

IPv6 network management

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Contributions

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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

Introduction

- Network Management : What is it?
 1. Fault management
 2. Security management
 3. Topology management
 4. Configuration management
 5. Accounting management

Introduction

- IPv6 networks deployed:
 - Most are dual stack
 - LANs (campuses, companies, ...)
 - MANs (RAP, ...)
 - 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

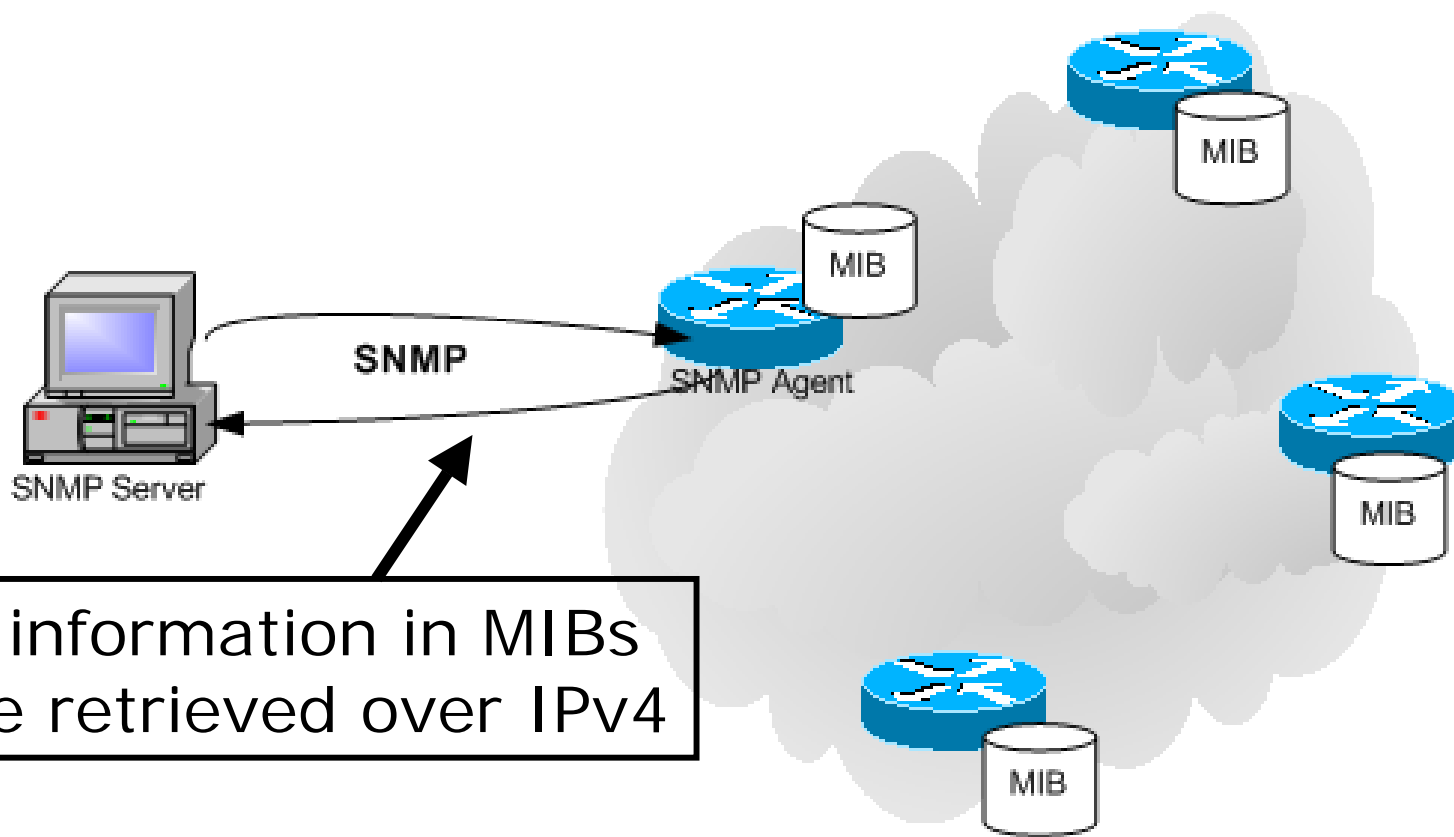
SSH/TELNET/TFTP...

