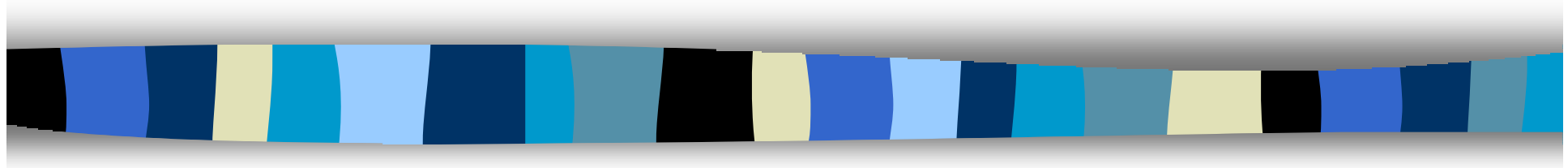


# RENATER

## IPv6 activities



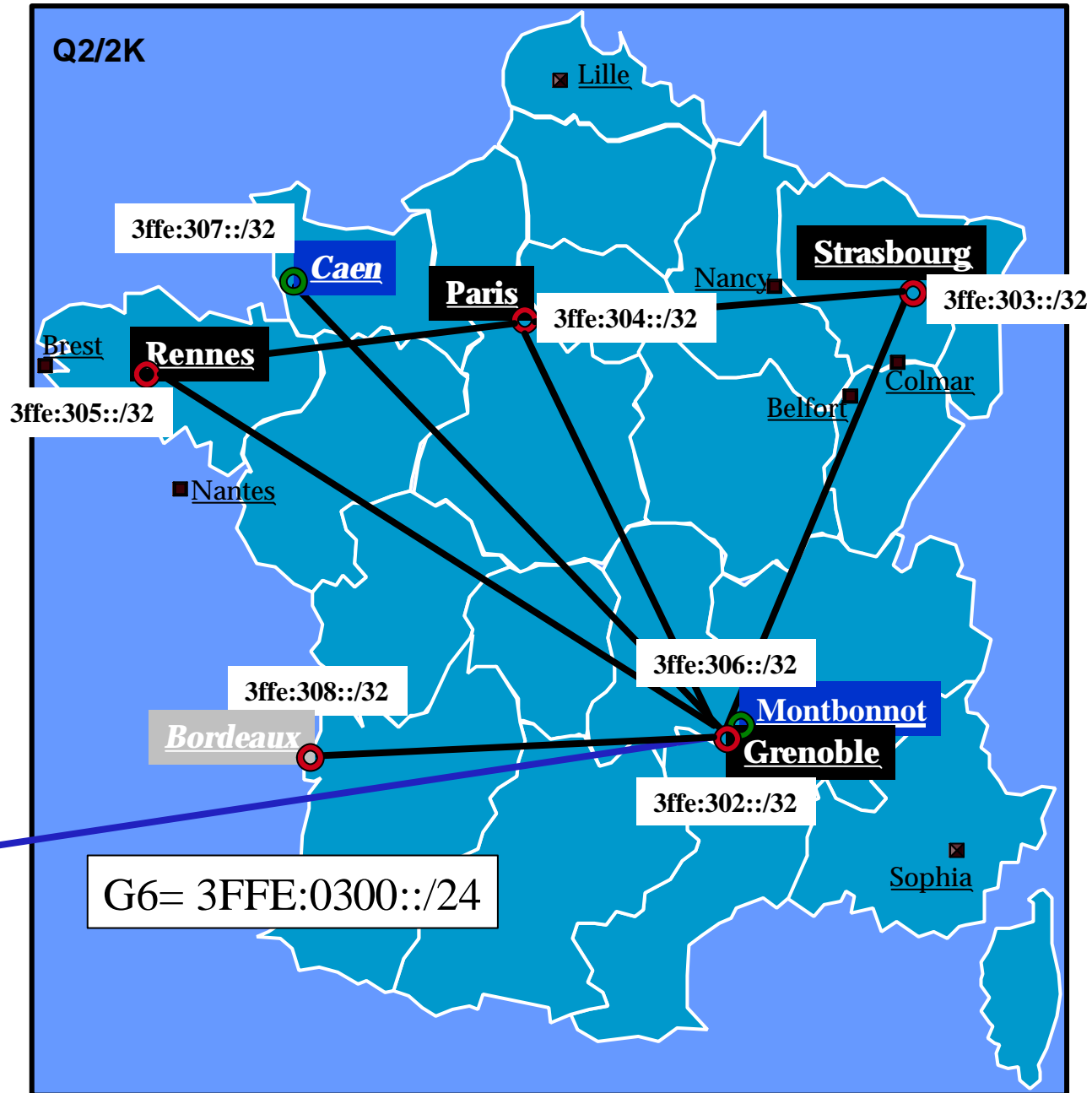
[Jerome.Durand@renater.fr](mailto:Jerome.Durand@renater.fr)



