Large Scale International IPv6 Pilot Network (6NET)

Athanassios Liakopoulos (aliako@grnet.gr)
Greek Research & Technology Network (GRNET)

III Global IPv6 Summit
November 2004

Presentation Outline

- Project Overview & Objectives
- Network Details
- Transition to IPv6
- Basic & Advanced Services
- Applications & Monitoring Tools
- Dissemination & Demonstrators
- Conclusions

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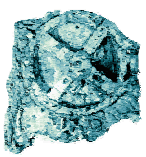
Project Overview

- One of the largest Internet research projects funded from the European Commission
  - More than 18.4 MEuros budget
  - 50% funded by EC for industry and major research institutes; 100% for Universities
- Around 37 partners from Industry, National Research Networks (NRENs) and Academic Community (Universities and Research Institutes)
- A 3-year project, started in 1st of January 2002
  - Currently, 6NET is extended 6 more months, a.k.a. until June 2005

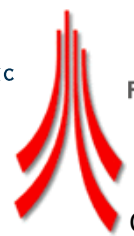
Project Objectives

- Built and operate a dedicated international IPv6 network
  - Avoid using tunnels for interconnection links
- Gain experience from the deployment of IPv6 protocols, applications, and services in the 6NET testbed network
  - Use this experience to accelerate the deployment of IPv6 technology to the production networks.
- Participate in the evolution of IPv6 technology
  - Validate new concepts and protocols, identify missing parts in the IPv6 implementations and provide feedback to the standardisation bodies.
- Disseminate results from the 6NET tests to the research and industrial community

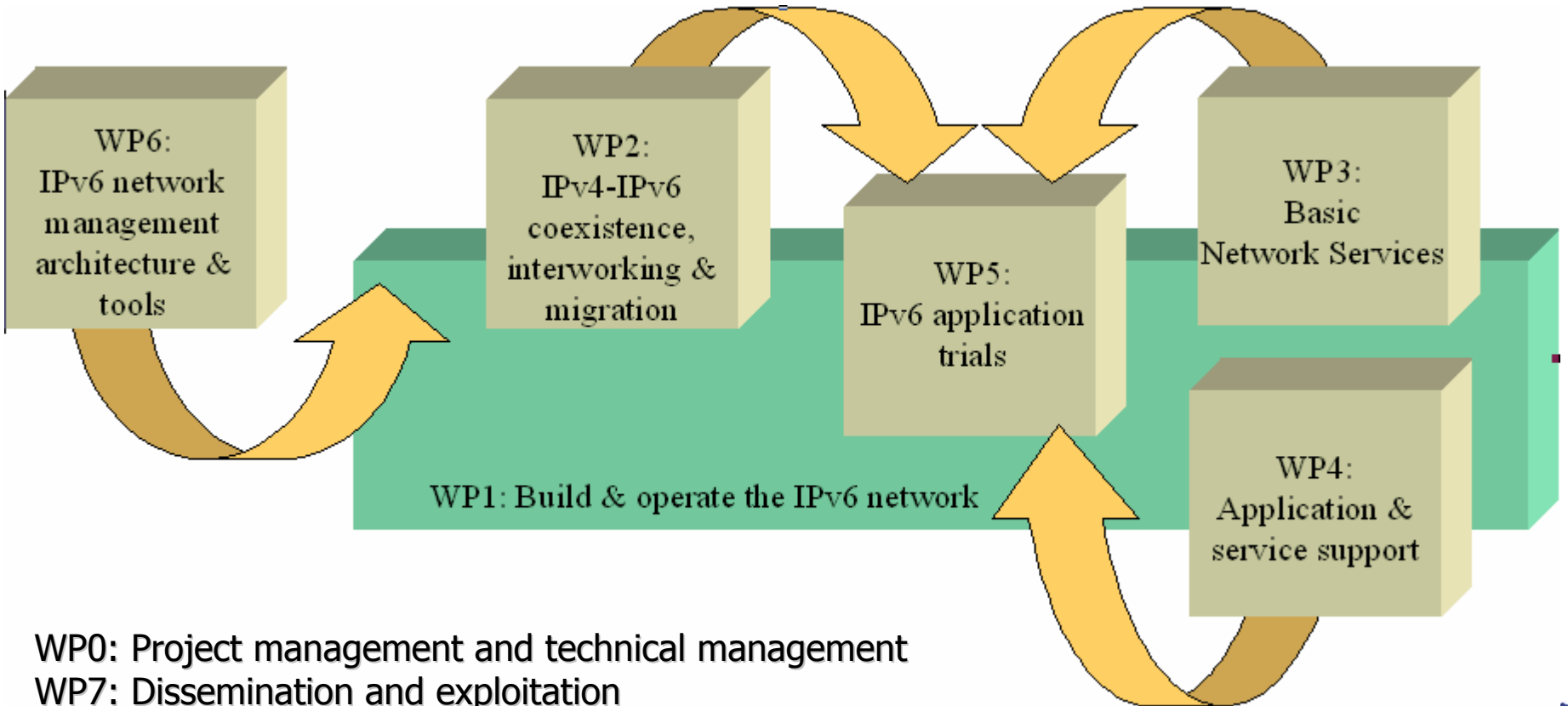
Partners: Industry, NRENs, Academic



Research Academic Computer Technology Institute



Project Workflow



WP0: Project management and technical management
WP7: Dissemination and exploitation

Work Packages

- WP1: Build and Operate the IPv6 Network
  - Operation, interoperability tests.
- WP2: IPv4-IPv6 coexistence, interworking and migration
  - Transition mechanisms for core and university networks.
- WP3: Basic Network Services
  - DNS, DHCP, Multicast, Security, Renumbering, etc.
- WP4: IPv6 application and service support
  - Application support, IPv6 mobility, QoS, VPNs, IPv6 Wireless LANs, etc.
- WP5: IPv6 middleware and user application trials in demanding environments
  - Videoconferencing, Media Streaming, e-bussiness
- WP6: IPv6 network management architecture and tools
  - Definition of management architecture, development of tools
- WP7: Dissemination and Exploitation of Results