- 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
 - More features available from 12.0(30)S
 - Will become available in 12.3(14)T
- Juniper, Hitachi, 6wind:
 - SNMP over IPv6 is available

IPv6 MIBs Status

IPv6 MIBs status

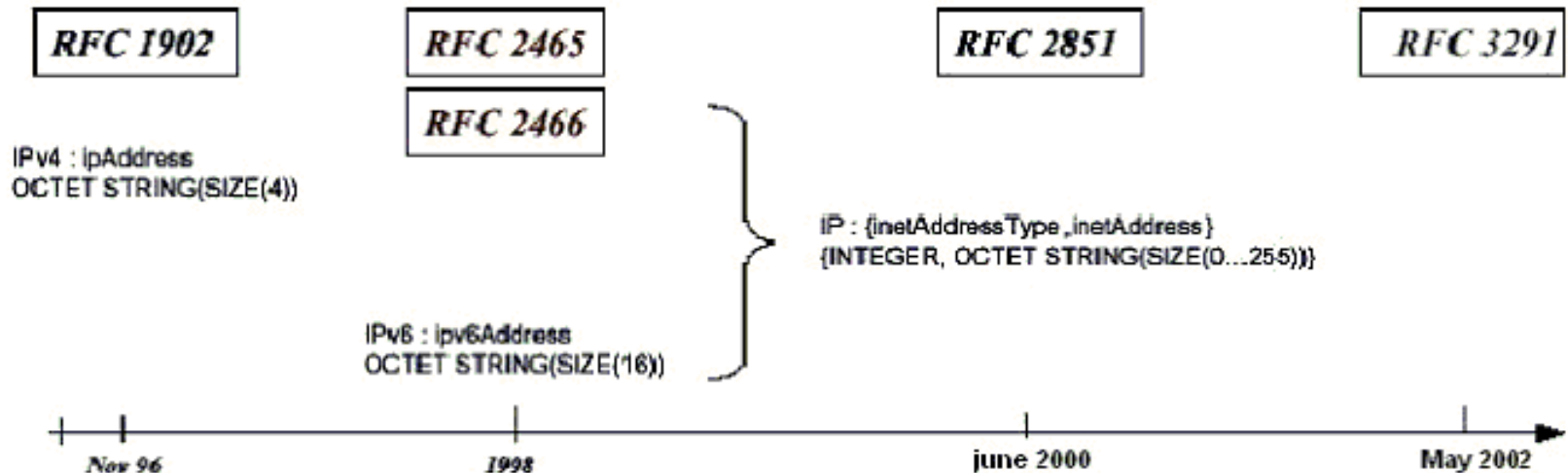
- MIBs are essential for the network management
- SNMP-based applications are widely used but others exist too (NetFlow, XML...)
- SNMP rely upon MIBs ...
 - => Need to have MIBs to collect IPv6 information as well as get MIBs reachable from an IPv6 address family.

IPv6 MIBs /2

■ Standardization status at IETF:

