Network Management

2nd South East Europe 6DISS Workshop
Plovdiv, Bulgaria
27-29 June 2007

Athanassios Liakopoulos
(aliako@grnet.gr)

Copy …Rights

- ***This slide set is the ownership of the 6DISS project via its partners***
- ***The Powerpoint version of this material may be reused and modified only with written authorization***
- ***Using part of this material must mention 6DISS courtesy***
- ***PDF files are available from www.6diss.org***
- ***Looking for a contact ?***
  - ***Mail to : martin.potts@martel-consulting.ch***
  - ***Or helpdesk@6diss.org***

Outline

- Introduction
- Basic Network Management Protocols
- MIBs & IPv6 support
- Flow Monitor
- Management platforms and tools
- Conclusions

Introduction

- Network Management : What is about?
  1. Configuration
  2. Inventory
  3. Topology
  4. Fault
  5. Security
  6. Accounting

  …

Introduction

- Deployed IPv6 networks
  - LANs (e.g. campuses, companies, …), MANs, WANs (e.g. GÉANT, NRENs, IIJ, NTT/Verio, Abilene, …), IX's
  - Most are dual stack but there are few IPv6-only networks
  - Testbed, pilot networks, production networks
  - In all cases, the appropriate management tools and procedures are required.
- Important to keep in mind
  - Dual stack network will not last for ever!
  - One IP stack should be removed … eventually!
  - No reasons for network admins to face twice the amount of work

Dual stack IP networks

- Part of the monitoring can be done via IPv4
  - Connectivity to the equipment
  - Tools to manage the network, e.g. inventory, configurations, «counters», routing info, …
- Remaining part (of monitoring) needs IPv6
  - MIBs with IPv6 support
  - NetFlow (v9)

IPv6-only networks

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

Need to identify the missing parts!

Outline

- Introduction
- **Basic Network Management Protocols**
- MIBs & IPv6 support
- Flow Monitor
- Management platforms and tools
- Conclusions

Basic Network Management Protocols

- SSH / TELNET
  - Most commercial routers/systems supports them
  - Periodic scripts can retrieve information from the routers over IPv6
- TFTP
  - Software images/configuration can be transported over IPv6

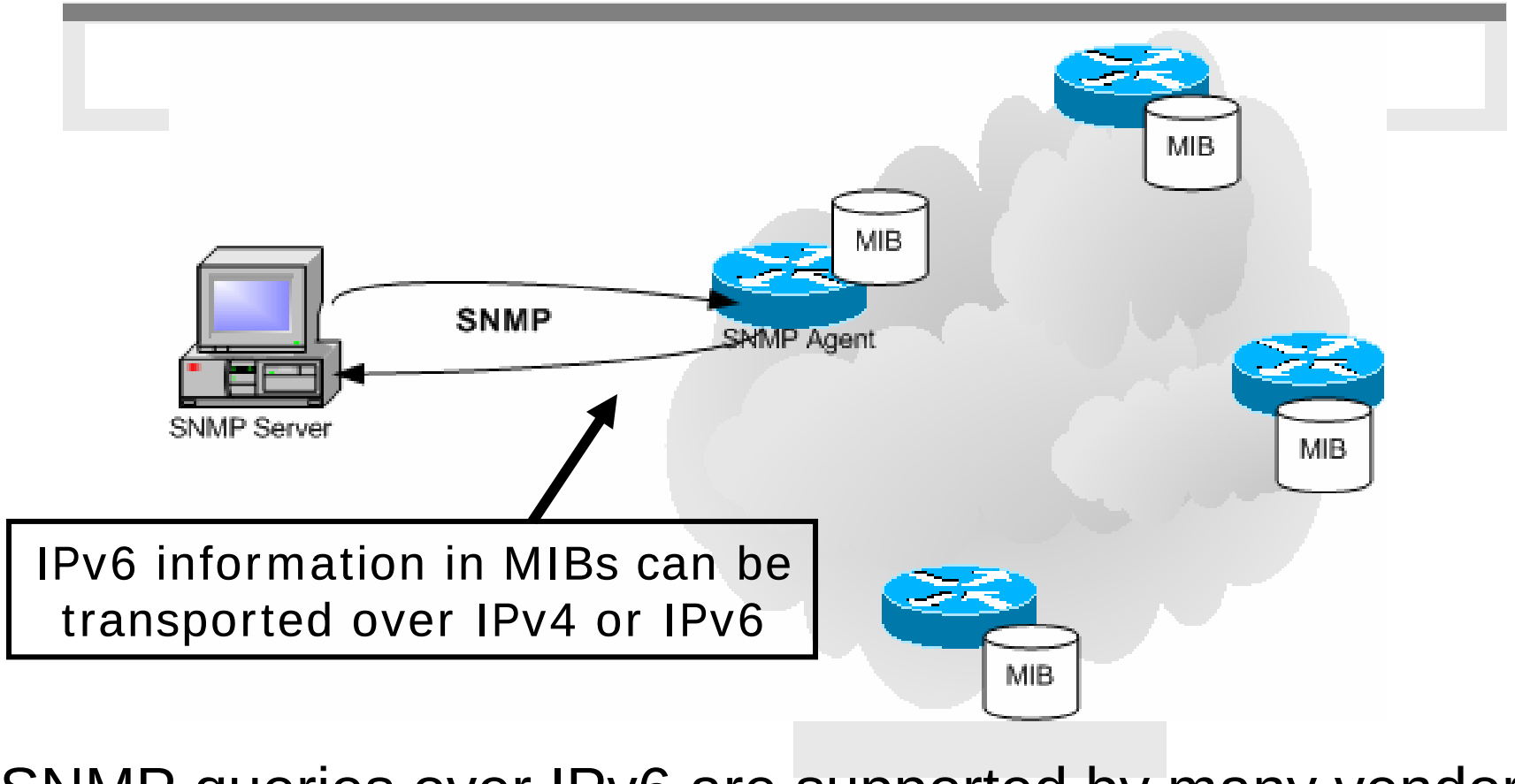
Outline

- Introduction
- Basic Network Management Protocols
- **MIBs & IPv6 support**
- Flow Monitor
- Management platforms and tools
- Conclusions

MIBs & IPv6 support

- SNMP over IPv6
- IPv6-related MIB status
- Implementation issues
  - Different levels of support; mixture of *private*, *IPv6-standard MIBs*, and *Unified MIBs.*

SNMP over IPv6



SNMP queries over IPv6 are supported by many vendors, e.g. Cisco, Juniper, Hitachi, 6WIND