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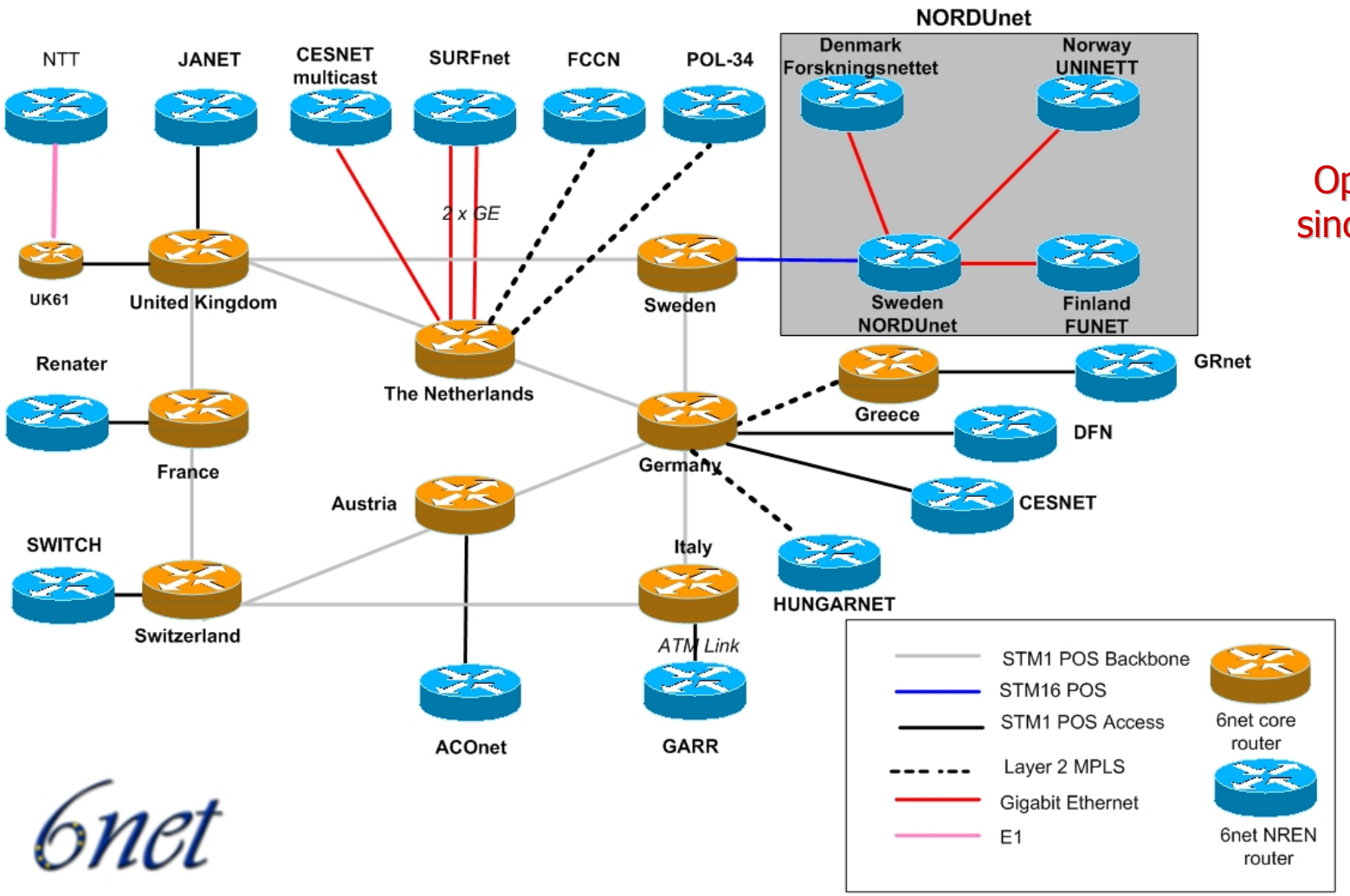
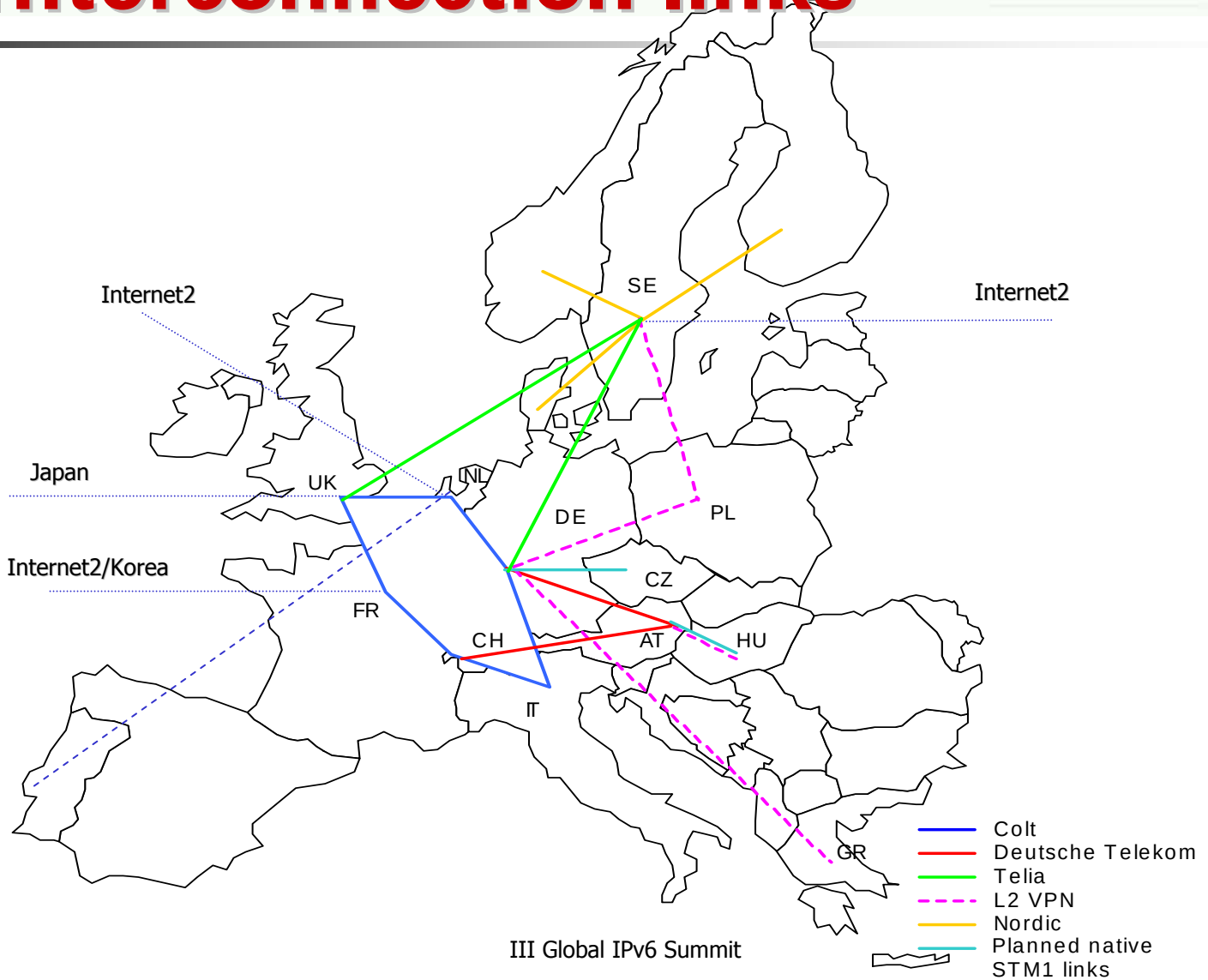
Logical network topology (June 2004)



Operational since 2Q2002!