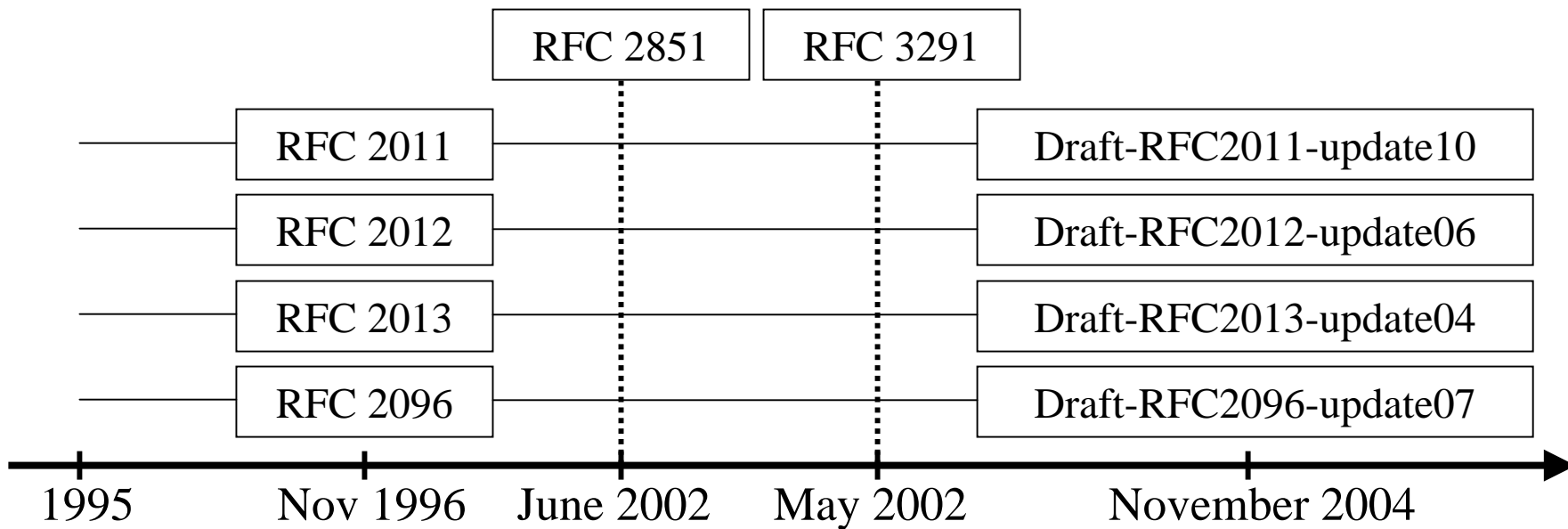
■ At the beginning:

- IPv4 and IPv6 MIBs dissociated
- TCP MIB → RFC2012 → RFC2452
- UDP MIB → RFC2013 → RFC2454
- IP MIB → RFC2011 → RFC2465



IPv6 MIBs /3

- Standardization status at IETF:
 - Today :
 - Unified MIBs are on standardization track.



IETF MIB Status /4

- draft-ietf-ipv6-rfc2011-update-10.txt
 - **IP MIB** (05/2004)
 - In the RFC Editor's queue (06/2004)

- draft-ietf-ipv6-rfc2012-update-06.txt
 - **TCP MIB** (02/2004), last call (11/2003)

- draft-ietf-ipv6-rfc2013-update-04.txt
 - **UDP MIB** (10/2004), last call (08/2004)

- draft-ietf-ipv6-rfc2096-update-07.txt
 - **IP Forwarding Table MIB** (02/2004)
 - proposed standard RFC
 - (in the RFC Editor's queue... can be considered as done)

IETF MIB Status /5

- BGP MIB v6: the draft expired (08/2004).
 - draft-ietf-idr-bgp4-mibv2-04.txt (01/2004)

Note that the same people are working on

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

IPv6 MIBs implementations

IPv6 MIBs implementation/1

■ Cisco

- Private Cisco MIBs implement ID-00 of RFC 2011 & 2096 updated drafts
- Working 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*
 - ...

IPv6 MIBs implementation/2

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

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/4

- 6WIND

- MIBs based on RFC 2465 and RFC 2466
- Checked at our lab.

IPv6 MIBs implementation/5

■ Net-SNMP

- RFC 2452: TCP/IPv6
- RFC 2454: UDP/IPv6
- RFC 2465: IPv6
- RFC 2466: ICMPv6

- RFC 3291: new textual convention
 - But no updated MIB

IPv6 flow monitoring

Netflow & IPFIX model



IPv6 flow monitoring /1

- IETF IPFIX WG
- Cisco
 - Available on IOS 12.3(7)T and after
 - 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 ...