# IPv6 service on RENATER3



# G6bone





# Academics' story with IPv6

Then came Renater ...

## ■ IPv6 Pilot over Renater-2 (P6R2)

- May 2000

- A native IPv6 network

- dedicated ATM VPN

- Deploy the production addressing plan

- July 1999 : first sTLA allocation

- Same two-level topology as in G6bone

- Academic sites

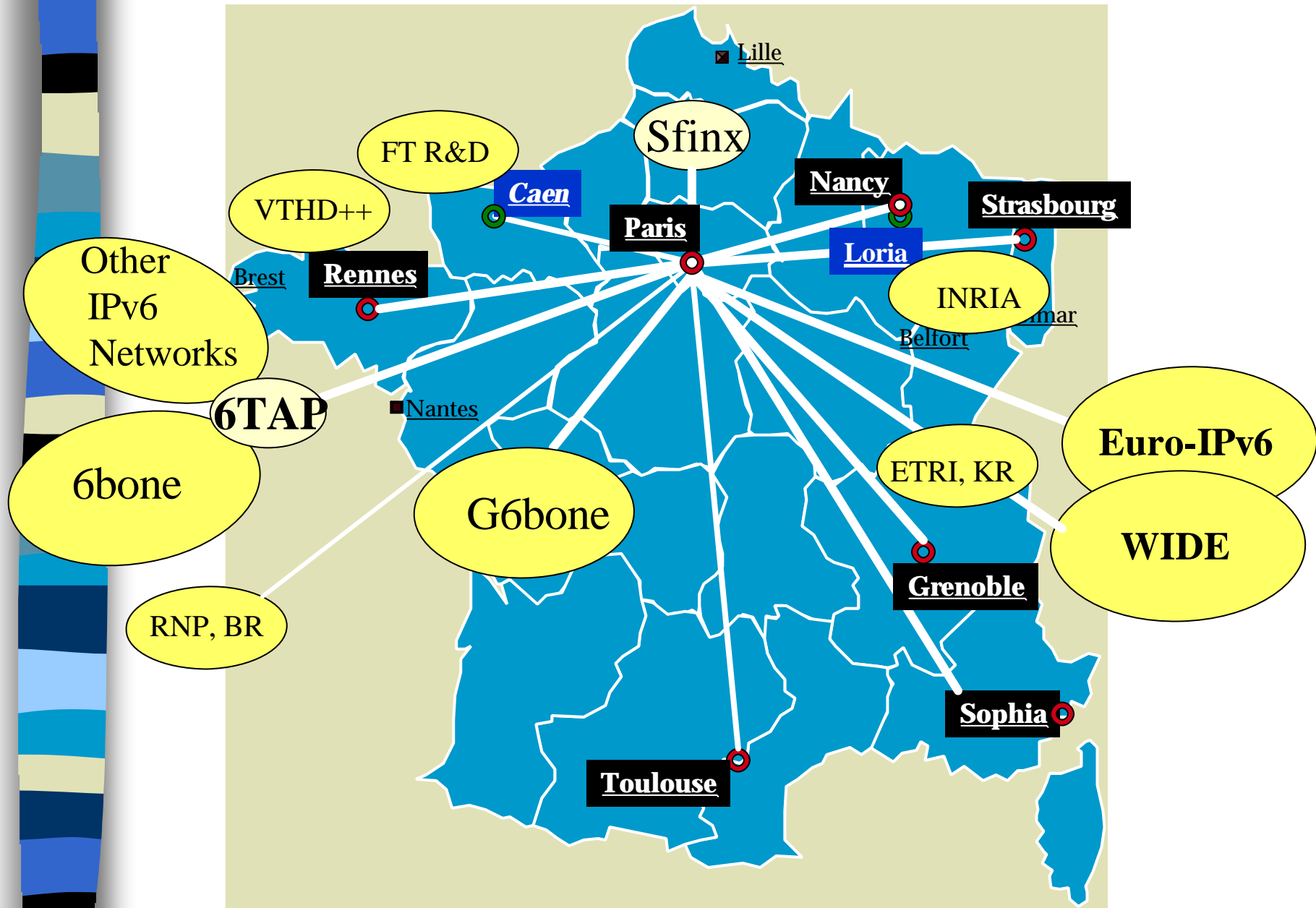
- production addressing scheme

- Industrial sites involved in research projects

- 6bone addressing scheme

## ■ Gain experience with a pre-production service

# Renater's IPv6 Pilot topology





# The Pilot experience

- Experience Using the protocol
  - Equipments
    - Cisco partnership
  - Addresses
    - Deploying a consistent scheme (/35) for the core and the sites
  - Routing
    - ISIS and BGP4+
- IPv6 resources allocation
  - Procedures and management
- IPv6 DNS
  - Deployment of the DNS service
  - Reverse zones delegation to RIs and end-users sites
- Management
  - IPv6 NOC within Renater-2 NOC
  - Management and monitoring tools
    - Set of looking glasses at the RIs



# Towards a native IPv6 network

- G6bone was an overlay network
  - IPv6 traffic was encapsulated in IPv4 packets
- « independent » from Renater's underlying infrastructure
- P6R2, IPv6 pilot was/is a VPN of ATM PVCs
- Goals
  - Have a production IPv6 network
    - In the core
    - Allow Regional and Metropolitan Networks to deploy IPv6



# Additional goals

As production addresses are available

And sTLA expanded from /35 to /32

- Renumber the IPv6 pilot using a new addressing scheme
  - much simpler to be aligned on nibble boundaries !
- Keep a two-level hierarchy
  - A core backbone of Regional Interconnects (RI)
  - User sites connect to one or more RIs





## Additional goals (2)

- Transition period
  - Offer the new connectivity
  - Keep the old infrastructure
  - Move step by step : no D day
- Gather non academic organisations in the G6bone addressing plan
  - Allow them to gain experience with IPv6 until commercial ISPs are ready
  - Have full IPv6 connectivity to the evolving Internet v6
- Connect the pilot to the SFINX (Renater's IX)
  - Peer with ISPs and non academic organisms
- Provide IPv6 connectivity to
  - National projects (RNRT/RNTL)
  - European projects (IST, Esprit)
  - ...