Interconnection links



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IPv6 to IPv4 Transition Studies

- Investigate ISPs/NRENs transitions methods
  - "IPv4 to IPv6 Transition Cookbook for ISPs and Backbone Networks"
    - Methods: Dual stack, IPv6 over MPLS (6PE), IPv6 over ATM, tunnel brokers, 6to4 relay routers, etc.
    - Include case studies from multiple NRENs
- Investigate University network transitions methods
  - "IPv4 to IPv6 Transition Cookbook for End-sites"
    - Methods: Configured tunnel, tunnel brokers, automatic tunnels, 6to4, 6over4, ISATAP, Toredo, etc.
    - Include IPv6 translation methods and few case studies

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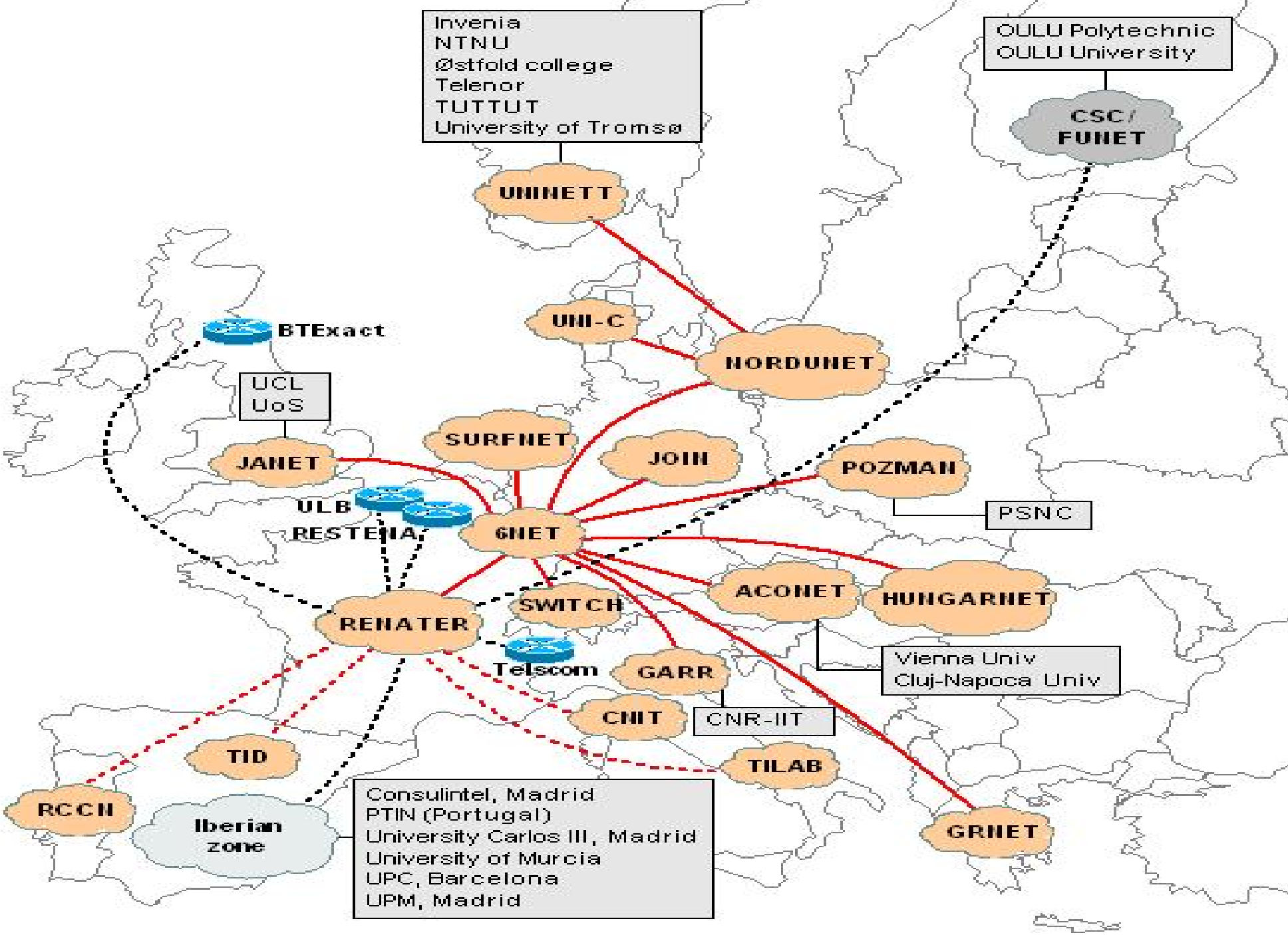
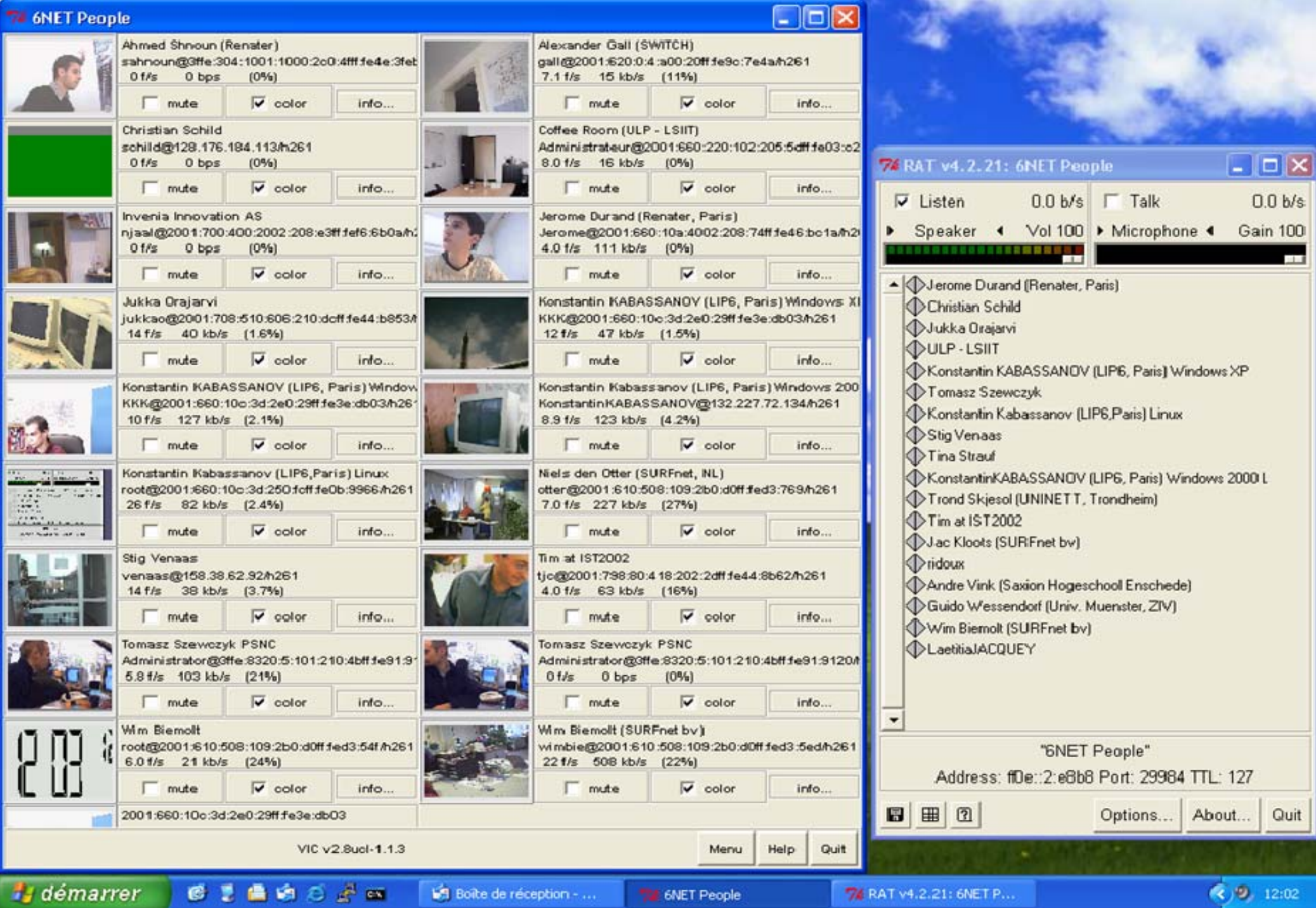
Basic and Advanced Network Services