IPv6 flow monitoring /2

- Hitachi
 - Support sflow (<http://www.sflow.org/>) and Netflow is on the roadmap.

- 6WIND:
 - Not available

- Juniper:
 - Not available

Commercial Management platforms

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
 - Campus Manager under testsApplication note on IPv6 management
- **Tivoli Netview** doesn't propose any IPv6 features
- **Infovista** : « no IPv6 plan at the moment »

Monitoring tools

- 6NET work
- Recommendations...
 - LAN (Sites...)
 - WAN (ISP networks...)
- Examples

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/>

LAN - recommendations

- Traffic & service management (web, DNS, SMTP, IMAP...)
 - A single tool: *Argus*, *Nagios* or *Ntop*
- End-to-end performance of the IPv6 network
 - *Iperf* or *Pchar*
- Configuration management
 - *Rancid*
- Analysis of packets on shared links for occasional troubleshooting
 - *Ethereal*, *tcpdump* or *Ntop*
- IPv6 multicast management
 - *Multicast beacon*

WAN - recommendations

- Traffic management
 - MRTG, Cricket or Nagios
- Equipment and link status:
 - Intermapper or Nagios
- Routing management:
 - ASpath-tree (routing policy study)
 - Home-made scripts (routing fault management)
- For accounting management:
 - Ipflow, CISCO NFC v5.0 or Home-made collectors
- Configuration management:
 - Rancid, Home-made inventory tool
- Looking-glass for customers

Examples

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

Top:Serveurs-SIPA User: jdurand

name Serveurs-SIPA
status up

- [Override](#)
- [Annotate](#)
- [Flush Cache](#)
- [Display Config](#)
- [Debugging](#)
- [Un-Acked Notifies](#)
- [Notifies](#)
- [Error Log](#)
- [Top](#)
- [Logout](#)

Name	Status
data-ipv6 IPv4	Ping FTP
data-ipv6 IPv6	Ping FTP
sem2 IPv4	Ping HTTP renater.fr
sem2 IPv6	Ping HTTP renater.fr

Status: up since Thu 11 Nov 20:59:44 2004

	start	elapsed time	% up	% down	times down
Today	Mon 22 Nov 00:00:00 2004	10:00:00	100.0	0.00	0
Yesterday	Sun 21 Nov 00:00:00 2004	1d 0:00:00	100.0	0.00	0
2 Days Ago	Sat 20 Nov 00:00:00 2004	1d 0:00:00	100.0	0.00	0
This Month	Mon 1 Nov 00:00:00 2004	21d 9:48:49	98.28	1.72	1
Last Month	Fri 1 Oct 00:00:00 2004	1m 1:00:00	99.97	0.03	1
2 Months Ago	Mon 13 Sep 11:14:37 2004	17d 12:33:52	100.0	0.00	1
This Year	Mon 13 Sep 11:14:37 2004	2m 10d 23:22:41	99.46	0.54	3

- Thu 11 Nov 20:59:44 2004 up TRANSITION - data-ipv6_IPv4
- Thu 11 Nov 12:08:57 2004 down TRANSITION - data-ipv6_IPv6
- Wed 13 Oct 17:13:44 2004 up TRANSITION - data-ipv6_IPv4
- Wed 13 Oct 17:02:33 2004 down TRANSITION - data-ipv6_IPv6
- Mon 13 Sep 11:28:39 2004 up TRANSITION - sem2_IPv4

Nagios

- [URL: //www.nagios.org](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
 - ...

Nagios

Nagios

General

- Home
- Documentation

Monitoring

- Tactical Overview
- Service Detail
- Host Detail
- Status Overview
- Status Summary
- Status Grid
- Status Map
- 3-D Status Map
- Service Problems
- Host Problems
- Network Outages
- Comments
- Downtime
- Process Info
- Performance Info
- Scheduling Queue

Current Network Status
 Last Updated: Thu Jan 8 09:33:05 CET 2004
 Updated every 90 seconds
 Nagios@ - www.nagios.org
 Logged in as ?

