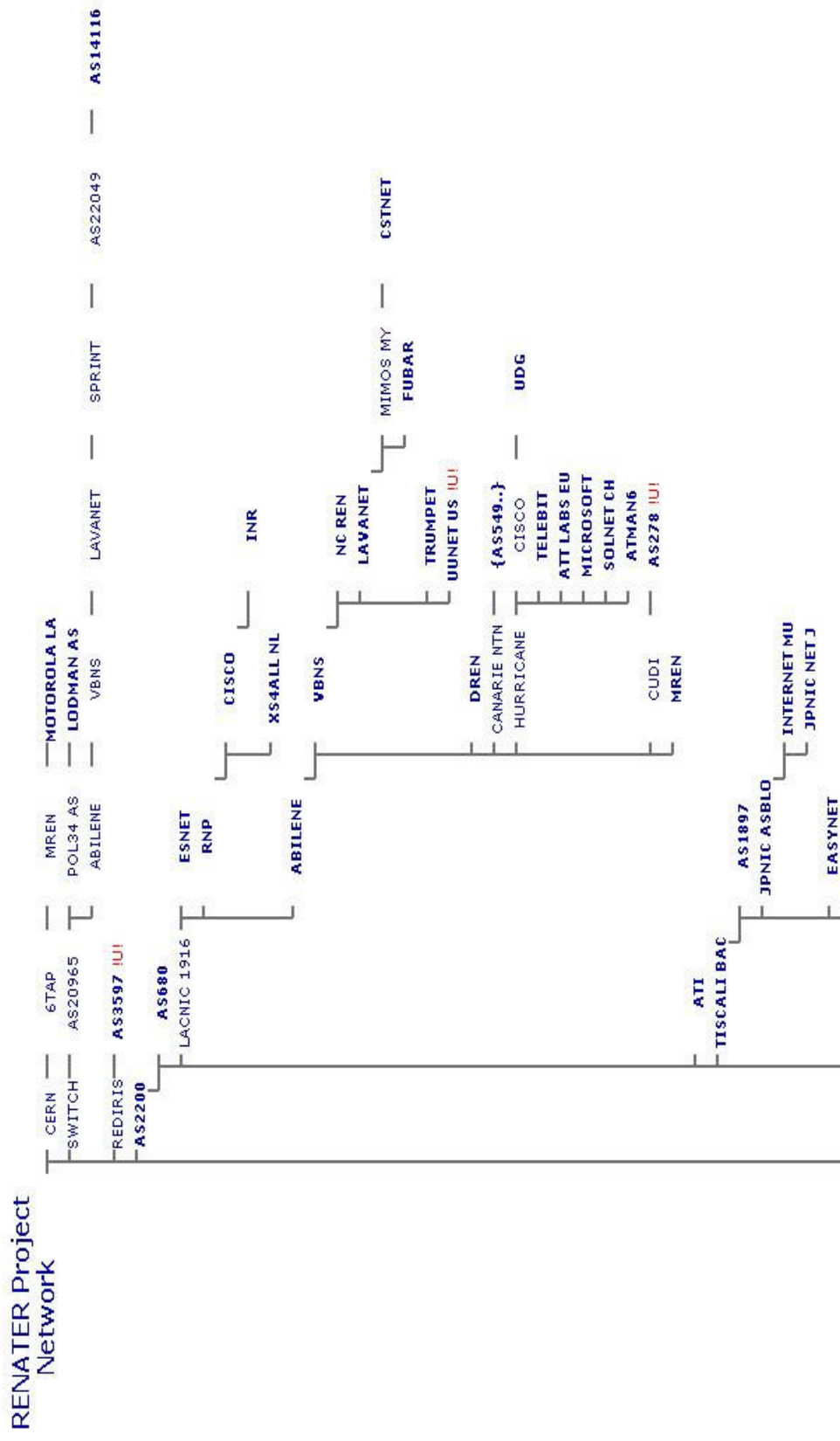
ASpath-Tree

- Display BGP4+ « topology » from
 - BGP4+ routing table
 - Retrieved from connection to routers (RSH/SSH...)
- Generate HTML pages.