IPv6-related MIB status

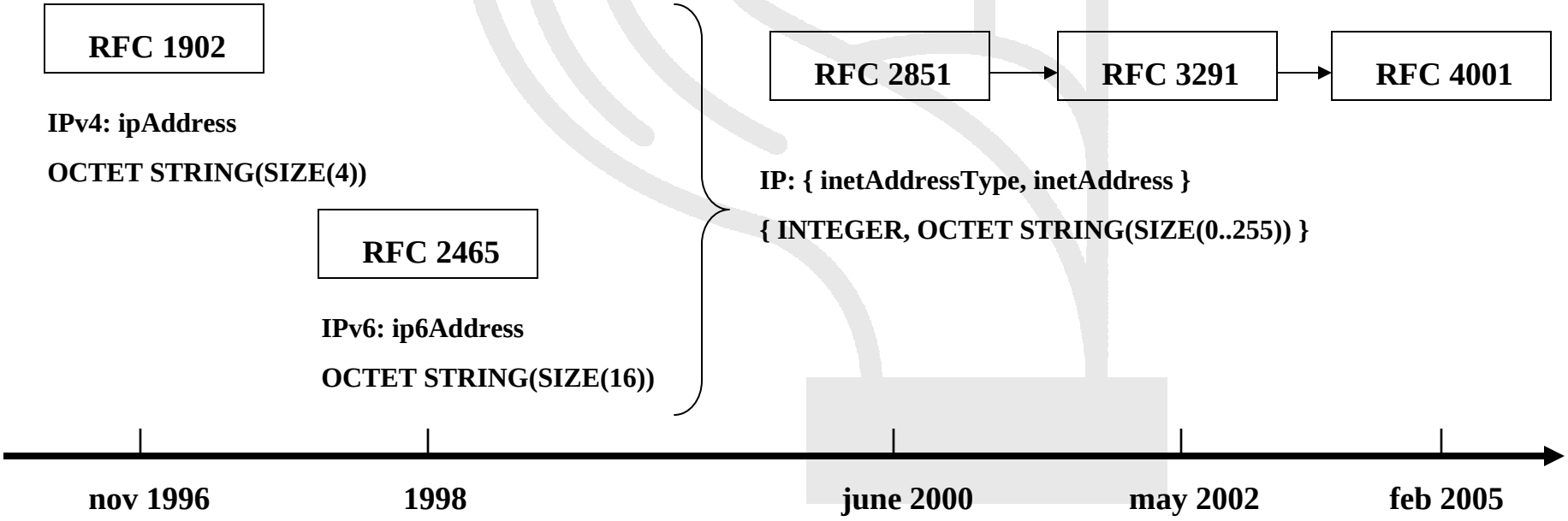
- MIBs are essential for the network management
- SNMP-based applications are widely used but others applications may also be used, e.g. NetFlow, XML-based, …
- SNMP rely upon MIBs …
  - Necessity to have MIBs that collect IPv6 information as well as have MIBs reachable from an IPv6 address.

IPv6-related MIB status #2

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

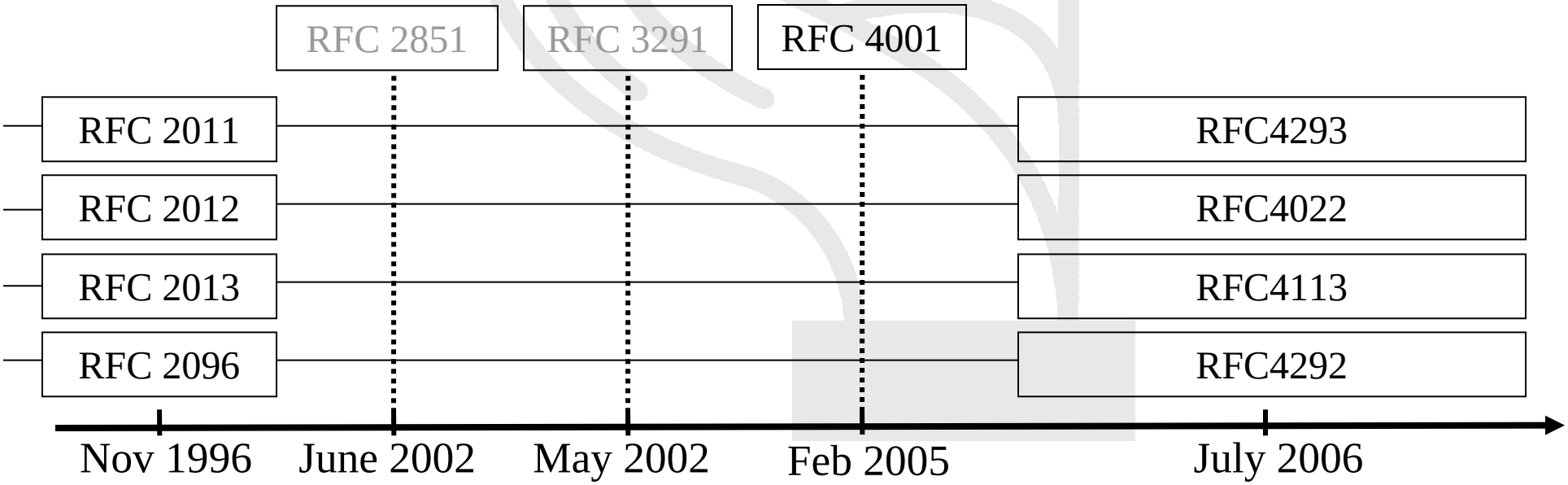
	IPv4	IPv6	Remarks
Textual Conventions	RFC1902	RFC2465	Definition of IP address format
IP MIB	RFC2011		
ICMP MIB		RFC2466	
TCP MIB	RFC2012	RFC2452	
UDP MIB	RFC2013	RFC2454	

IPv6-related MIB status #3



IPv6-related MIB status #4

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



IPv6-related MIB status #5

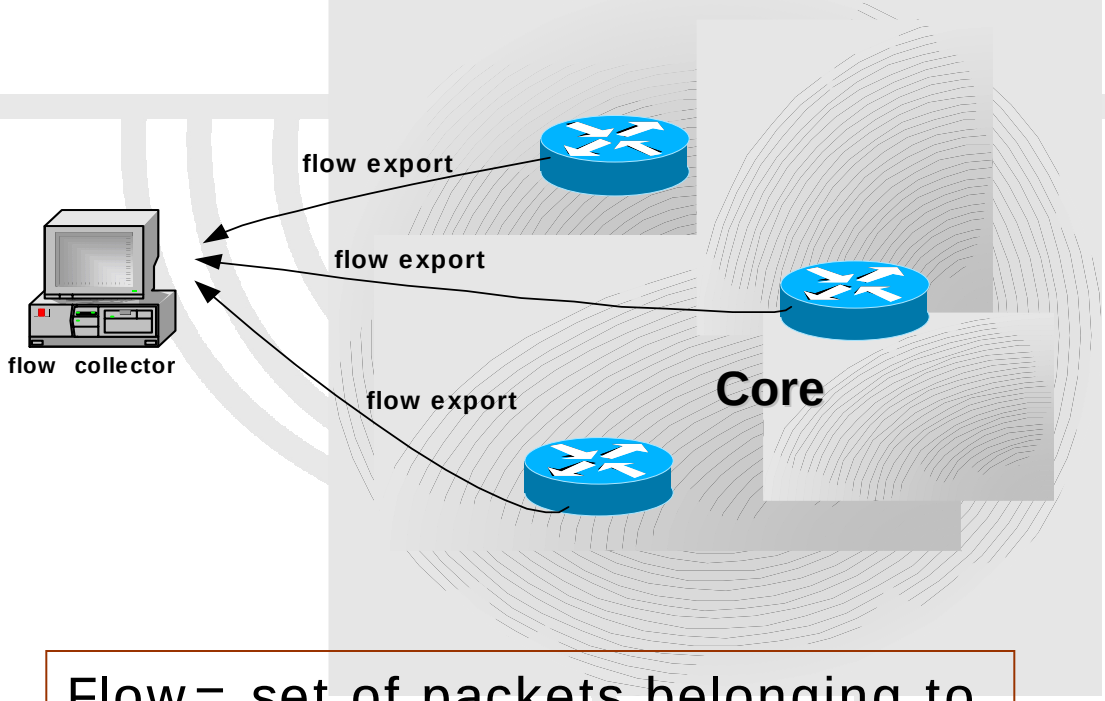
- BGP MIB v6:
  - draft-ietf-idr-bgp4-mibv2-05.txt (07/2005)
    - Expired