[View Service Status Detail For All Host Groups](#)
[View Status Overview For All Host Groups](#)
[View Status Summary For All Host Groups](#)
[View Status Grid For All Host Groups](#)

Host Status Totals

Up	Down	Unreachable	Pending
1	1	0	0

All Problems	All Types
1	2

Service Status Totals

Ok	Warning	Unknown	Critical
1	0	1	3

All Problems	All Types
4	5

Host Status Details For All Host Groups

Host ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Status Information
data-ipv6	DOWN	08-12-2003 15:26:43	148d 21h 58m 44s	/bin/ping -n -U -c 1 193.49.159.67
sem2	UP	08-12-2003 15:27:43	148d 21h 55m 22s	(Host assumed to be up)

2 Matching Host Entries Displayed

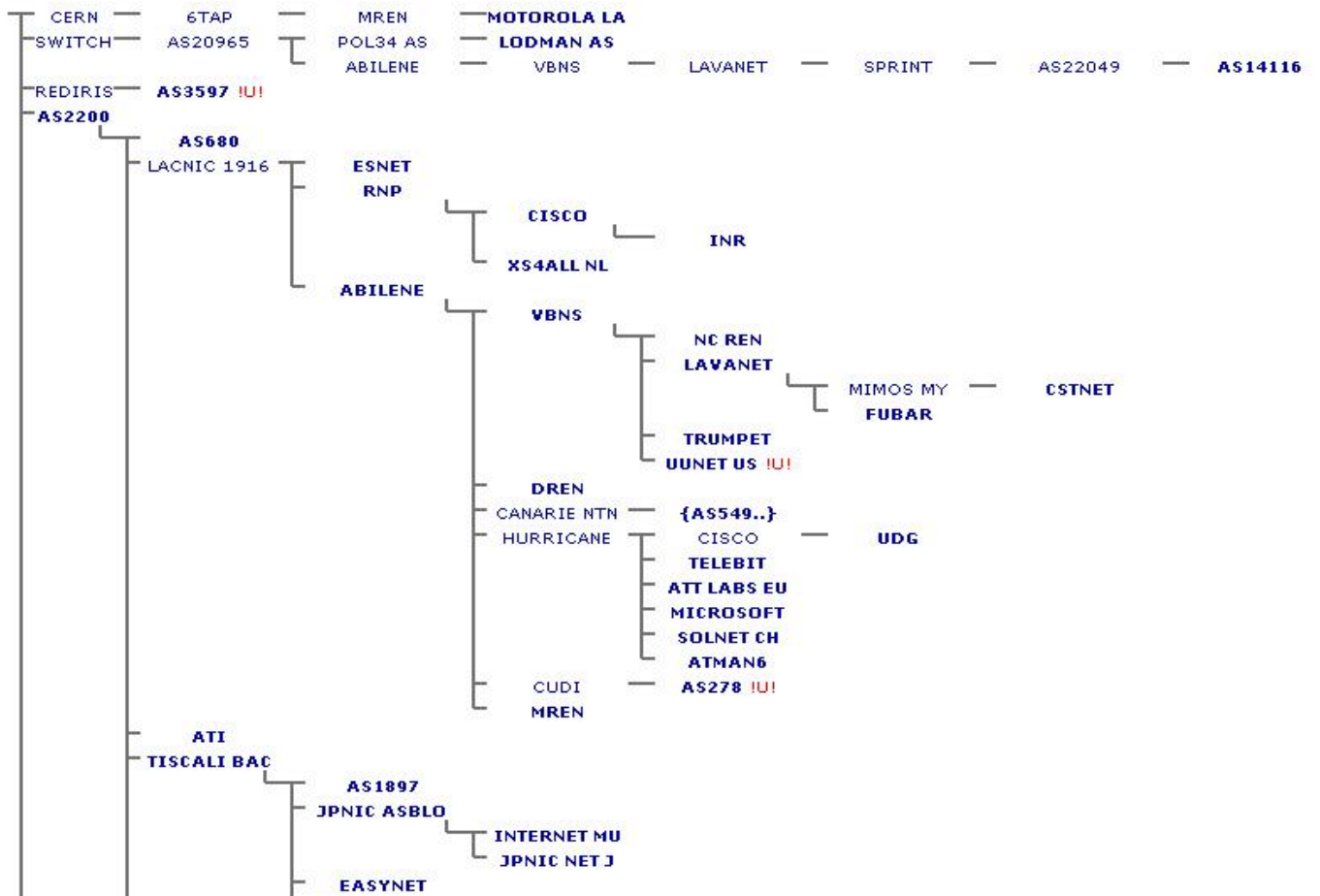
ASpath-Tree

- 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

RENATER Project Network



Looking Glass

- Get information on a router w/o direct connection
- Web Interface
- Final user don't need a login
- Allow 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 regex

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 dampening 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

Inventory: Interfaces

NR de marseille





nr_Marseille	switch_atm_Marseille

[peering](#)


	<p>POS2/0 - Lien vers MONTPELLIER(pos2/0)</p> <hr/> <p>POS3/0 - Lien vers NICE(pos 1/0)</p>	
<p>interfaces Ethernet</p> <hr/> <p>Ethernet0 - Administration LOCALE</p>	<p>nr_Marseille</p>	<p>Interfaces ATM</p> <p>ATM0/1 - Lien vers MARSEILLE-ATM(a2/0/1)</p> <p>ATM0/1.254-aa15_layer - Administration inB</p> <p>ATM0/1.3-aa15_layer - -rrRRTHD PACA</p> <p>ATM0/1.789-aa15_layer - IN2P3</p> <p>ATM0/1.90-aa15_layer</p> <p>Lien Xcast vers Marseille (0 90)</p> <hr/> <p>ATM0/2 - Lien vers MARSEILLE-ATM(a0/0/1)</p> <hr/> <p>ATM0/3 - Lien vers MARSEILLE-ATM(a2/0/3)</p> <hr/> <p>ATM0/3.1-aa15_layer - Universite PHOCEAN</p>