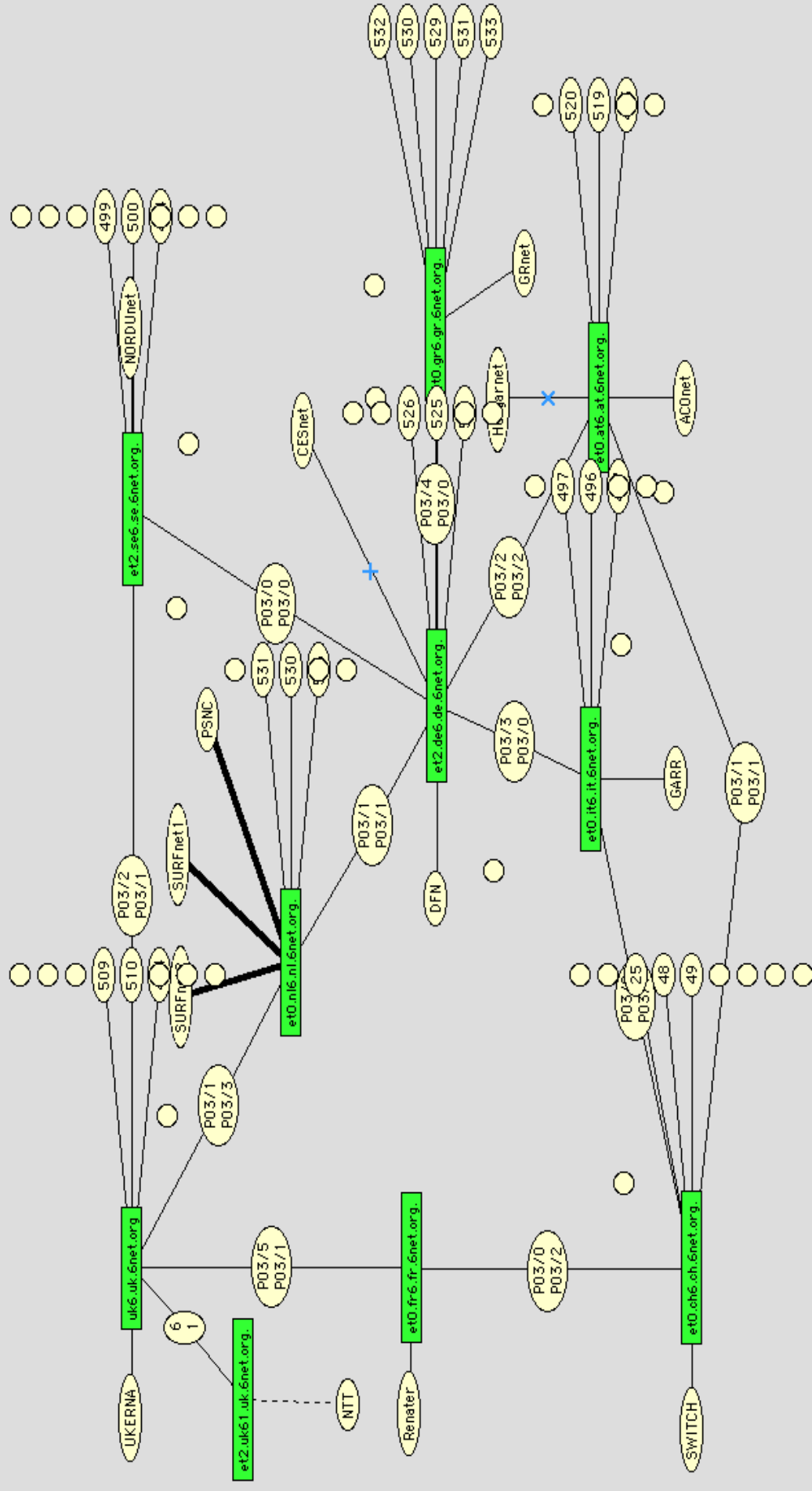


Aspath-Tree

Renater The whole IPv6 BGP table



Intermapper



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IPv6DISSEmination and Exploitation

Looking Glass

- Get information on a router w/o direct connection
- Web Interface
- Final user don't need a login
- Allows the user to detect causes of failures w/o asking the NOC or netadmin