- DNS and DNSSec
  - Deploy IPv6 DNS nameservers throughout the network. Perform tests with DNS proxies.
  - DNSSec secures the data exchange. Standardisation process in progress.
- Multicast
  - Provide the needed infrastructure for other tests, e.g. WP5 application tests.
- DHCPv6
  - Missing available products delayed the tests.
- Routing policies and RPSLng
  - Extend RPSL (Routing Policy Specification Language) to describe routing policies for IPv6. 6NET tested prototype RPSLng registry and tools.
- Security
  - Define the security policy in the 6NET network
- "Routing, DNS, Interdomain Multicast, and Security Cookbook"
  - Implementation details (a.k.a. configuration) for multiple routing protocols, multicast, ACLs and *bind*.

Multicast

- 6NET provides native IPv6 multicast services since 2003.
- Deployment in multiple phases
  - Phase 1: PIMv2 – SM/SSM, MLD, Static RP configuration, etc
  - Phase 2: Embedded RP, MLDv2, Scoped BSR, PIM boundaries, etc.
- Application tests
  - Videoconferencing: VIC/RAT, VideoLAN, WMPlayer9, etc
  - Radio broadcast: Freeamp
  - Other: SDR, beacon monitoring, NTE, etc
- Multicast gateway (MG)
  - Allows IPv6 hosts to receive / send data to IPv4 multicast groups
  - MG is a "IPv6 PIM router+RP (/96 prefix)" combined with an "IPv4 host (IGMP)"
  - http://www.uninett.no/testnett/multicast/mcgw/
- Multicast reflector
  - Receive multicast streams and resend them as unicast streams and the opposite (two way communication).
  - Supports IPv6/IPv4 multicast groups or unicast streams.
  - http://www.kabassanov.com/reflectors/


Invenia
NTNU
Østfold college
Telenor
TUTTUT
University of Tromsø
OULU Polytechnic
OULU University
CSC/
FUNET
UNINETT
UNI-C
NORDUNET
BTExact
UCL
UoS
SURFNET
JANET
JOIN
POZMAN
PSNC
ULB
RESTENA
GNET
ACONET
HUNGARNET
SWITCH
RENATER
Telscom
GARR
Vienna Univ
Cluj-Napoca Univ
CNIT
CNR-IIT
TID
TILAB
RCCN
Iberian
zone
Consulintel, Madrid
PTIN (Portugal)
University Carlos III, Madrid
University of Murcia
UPC, Barcelona
UPM, Madrid
GRNET


6NET People
Ahmed Shnoun (Renater)
sahnoun@3ffe:304:1001:1000:2c0:4fff:fe4e:3feb
0 f/s 0 bps (0%)
mute color info...
Alexander Gall (SWITCH)
gall@2001:620:0:4:a00:20ff:fe9c:7e4a/h261
7.1 f/s 15 kb/s (11%)
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Christian Schild
schild@128.176.184.113/h261
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mute color info...
Coffee Room (ULP - LSIIT)
Administrateur@2001:660:220:102:205:5dff:fe03:c2
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Invenia Innovation AS
njaal@2001:700:400:2002:208:e3ff:fef6:6b0a/h2
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KonstantinKABASSANOV@132.227.72.134/h261
8.9 f/s 123 kb/s (4.2%)
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Stig Venaas
venaas@158.38.62.92/h261
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Tim at IST2002
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Administrator@3ffe:8320:5:101:210:4bff:fe91:9
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mute color info...
2001:660:10c:3d:2e0:29ff:fe3e:db03
VIC v2.8ucl-1.1.3
Menu
Help
Quit
RAT v4.2.21: 6NET People
Listen 0.0 b/s
Talk 0.0 b/s
Speaker Vol 100
Microphone Gain 100
Jerome Durand (Renater, Paris)
Christian Schild
Jukka Orajarvi
ULP - LSIIT
Konstantin KABASSANOV (LIP6, Paris) Windows XP
Tomasz Szewczyk
Konstantin Kabassanov (LIP6,Paris) Linux
Stig Venaas
Tina Strauf
KonstantinKABASSANOV (LIP6, Paris) Windows 2000 L
Trond Skjesol (UNINETT, Trondheim)
Tim at IST2002
Jac Kloots (SURFnet bv)
ridoux
Andre Vink (Saxion Hogeschool Enschede)
Guido Wessendorf (Univ. Muenster, ZIV)
Wim Biemolt (SURFnet bv)
LaetitiaJACQUEY
"6NET People"
Address: ff0e::2:e8b8 Port: 29984 TTL: 127
Options...
About...
Quit
démarrer
Boîte de réception - ...
6NET People
RAT v4.2.21: 6NET P...
12:02

Service Support

- MIPv6
  - Multiple MIPv6 Home Agents deployed and tested.
- QoS activity
  - Phase 1: Investigate the performance of QoS mechanism in limited size testbeds. Identify supported (or missing) functionality in core / edge routers.
  - Activate QoS services in 6NET network. Large-scale tests planned in the following month.
- VPN deployment and testing
  - Initial deployment of XBone and DVC.
  - Tests with OpenVPN.
- Multihomming
  - Limited work – Follow the standardisation process.