  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*

Outline

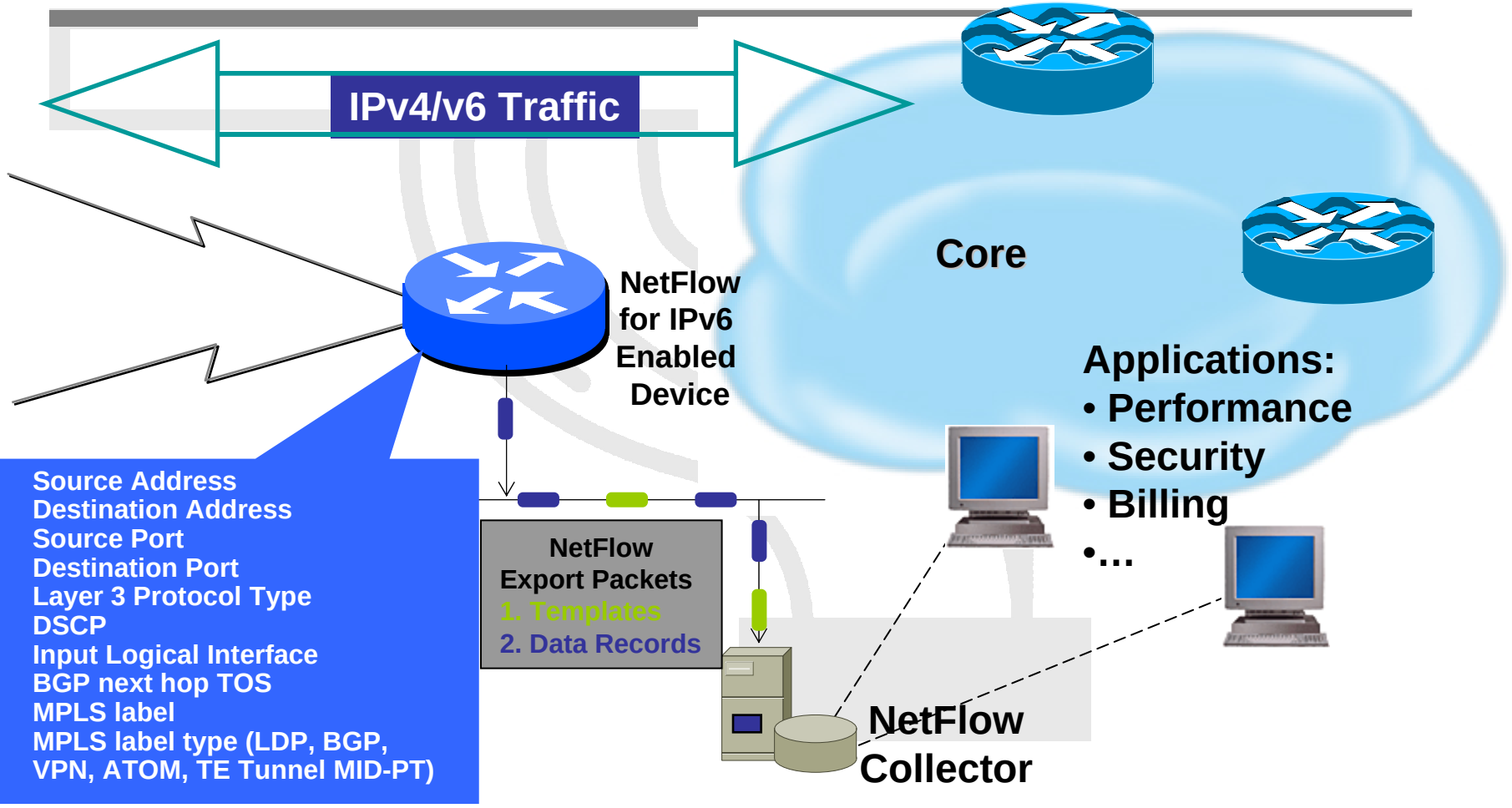
- Introduction
- Basic Network Management Protocols
- MIBs & IPv6 support
- **Flow Monitor**
- Management platforms and tools
- Conclusions

Netflow & IPFIX model



Flow= set of packets belonging to the same application between a Source/Destination couple

NetFlow ver.9 & IPv6



Netflow ver. 5/7/8 are *unable* to handle IPv6 packets

IPv6 flow monitoring

- Cisco
  - *Netflow v9*
    - IPv6 packets captured (needs IPv6 CEF)
    - Still uses *IPv4 transport*
    - May need to update your own Netflow collector
- Juniper:
  - *Cflow*
- Hitachi
  - Sflow (RFC 3176)

Outline

- Introduction
- Basic Network Management Protocols
- MIBs & IPv6 support
- Flow Monitor
- **Management platforms and tools**
- Conclusions

Commercial platforms

- Commercial ISPs usually have integrated management platforms
  - **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** : (still?) «no IPv6 plans at the moment »
- NRENs mainly use *open-source* or *home-made* tools

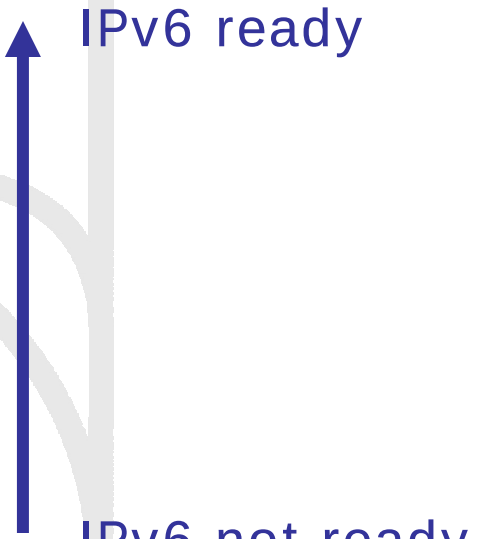
Cisco: LMS Application supports IPv6

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
- …



Tools (routing, performance)