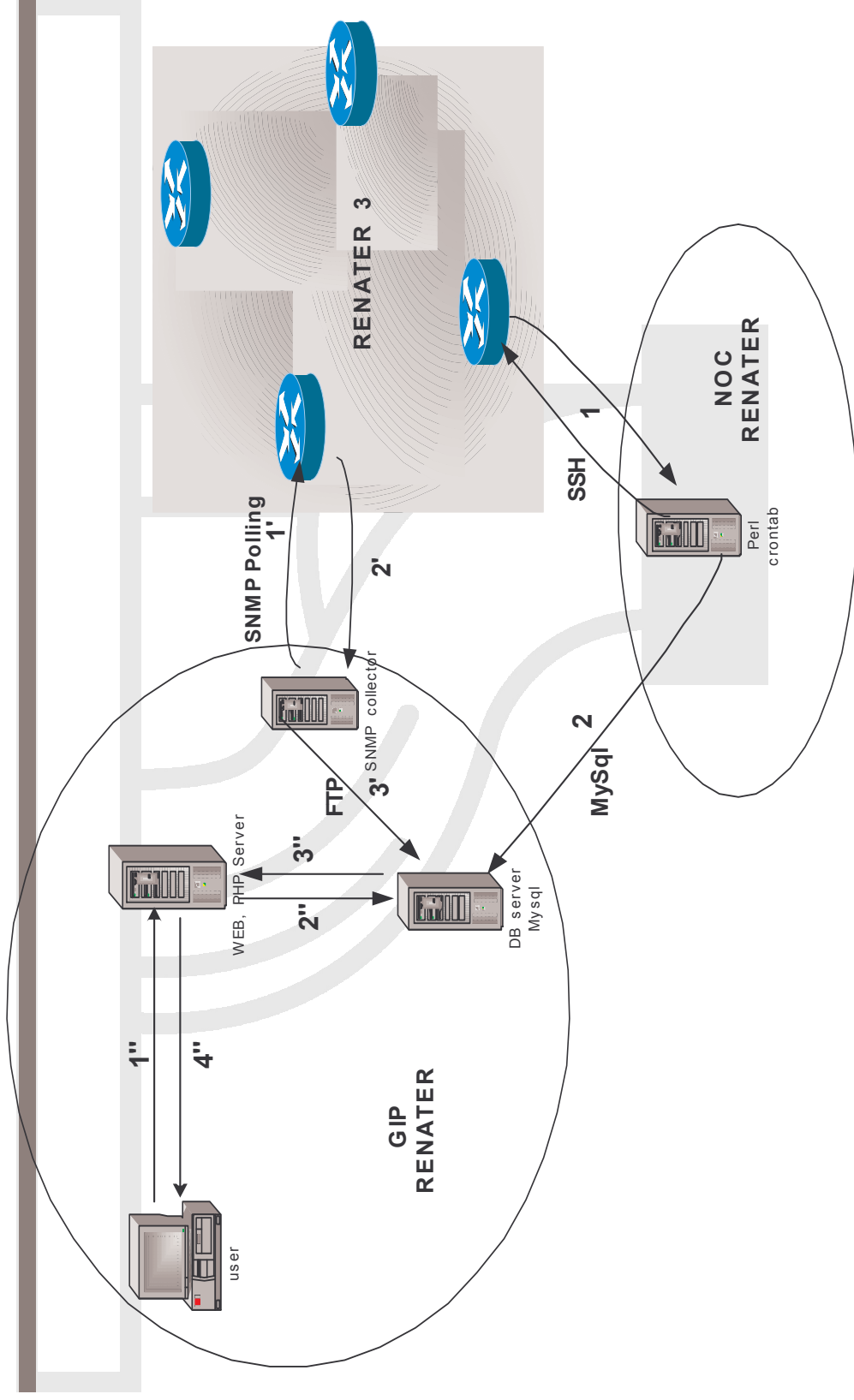
Looking Glass

RENATER Looking Glass

BGP tables ☒ show bgp IPv6 routing_table routing_table summary neighbors	BGP with regular expression ☐ show bgp IPv6 regexp regular expression : Don't use the character '\$'
☐ IPv6 traffic ☐ IPv6 interface ☐ IPv6 tunnels ☐ IPv6 neighbors ☐ IPv6 route	☐ Ping XXXXX ☐ Traceroute XXXXX ☐ show ip bgp XXXXX ☐ show ip bgp summary ☐ show ip bgp damping dampened-paths ☐ show ip mroute summary ☐ show ip mroute active ☐ show ip mbgp summary ☐ show ip mbgp XXXXX ☐ IPv4 address ☐ IPv6 address ☐ name address IPv4 ☐ name address IPv6
Router: Toulouse submit Reset	



Inventory : interfaces & peerings



Inventory: Interfaces

peering

nr_Marseille

switch_atm_Marseille



NR de marseille

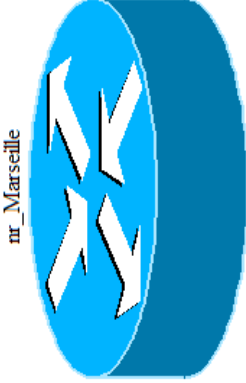
POS2/0 - Lien vers MONTPELLIER(pos2/0)

POS3/0 - Lien vers NICE(pos 1/0)

interfaces Ethernet

Ethernet0 - Administration LOCALE

nr_Marseille



Interfaces ATM

ATM0/1 - Lien vers MARSEILLE-ATMca2/0/1)
ATM0/1.254-aal5_laver - Administration inB
ATM0/1.3-aal5_laver - rrRRTHD PACA
ATM0/1.789-aal5_laver - IN2P3
ATM0/1.90-aal5_laver
Lien Xcast vers Marseille (0 90)
ATM0/2 - Lien vers MARSEILLE-ATMca0/0/1)
ATM0/3 - Lien vers MARSEILLE-ATMca2/0/3)