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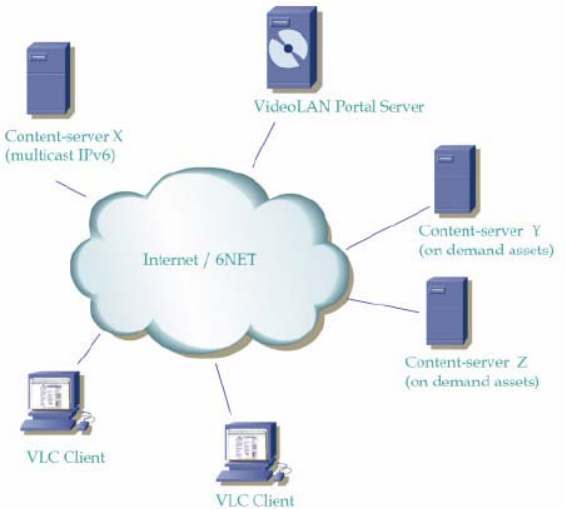
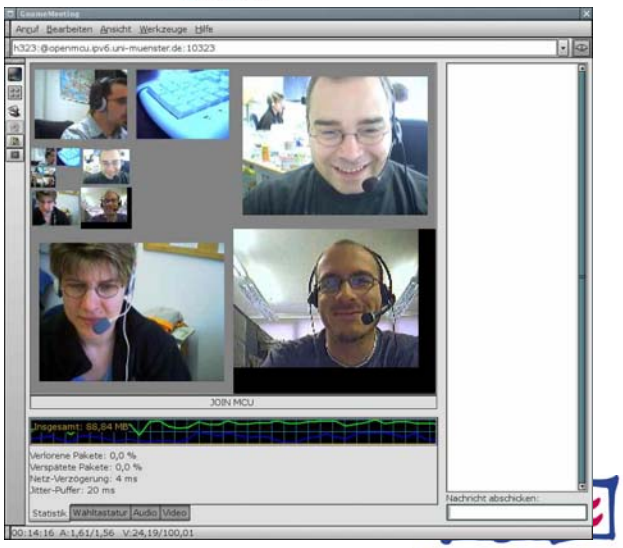
Applications

- Real-time videoconference and media streaming
  - Gnomemeeting, OpenMCU, VideoLAN, DVTS, MPEG4IP(DSS), VIC/RAT, NTE etc.
- On-line games
  - Quake
- E-business solutions
  - WEBsphere portals
- http://serverwas.lab.telin.nl/WP5Apps/





Applications summary

Click on the column headers to change sorting order

name	category	class	summary	status	responsible	modified
6UMS	Streaming	C	IPv6-enabled unified messaging system	6UMS is being developed by UoS in Euro6IX, but will be made available to 6NET. Existing tools will be re-used where appropriate.	UoS	2003-01-16
Agent Framework	E-business	C	Framework for agent research	Available, in Java. Unicast works. Multicast not tested yet.	UoS	2003-01-24
AMUSE	Streaming	C	Adaptive MUltimedia Support Environment	Available. Usage limited to Sony and WP5. Work planned to support MobileIPv6.	Sony	2003-01-27
AWM	E-business	No	Application Workload Modeler	Released product with IPv6 support for zSeries. Needs special build for Linux/Intel.	IBM	2003-04-14
Bonephone	Streaming	B	Internet phone sending and receiving SIP messages	Demo version released.	FhG	2003-04-10
CDN	Edge Services	C	Content Distribution Networks	No specific work at the moment.	Cisco	2003-01-16
DVTS	Streaming	C	Application for sending and receiving Digital Video	The source and binaries for DVTS on various platforms are available from the DVTS URL.	UCL	2003-01-16
Edge Server	Edge Services	C	IBM Edge Server	Porting to IPv6 in progress.	IBM	2003-01-16
EGP	Gaming	No	Experimental Gaming Platform	Sony has stopped working on EGP. This activity has been dropped.	Sony	2003-03-27
FreeAMP	Streaming	A/B	Free unicast/multicast MP3 player	The code has been released on the web. Both a unicast and a multicast MP3 source will be activated in a network which will be available to all 6Net partners.	GARR	2003-01-24
FunnelWeb	E-business	C	Application level active services	Implemented as a Java application. Available on request within the project.	UCL	2003-01-16
Globus	E-business	C	GLOBUS toolkit (Grid)	Release 2.0 available. Globus 3.0 is expected early 2003. 6NET expectation is to get IPv6 support enabled as a patch for Globus 2.0, later as an integral part of Globus 3.0.	UCL	2003-01-16
GnomeMeeting	Streaming	C	Open source H323 Linux application	Deployment and support in progress for Greek Research Network community	GRNET	2003-02-05
			Tool for sending and receiving MP3	HAT works on MSR IPv6 stack. Another version which works on		