- AS Path Tree
  - Displays inter-domain network ”topology” using BGP routing table
  - http://carmen.ipv6.tilab.com/ipv6/download.html/
- Looking Glass
  - Collect information from network nodes without direct connection.
  - http://w6.loria.fr/
- Mping
  - A tool for collecting statistics for ping RTT/loss.
  - http://mping.uninett.no/
- RIPE Test Traffic Measurement Service
  - Monitor & diagnose network problems.
  - http://www.ripe.net/ttm/
- Open_Eye / Panoptis
  - Tool to detect and block DoS/DDoS attacks
  - http://panoptis.sourceforge.net/

Tools (monitor)

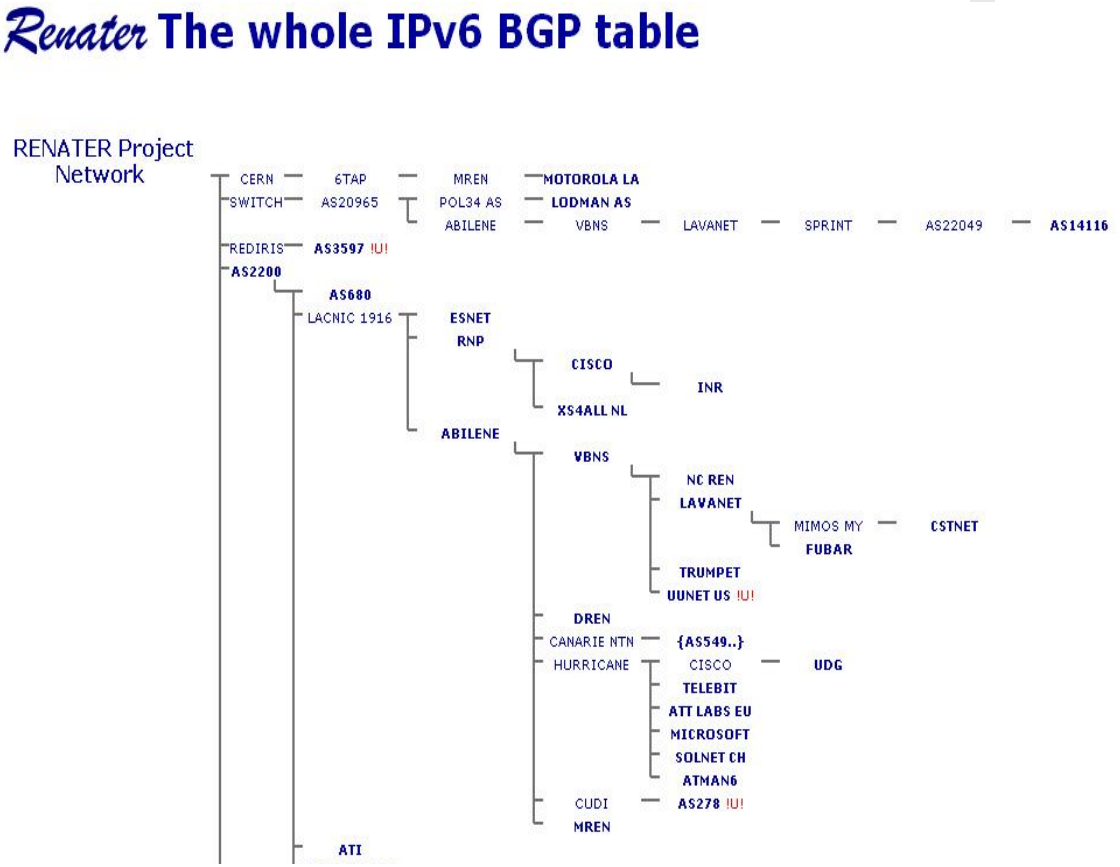
- Argus
  - A system and network monitoring application
  - http://argus.tcp4me.com/
- Nagios
  - A host, service and network monitoring program
  - http://www.nagios.org/
- Cricket
  - System for monitoring and visualizing network traffic.
  - http://cricket.sourceforge.net/
- MRTG & Weathermap
  - http://netmon.grnet.gr/weathermap/
- Wireshark / Ethereal
  - Network protocol analyzers
  - http://www.wireshark.org/
  - http://www.ethereal.com/

Tools (troubleshoot)

- iperf / pchar
  - Network performance tools
  - http://dast.nlanr.net/Projects/Iperf
  - http://www.employees.org/~bmah/Software/pchar/
- Multicast Beacon / dbeacon
  - Multicast tools that provides statistics and diagnostic information.
  - http://dast.nlanr.net/Projects/Beacon/
  - http://dbeacon.innerghost.net/
- ssmping / asmping
  - Tools for troubleshooting multicast SSM/ASM.
  - http://www.venaas.no/multicast/ssmping/
- ntop
  - A network traffic probe that shows the network usage
  - http://www.ntop.org/

ASpath-Tree

- Displays inter-doma network ”topology” collecting BGP routing table
- Automatic generati of HTML pages.