Interfaces libres

* ATM0/0 - LIBRE

Interfaces ATM

Autres interfaces

Pas d'interfaces de ce type pour ce routeur

Légende:

Lien du backbone

Lien vers un site

Lien vers l'international

Lien vers un réseau régional

Lien Multicast

Lien d'administration

* Interface DOWN



Inventory: BGP Peerings

NR de PROJETS


 PROJETS_GSR-NIO


 PROJETS_GSR-6NET


 PROJETS_7200-MCAST


 PROJETS_M5

[interfaces](#)

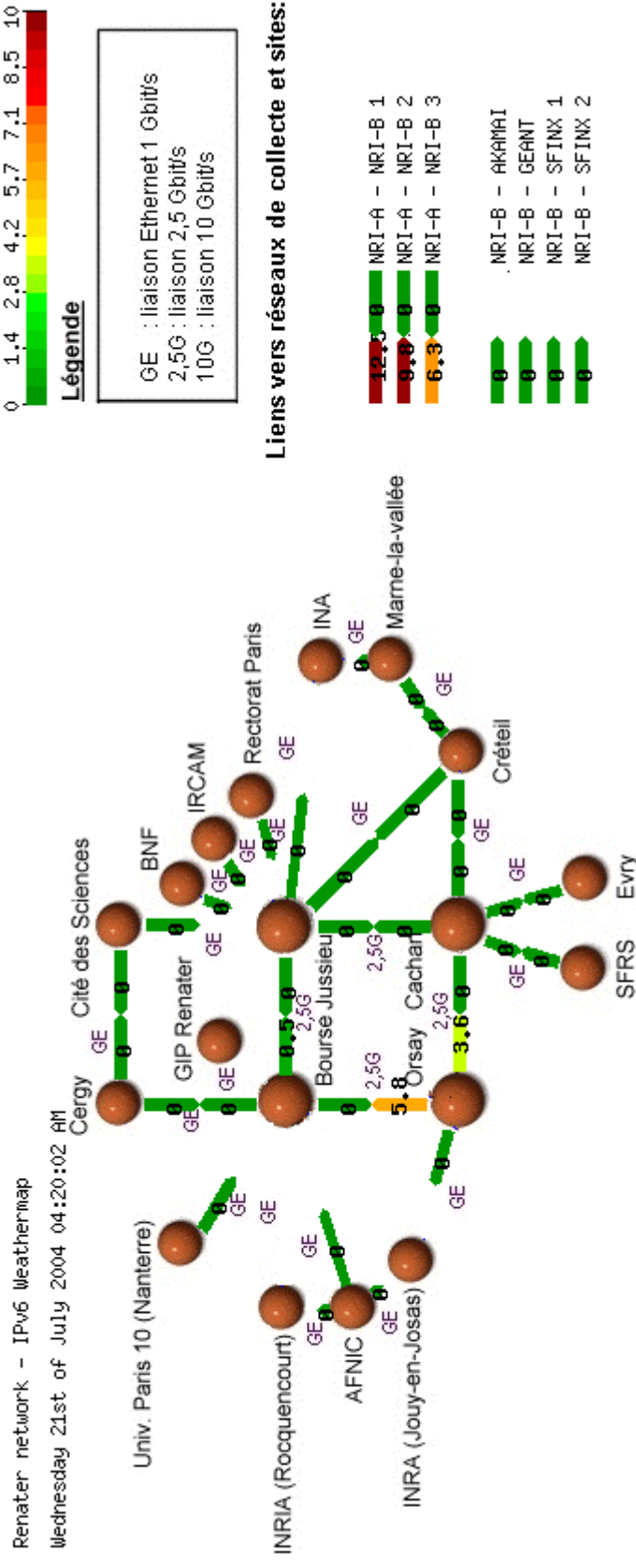


IPv6 traffic on Cisco routers

- Based on CLI program
 - "show interface accounting"
 - Differentiate IPv4/IPv6 counters at the physical interface level
- One query per hour
 - IPv6 Weather Map of RENATER



IPv6 traffic on Cisco routers



Conclusion

- ISPs –and any other organizations– need monitoring tools to launch a new service/protocol into production
- Most of management protocols are on standard track
- Lots of monitoring tools are now ready for IPv6 networks
- But :
 - Q1: are my usual tools (used for IPv4 monitoring) available for IPv6 too ?
 - Q2: what do I need to stress to my favourite vendor to be ready and manage my IPv6 network ?



Retrieve this information ...

- <http://www.renater.fr> > users > training courses
 - > Presentations
- <http://www.renater.fr> > research & innovation > bibliographie
 - > Bibliography, RFCs, ...