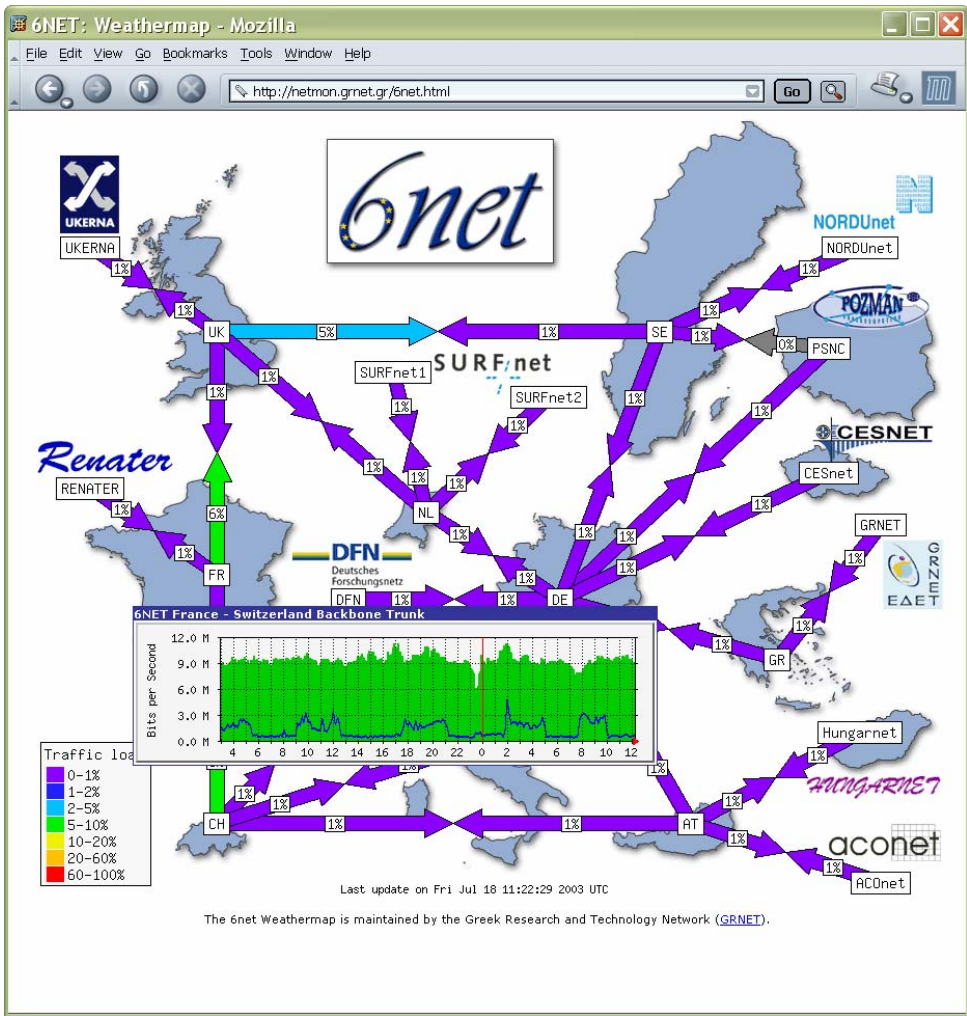
HAT	Streaming	No	Tool for sending and receiving MP3 audio	HAT works on MSR IPv6 stack. Another version which works on Microsoft Tech Preview IPv6 will be released.	UCL	2003-01-22
Hypermedia LS	E-business	No	Hypermedia Link Services	Two servers available to experiment with an IPv6-enabled link service (output of 6WINIT)	UoS	2003-01-16
IBP	E-business	A	Internet Back Plane protocol - Middleware for Network Storage	Works. IPv6/IPv4. IPv6, if present, is automatically selected	GARR	2003-04-11
IRC	E-business	A	Internet Relay Chat communication system	Works.	GARR	2003-04-11
MCast6	Streaming	B	Tool for multimedia streaming in a computer network	Open source initiative. Mature versions will be widely available in the Internet. Architecture is designed to make other parties capable to change, adjust or add new modules.	PSNC	2003-01-22
MMCR	Streaming	No	Multicast MultiMedia Conference Recorder	Running. MMCR is fairly stable, and provides good performance.	UCL	2003-01-17
MPEG4IP	Streaming	B	Streaming video tool suite	Darwin Streaming Server will be ready by end 2003. Rest of MPEG4IP suite already ported to IPv6.	Telin	2003-04-23
MUD	Gaming	C	MUD gaming environment	Local to UoS. Can connect from anywhere via Telnet.	UoS	2003-01-16
Multicast Radio	Streaming	No	Multicast Radio	Running. Available to all within UoS site. Proprietary (doesn't currently use RTP).	UoS	2003-01-17
MUST	Streaming	C	MBONE Web-interface	Deployment and support in progress for Greek Research Network community	GRNET	2003-01-22
NTE	Streaming	C	Network Text Editor	NTE is currently fairly stable, and provides good performance. Further work is required on transcoding and support for interleaved formats.	UCL	2003-04-30
Open-LDAP	E-business	C	Open source implementation of the Lightweight Directory Access Protocol	Available. Ported to IPv6.	UNINETT	2003-01-17
OpenH323	Streaming	C	Open source H.323 protocol implementation	Test version on IPv6 available. Final application expected by end 2003.	CTI	2003-01-23
PKI	E-business	C	Public Key Infrastructure	Available on request within the project from the PKI URL.	UCL	2003-01-16
Portals	E-business	C/A	IBM Websphere Portal Technology	Equipment being prepared by IBM.	IBM	2003-03-26
Quake	Gaming	C	Multiplayer FPS action game	Works. Used at GARR.	Sony	2003-01-17
RAT	Streaming	A	Robust Audio Tool (audio	RAT is currently fairly stable, and provides good performance. Further work is required on transcoding and support for	UCL	2003-04-30

Portals	E-business	C/A	IBM Websphere Portal Technology	Equipment being prepared by IBM.	IBM	2003-03-28
Quake	Gaming	C	Multiplayer FPS action game	Works. Used at GARR.	Sony	2003-01-17
RAT	Streaming	A	Robust Audio Tool (audio conferencing)	RAT is currently fairly stable, and provides good performance. Further work is required on transcoding and support for interleaved formats.	UCL	2003-04-30
RQM	Streaming	C	RTP Quality Matrix (background tool for testing)	RQM is currently fairly stable, and provides good performance.	UCL	2003-01-16
SCS	Streaming	A	Secure Conference Store of conference information	SCS is currently fairly stable, and provides good performance.	UCL	2003-04-30
SDR	Streaming	No	Session Directory Tool	Not stabilised.	UCL	2003-04-30
SPAR	Streaming	A	SDP Parser Applet (component of SCS)	SPAR is currently stable, and provides good performance.	UCL	2003-04-30
TAG	E-business	C	Transcoding Active Gateway	Implemented in Java. JDK1.4 required if used in IPv6 environment. Initial release available for download to project partners.	UCL	2003-04-30
TUR	Streaming	A/B	Trondheim Underground Radio	Running. Publicly available. Multicast support planned by mid 2003.	UNINETT	2003-01-17
TZI-Gateway	E-business	C	Call signalling and media transcoding gateway	Supports IPv6 for SIP and H.323 on Linux-2.4 and Solaris (Intel). Tested with a number of agents/clients.	UCL	2003-01-16
VIC	Streaming	A	Video Conferencing Tool	VIC is currently fairly stable, and provides good performance. Further work is required on use of direct video display and integration of more codecs.	UCL	2003-04-30
VideoLAN	Streaming	A	Streaming video server and player	Works. Ported to IPv6 by Btexact for 6WINIT. May be good multicast and QoS demonstrator.	SURFnet	2003-05-08
VIP	Streaming	No	Video over IP (search and retrieval system)	Active at Telin. Central service would be delivered from Telin DataCenter through Surfnet	Telin	2003-01-17
VOCAL	Streaming	B	SIP-based VoIP client	The SIP user agents have been ported for use with IPv6 and are undergoing testing. Supports ENUM.	UoS	2003-01-20
WBD	Streaming	C	Whiteboard for conferencing	WDB is currently fairly stable, and provides good performance.	UCL	2003-01-16
XPilot	Gaming	C	Network game	Ported to IPv6. Field trial started.	UNINETT	2003-01-22

Add a description

Monitoring

- Multiple management tools were ported to IPv6.
  - Some of the tools are used in the everyday operation of 6NET network, e.g. ASPath, Looking Glass, Weathermap, IRRToolSet, Mping, MRTG, Nagios, rancid,etc.
  - http://tools.6net.org/
- "IPv6 Network Management Cookbook"



MonitoringToolsList

at Dante

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)