http://www.join.uni-muenster.de/bgp/bgp.html

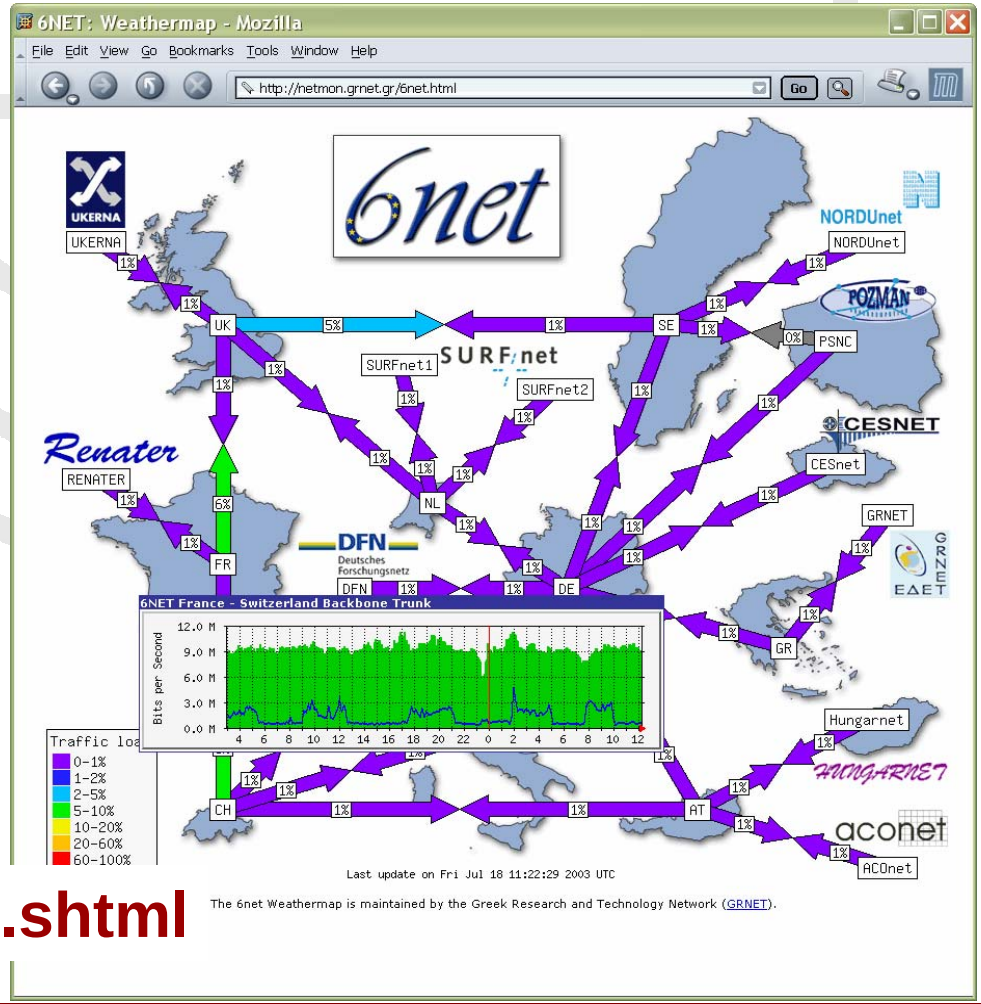
Looking Glass

- Get information from a router via a Web interface
- End user don't need to login to router
- Allows the user to detect causes of failures w/o asking the NOCs

http://netmon.grnet.gr/lg.shtml

Weathermap

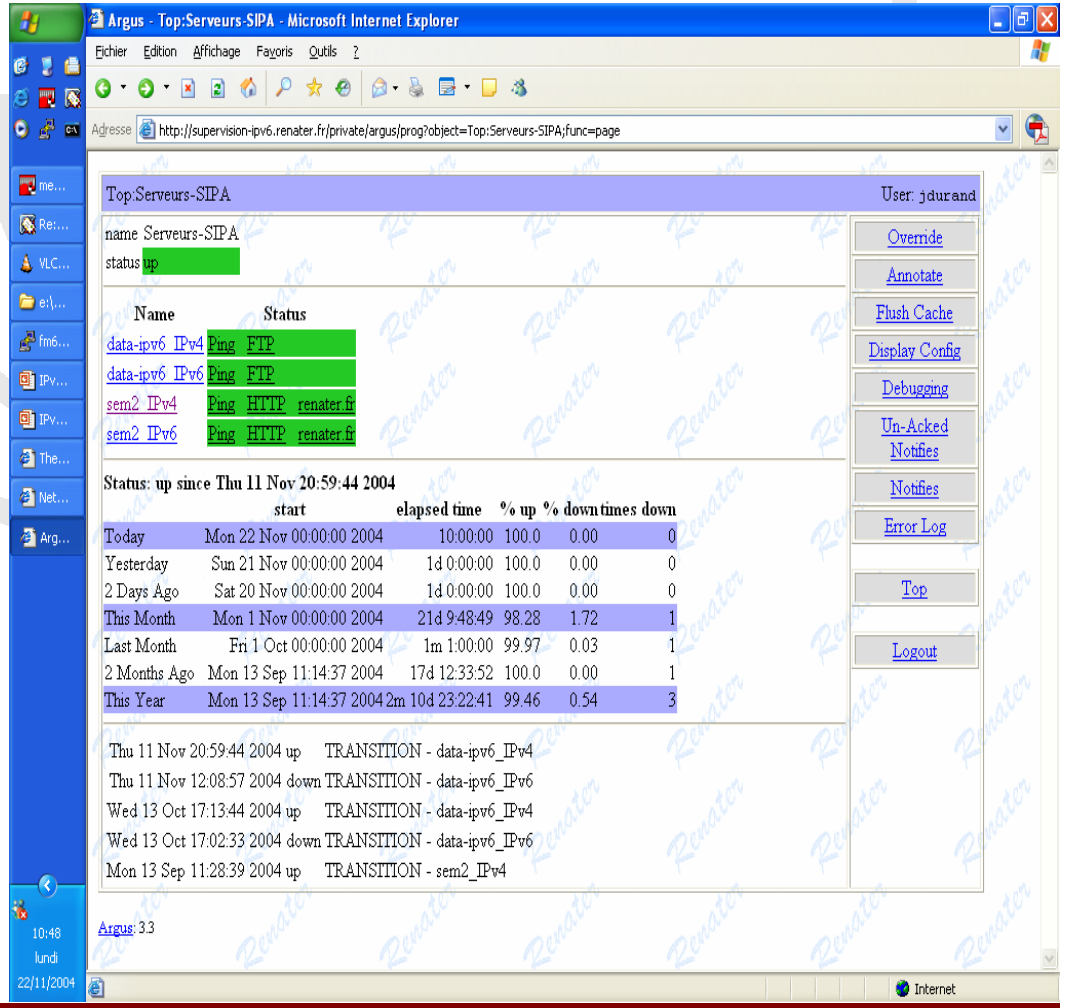
- SNMP-based network traffic grapher
- Monitor the link utilisation