<p>Légende:</p> <ul style="list-style-type: none"> Lien du backbone Lien vers un site Lien vers l'international Lien vers un réseau régional Lien Multicast Lien d'administration <hr/> <p>* Interface DOWN</p>	<p style="text-align: center;">Interfaces libres</p> <hr/> <p>* ATM0/0 - LIBRE</p>	<p style="text-align: center;">Autres interfaces</p> <hr/> <p style="text-align: center;">Pas d'interfaces de ce type pour ce routeur</p>

Inventory: BGP Peerings

NR de PROJETS

PROJETS_GSR-NIO	PROJETS_GSR-6NET	PROJETS_7200-MCAST	PROJETS_M5
			

[interfaces](#)

Routeur PROJETS_GSR-NIO	Peering BGP
	peering iBGP
	Established *** Peer-group de tous les routeurs IBGP *** AS 1717 - FR-RENATER-PROJETS
	Established *** Peer-group de tous les routeurs IBGP *** AS 1717 - FR-RENATER-PROJETS
	Established *** Peer-group de tous les routeurs IBGP *** AS 1717 - FR-RENATER-PROJETS
	peering eBGP
	Established *** eBGP NRI-A RENATER3 *** AS 2200 - FR-RENATER
	Established *** eBGP RENATER3 IPv4 *** AS 2200 - FR-RENATER
	Active *** eBGP @IRS++ KWAK durand@renater.fr *** AS 65004 -
	Active *** eBGP @IRS++ PIETRA durand@renater.fr *** AS 65004 -

Conclusion

- ISPs –and any other organizations- need monitoring tools to launch a new service/protocol into production
- 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://sem2.renater.fr/>
 - - > Presentations
 - - > RFCs ...