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Dissemination

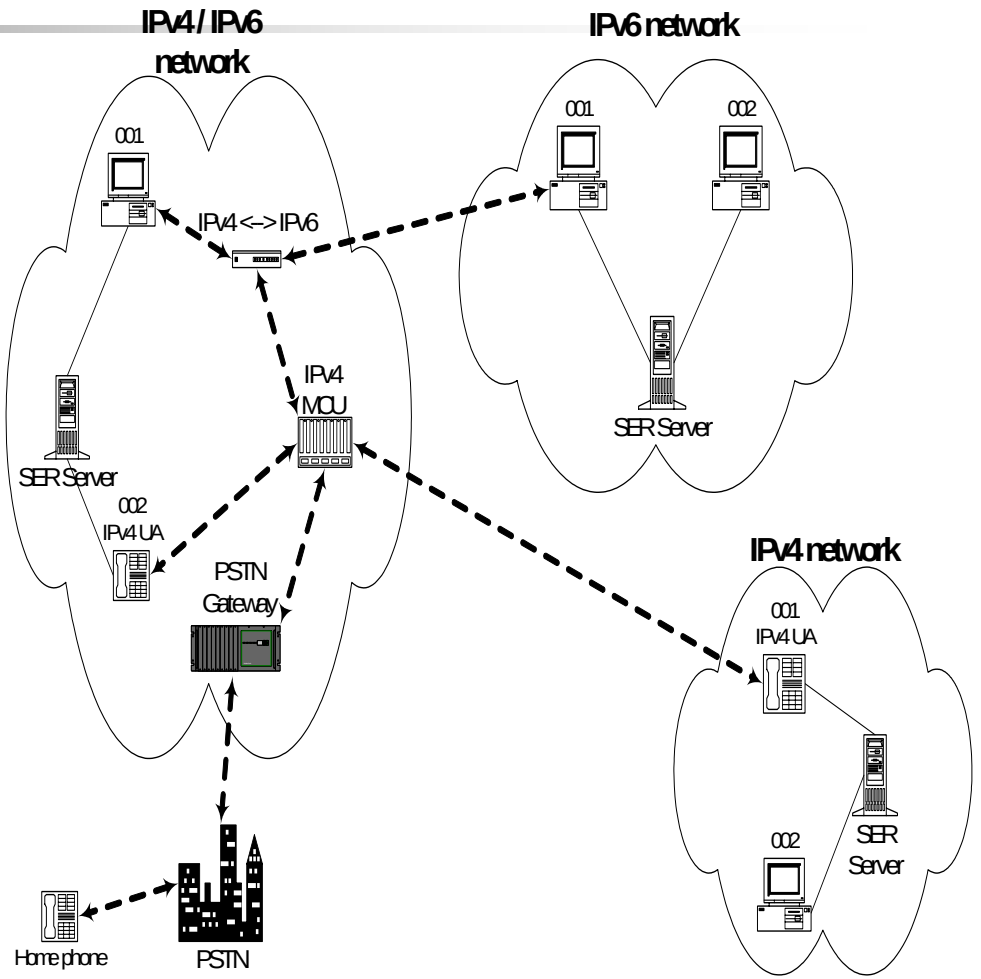
- Organise or participate to IPv6-related workshops
  - Global IPv6 Launch Event (co-organised with European Commission and Euro6IX), 6NET Spring Event, TERENA Conferences, etc.
  - Support multiple 6NET partners to organise local IPv6 workshops
- Organise technical training programs
  - Network administrators get practical training on all aspects of IPv6 deployment and management.
  - Target to NREN NOC members.
- Support IPv6 deployment in other regional networks, e.g. SEEREN network in Balkan area.
- Built a website that concentrates all the cookbooks, tutorials, presentation, papers, newsletters produced within the project.

Demonstrators

- Cross-WP activities that try to integrate multiple IPv6 technologies, a.k.a. “puts different pieces together”.
- Seek for wide deployment of IPv6 applications or services.
- Planned in 2005
  - SIP-based VoIP
  - SSM Multicast & Flute
  - Mobile Streaming
  - OpenH.323 and OpenVPNs
  - Globus Toolkit (GT3)
  - Home Networking
  - IPv6 support in Greek School Network
  - IPv6 Satellite connectivity to SILK region

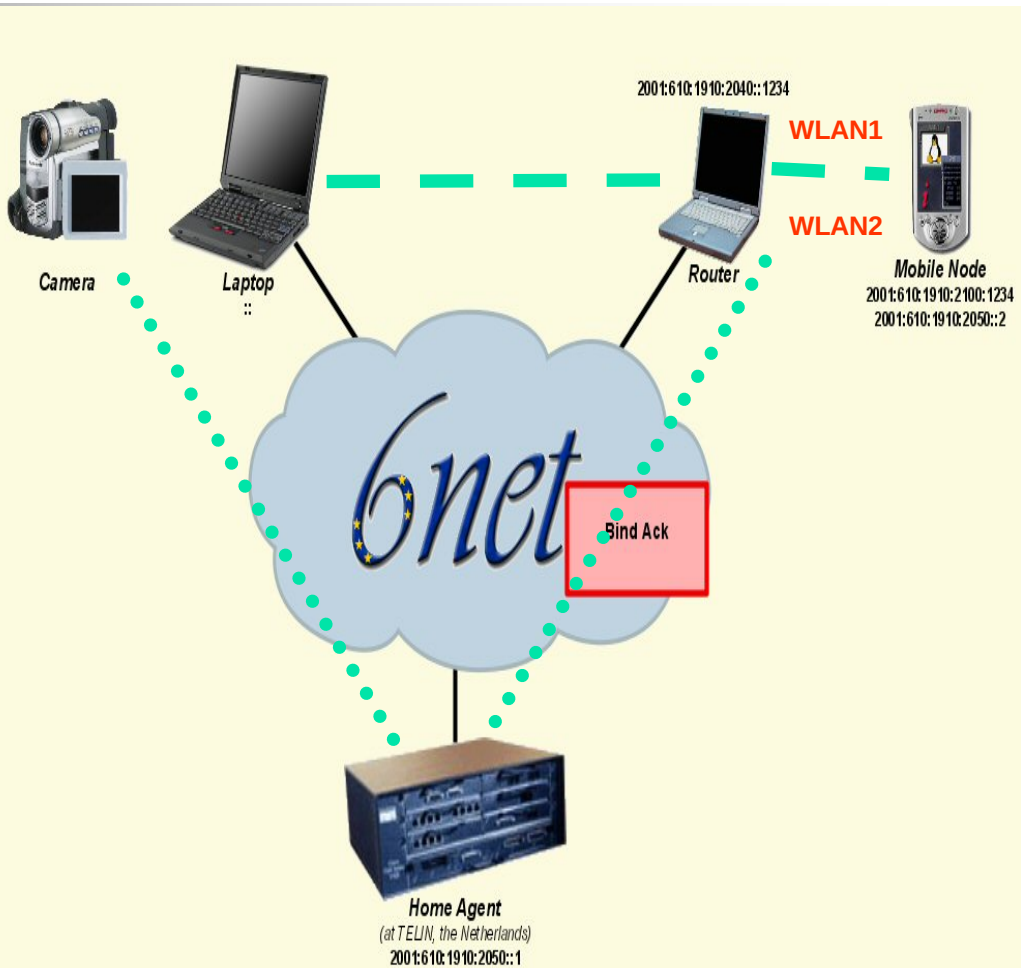
SIP-based VoIP

- SIP-based VoIP
  - Components: SER (SIP Express Router), Voice user agent (e.g. IPv6 Kphone), PSTN gateway, MCU, VPN functionality
  - Integrate: QoS, Mobility, VPNs, management and monitoring.