http://netmon.grnet.gr/map.shtml

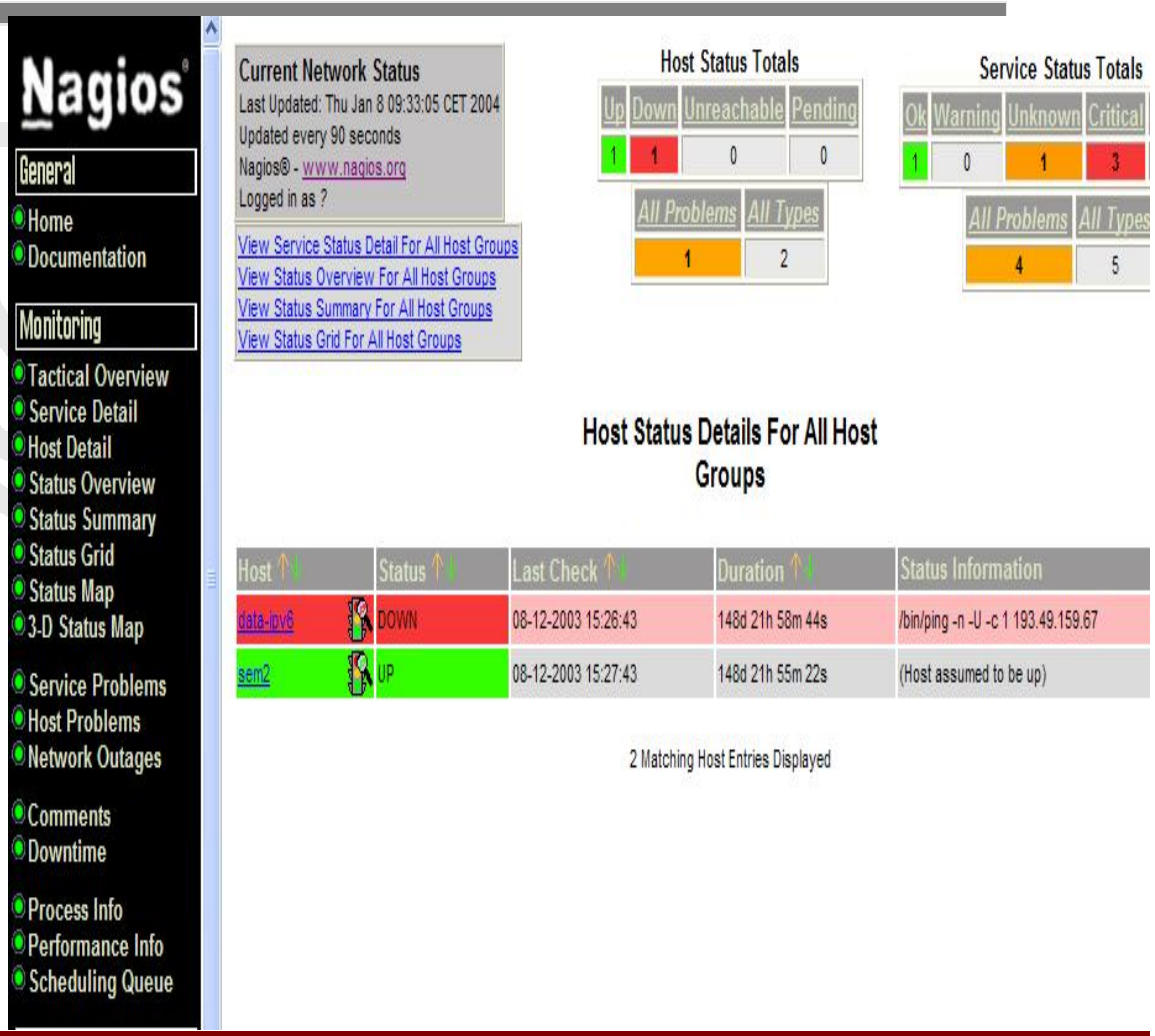
Argus

- Monitor network element status, (PCs, switches, routers, etc,), node availability, traffic, services, (http, ftp, dns, imap, smtp, etc)
- Easily extendible



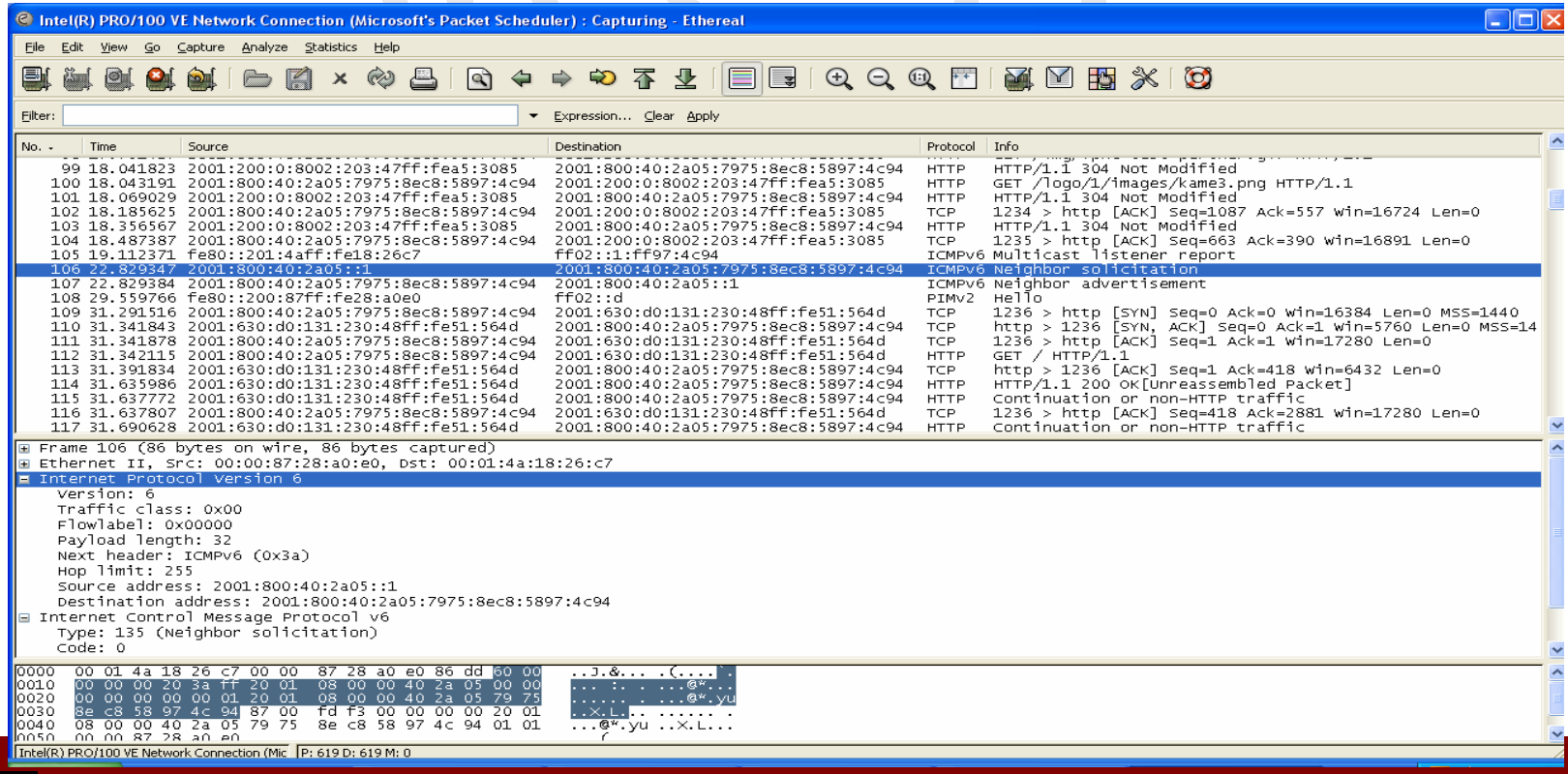
Nagios

- Monitor services and networks
- Could be a complex tool for a small network
- New features can be added with plug-ins, e.g. BGP monitoring