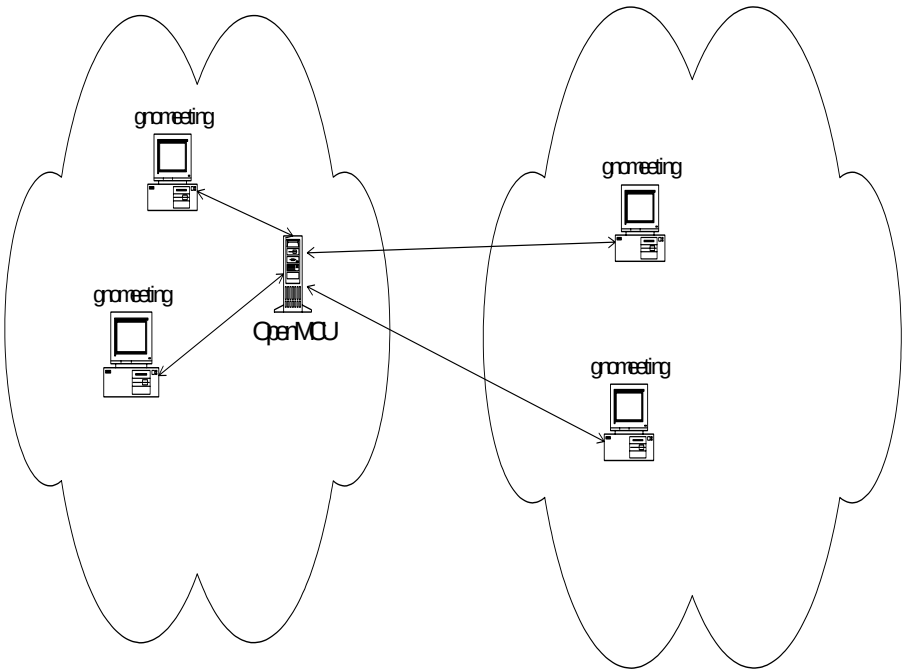
Mobile Streaming

- Demonstrate mobility in multimedia context
- Components: mobile nodes (laptop, iPAQ), correspondent node (laptop), home agents.
- Integrate/investigate: MIPv6, QoS(?), transition, etc.



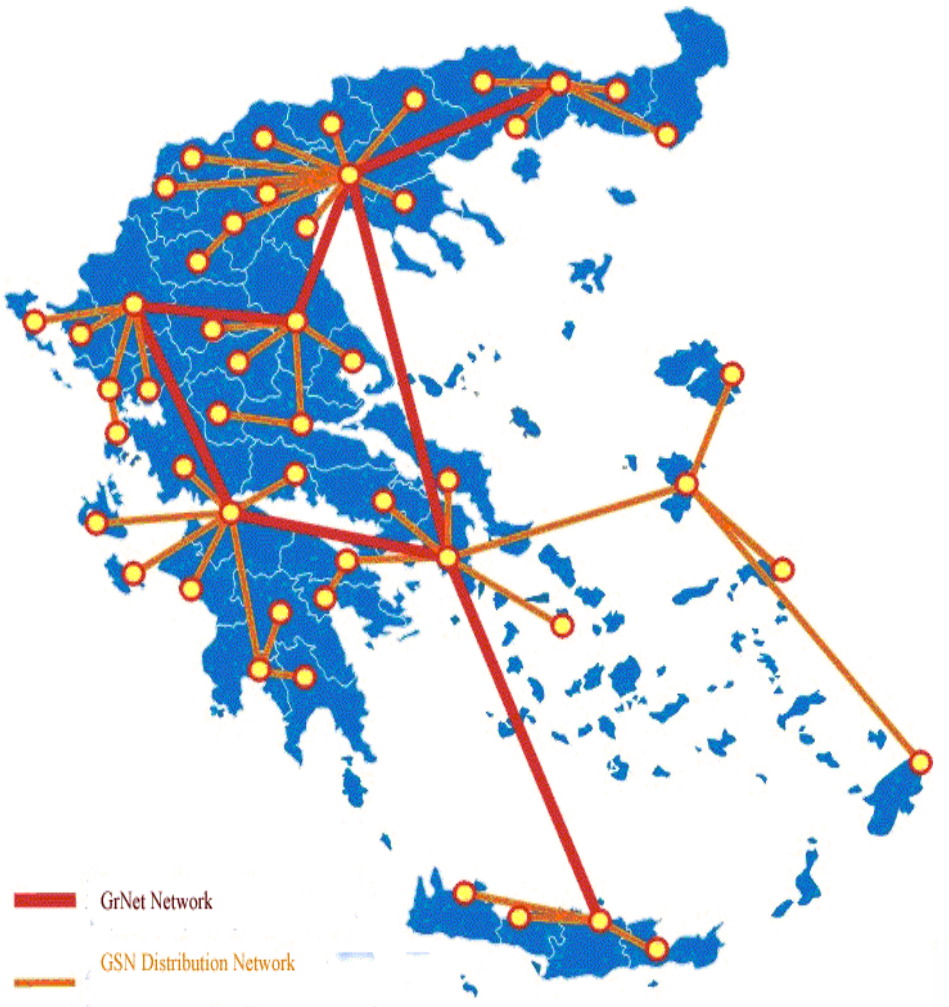
H.323 conferencing

- Use together IPv6 applications ported within 6NET, e.g. GnomeMeeting, OpenMCU.
- Integration: IPv4-IPv6 interworking via MCU, Open VPNs, QoS(?),



IPv6 support in Greek School Network

- Deploy IPv6 services to the national School Network in Greece, i.e. upgrade more than 5000 primary and secondary access (and core) routers.
- Plan a smooth migration of the network avoiding degradation of basic production services, e.g. email, dialup, web filtering, etc.
- Support advanced services over IPv6, e.g. synchronous distance learning, asynchronous distance learning and Video on Demand.



Standardisation activities

- Internet Engineering Task Force (IETF)
  - RFC 3627: Use of /127 Prefix Length Between Routers Considered Harmful
  - Submitted more than 40 internet drafts (I-Ds) related with Multicast, DHCPv6, v6ops, Multihoming, renumbering.
  - http://www.6net.org/publications/standards/
- Global Grid Forum (GGF)
  - Participate to GGF IPv6 WG
  - Guidelines for IP version independence in GGF specifications
  - Survey of IPv4 Dependencies in GGF specifications
  - Status of Java Developers Kit API for IPv6

Presentation Outline

- Project Overview & objectives
- Network Details
- Transition to IPv6
- Basic & Advanced Services
- Applications & Monitoring Tools
- Dissemination & Demonstrators
- Conclusions

Conclusions

- 6NET …
  - … has proved the feasibility of deploying and running a native IPv6 network
  - … has successfully addressed a large number of problems related to IPv6 and provided valuable feedback to standardisation bodies and router vendors
  - … leverages the expansion of IPv6 technology by disseminating the gained experience.

6NET contact details

http://www.6net.org

info@6net.org