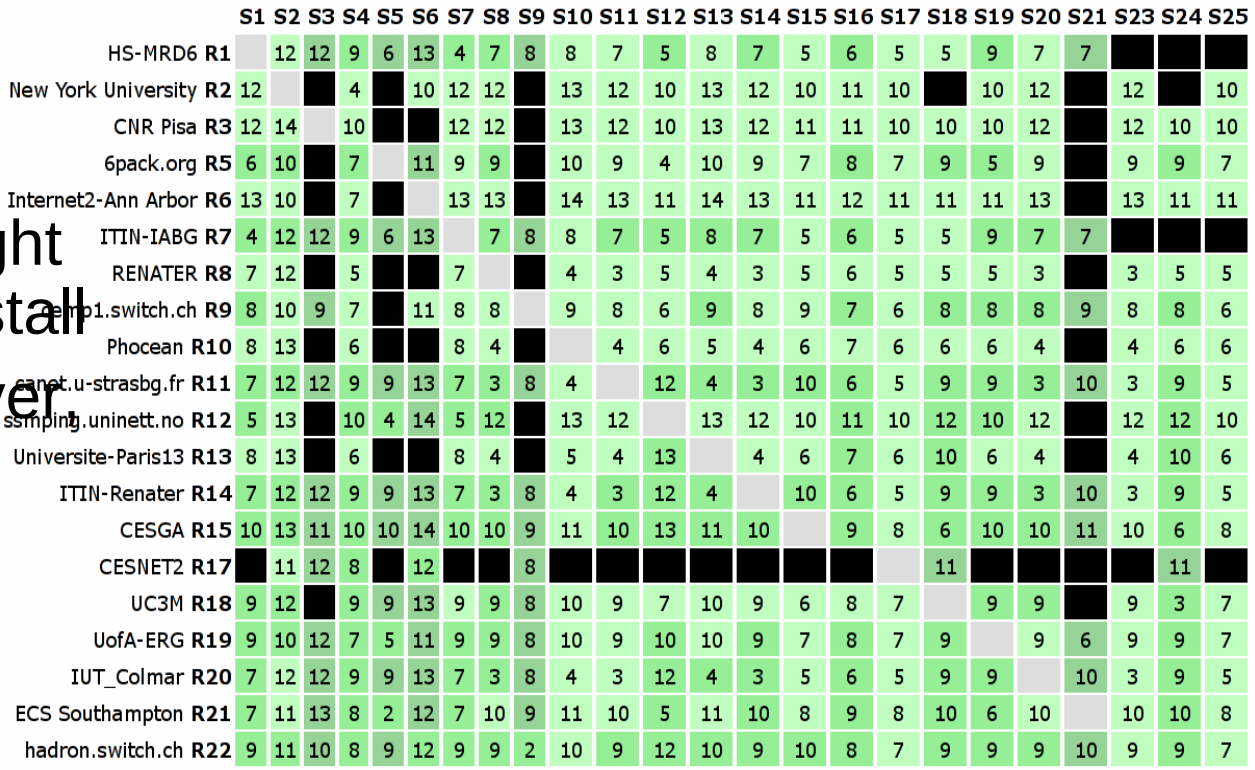
Wireshark / Ethereal

- Packet capturing tools
- Useful for connectivity and troubleshooting
- Available for most platforms



Multicast dbeacon

- Supports IPv4 and IPv6, ASM and SSM
- Written in C, light and easy to install
- No central server, ASM used for signaling



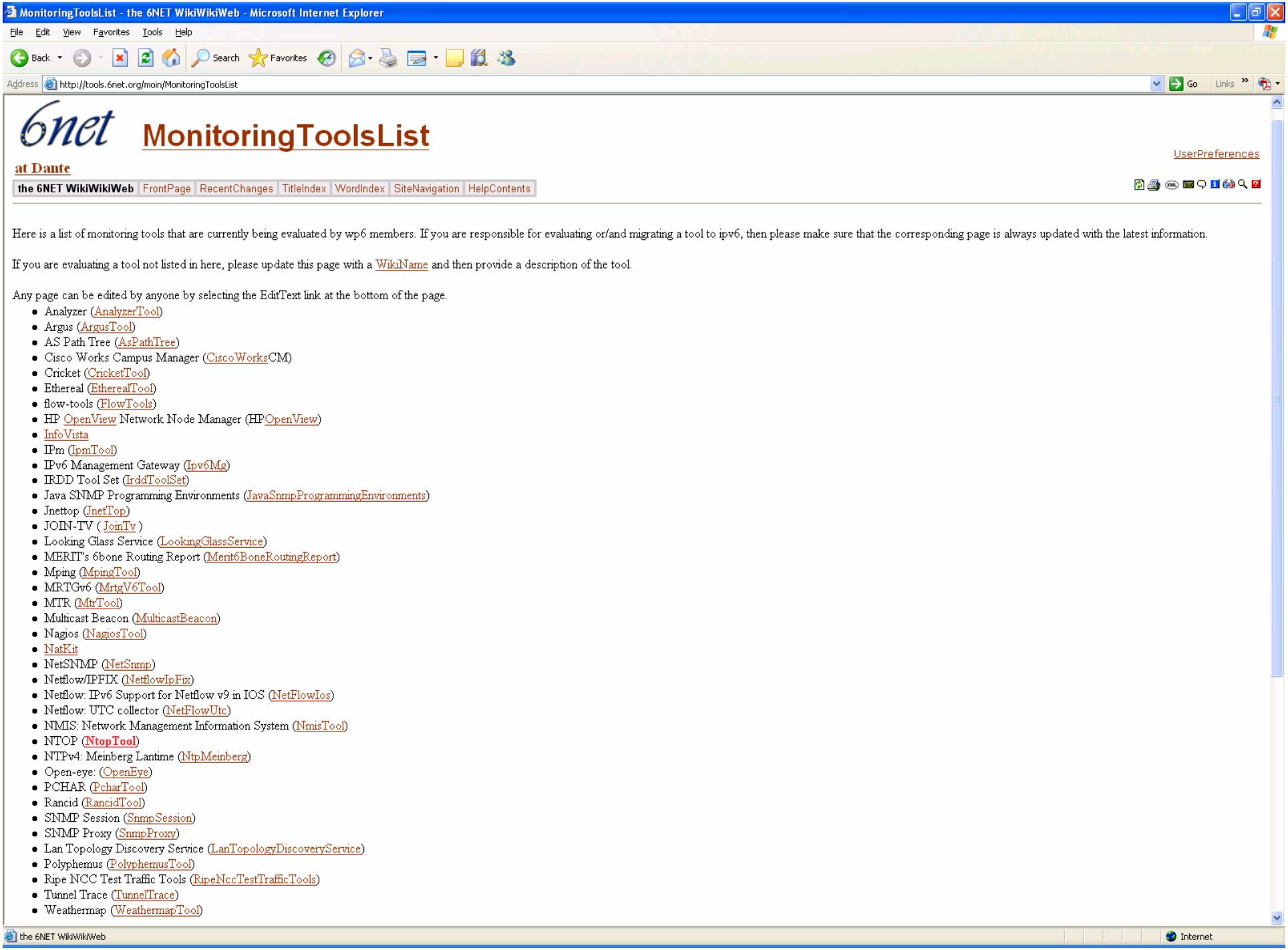
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S23	S24	S25
HS-MRD6 **R1**		12	12	9	6	13	4	7	8	8	7	5	8	7	5	6	5	5	9	7	7			
New York University **R2**	12			4		10	12	12		13	12	10	13	12	10	11	10		10	12		12		10
CNR Pisa **R3**	12	14		10			12	12		13	12	10	13	12	11	11	10	10	10	12		12	10	10
6pack.org **R5**	6	10		7		11	9	9		10	9	4	10	9	7	8	7	9	5	9		9	9	7
Internet2-Ann Arbor **R6**	13	10		7			13	13		14	13	11	14	13	11	12	11	11	11	13		13	11	11
ITIN-IABG **R7**	4	12	12	9	6	13		7	8	8	7	5	8	7	5	6	5	5	9	7	7			
RENATER **R8**	7	12		5			7			4	3	5	4	3	5	6	5	5	5	3		3	5	5
...ch1.switch.ch **R9**	8	10	9	7		11	8	8		9	8	6	9	8	9	7	6	8	8	8	9	8	8	6
Phocean **R10**	8	13		6			8	4			4	6	5	4	6	7	6	6	6	4		4	6	6
...canet.u-strasbg.fr **R11**	7	12	12	9	9	13	7	3	8	4		12	4	3	10	6	5	9	9	3	10	3	9	5
ssmping.uninett.no **R12**	5	13		10	4	14	5	12		13	12		13	12	10	11	10	12	10	12		12	12	10
Universite-Paris13 **R13**	8	13		6			8	4		5	4	13		4	6	7	6	10	6	4		4	10	6
ITIN-Renater **R14**	7	12	12	9	9	13	7	3	8	4	3	12	4		10	6	5	9	9	3	10	3	9	5
CESGA **R15**	10	13	11	10	10	14	10	10	9	11	10	13	11	10		9	8	6	10	10	11	10	6	8
CESNET2 **R17**		11	12	8		12			8									11					11	
UC3M **R18**	9	12		9	9	13	9	9	8	10	9	7	10	9	6	8	7		9	9		9	3	7
UofA-ERG **R19**	9	10	12	7	5	11	9	9	8	10	9	10	10	9	7	8	7	9		9	6	9	9	7
IUT_Colmar **R20**	7	12	12	9	9	13	7	3	8	4	3	12	4	3	5	6	5	9	9		10	3	9	5
ECS Southampton **R21**	7	11	13	8	2	12	7	10	9	11	10	5	11	10	8	9	8	10	6	10		10	10	8
hadron.switch.ch **R22**	9	11	10	8	9	12	9	9	2	10	9	12	10	9	10	8	7	9	9	9	10	9	9	7

ssmping

- A tool for testing SSM multicast connectivity
- Behavior “similar” to unicast ping
- A server must run ssmpingd
- Sssping server replies with both unicast and multicast ssmping replies

```
$ ssmping -4 -c 5 ssmping.beacon.ja.net
ssmping joined (S,G) = (193.60.199.162,232.43.211.234)
pinging S from 158.38.63.22
  unicast from 193.60.199.162, seq=1 dist=16 time=39.331 ms
  unicast from 193.60.199.162, seq=2 dist=16 time=39.394 ms
multicast from 193.60.199.162, seq=2 dist=16 time=43.905 ms
  unicast from 193.60.199.162, seq=3 dist=16 time=39.542 ms
multicast from 193.60.199.162, seq=3 dist=16 time=39.547 ms
  unicast from 193.60.199.162, seq=4 dist=16 time=39.137 ms
multicast from 193.60.199.162, seq=4 dist=16 time=39.142 ms
  unicast from 193.60.199.162, seq=5 dist=16 time=39.535 ms
multicast from 193.60.199.162, seq=5 dist=16 time=39.539 ms

--- 193.60.199.162 ssmping statistics ---
5 packets transmitted, time 5000 ms
unicast:
   5 packets received, 0% packet loss
   rtt min/avg/max/std-dev = 39.137/39.387/39.542/0.292 ms
multicast:
   4 packets received, 0% packet loss since first mc packet (seq 2)
     recvd
   rtt min/avg/max/std-dev = 39.142/40.533/43.905/1.958 ms
$
```


MonitoringToolsList - the 6NET WikiWikiWeb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://tools.6net.org/moin/MonitoringToolsList
Go Links
6net
MonitoringToolsList
at Dante
UserPreferences
the 6NET WikiWikiWeb FrontPage RecentChanges TitleIndex WordIndex SiteNavigation HelpContents
Here is a list of monitoring tools that are currently being evaluated by wp6 members. If you are responsible for evaluating or/and migrating a tool to ipv6, then please make sure that the corresponding page is always updated with the latest information.
If you are evaluating a tool not listed in here, please update this page with a WikiName and then provide a description of the tool.
Any page can be edited by anyone by selecting the EditText link at the bottom of the page.
Analyzer (AnalyzerTool)
Argus (ArgusTool)
AS Path Tree (AsPathTree)
Cisco Works Campus Manager (CiscoWorksCM)
Cricket (CricketTool)
Ethereal (EtherealTool)
flow-tools (FlowTools)
HP OpenView Network Node Manager (HPOpenView)
InfoVista
IPm (IpmTool)
IPv6 Management Gateway (Ipv6Mg)
IRDD Tool Set (IrddToolSet)
Java SNMP Programming Environments (JavaSnmpProgrammingEnvironments)
Jnettop (JnetTop)
JOIN-TV (JoinTv)
Looking Glass Service (LookingGlassService)
MERIT's 6bone Routing Report (Merit6BoneRoutingReport)
Mping (MpingTool)
MRTGv6 (MrtgV6Tool)
MTR (MtrTool)
Multicast Beacon (MulticastBeacon)
Nagios (NagiosTool)
NatKit
NetSNMP (NetSnmp)
Netflow/IPFIX (NetflowIpFix)
Netflow: IPv6 Support for Netflow v9 in IOS (NetFlowIos)
Netflow: UTC collector (NetFlowUtc)
NMIS: Network Management Information System (NmisTool)
NTOP (NtopTool)
NTPv4: Meinberg Lantime (NtpMeinberg)
Open-eye: (OpenEye)
PCHAR (PcharTool)
Rancid (RancidTool)
SNMP Session (SnmpSession)
SNMP Proxy (SnmpProxy)
Lan Topology Discovery Service (LanTopologyDiscoveryService)
Polyphemus (PolyphemusTool)
Ripe NCC Test Traffic Tools (RipeNccTestTrafficTools)
Tunnel Trace (TunnelTrace)
Weathermap (WeathermapTool)
the 6NET WikiWikiWeb
Internet

Conclusions

- Management tools are absolutely needed in every IPv4/6 network
- Network engineers 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. However, question yourself …
  - Are your management tools (used for IPv4 monitoring) available for IPv6 too ?
  - What do I need to stress to my favourite vendor to be ready and manage my IPv6 network ?

Questions?

Thanks for your attention!

Contact
Athanassios Liakopoulos (aliako@grnet.gr)