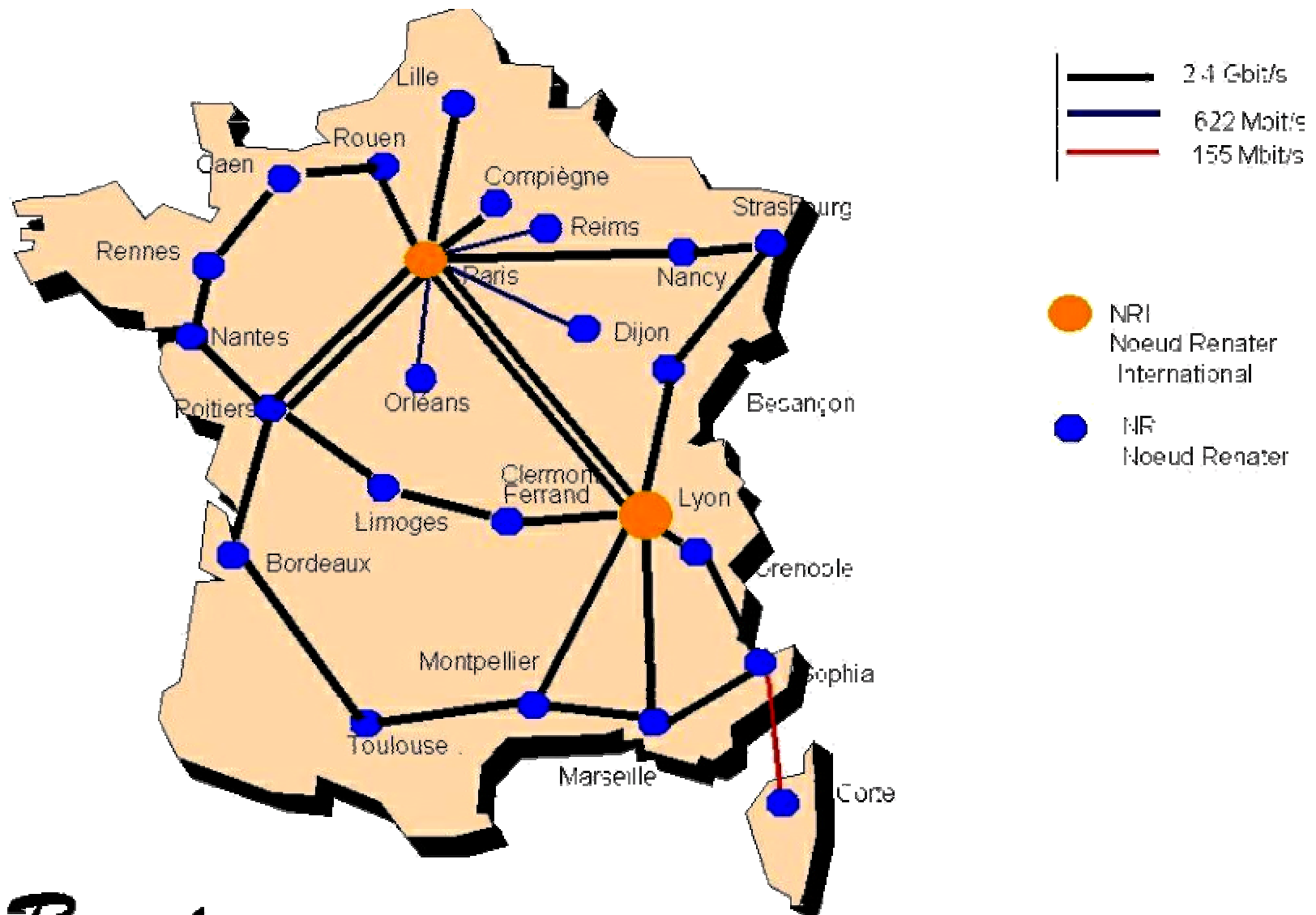


# Toward a production IPv6 service

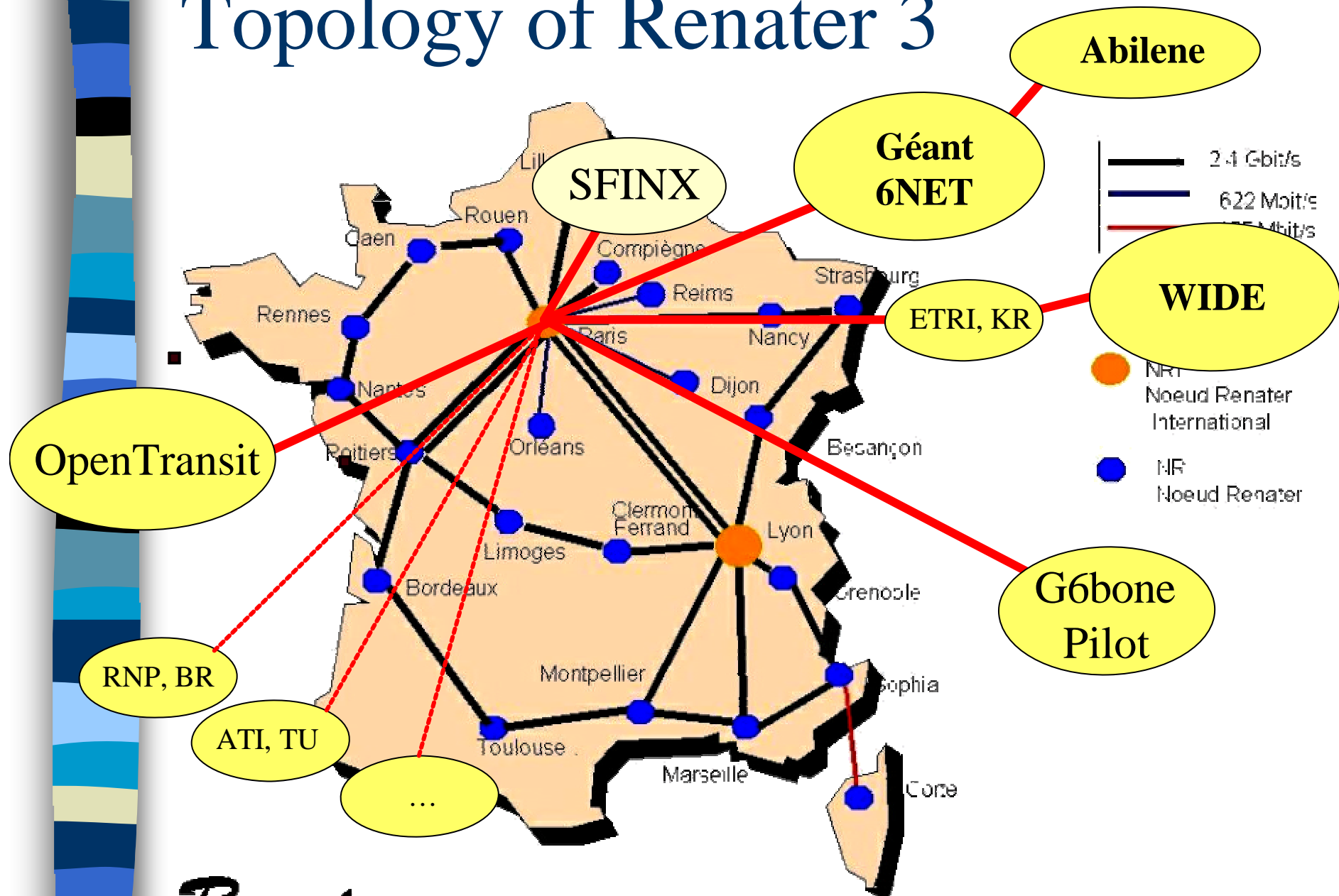
And now Renater-3 ...

- Why a production-like IPv6 service ?
- ATM removed ...
  - Move all network services on a unique topology
- Need of IPv6 transport
  - Research projects using IPv6
  - Sites with native IPv6 network
  - →install a native IPv6 core
  - →run both versions of IP the same way
- Manage the IPv6 service with the same operational quality as for IPv4

# Topology of Renater 3



# Topology of Renater 3



*Renater*

Paris, 27 juin 2002

RENATER-3

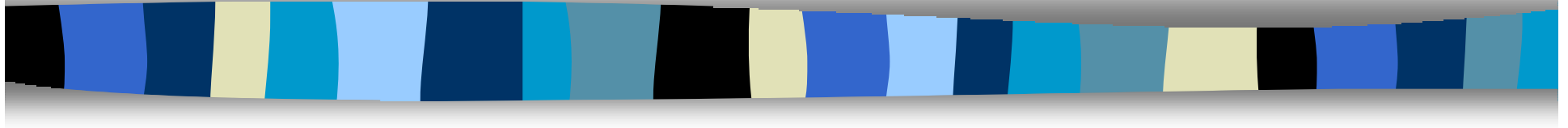
10/12



# Renater 3: Native support

- 2.5 Gbits/s backbone
- 30 Regional Nodes (NR)
- Native support on all regional nodes
  - Dual stack backbone → IPv4 and IPv6
- Global IP Service
  - IPv4 unicast and multicast
  - IPv6 unicast
  - IPv6 and IPv4 carried without any distinction
- Experimental IPv6 multicast network
- Goal : achieve an equal level of
  - Performance
  - Availability
  - Management
  - Support

# The M6Bone





## What is M6Bone ?

- An IPv6 Multicast test network
- M6Bone started in July 2001 (Aristote association, G6 and Renater)
- 55 sites are connected today

## Goals

- To offer IPv6 Multicast connectivity to interested sites
- Test and develop soft and equipments related to IPv6 Multicast technologies
- To deploy an advanced service on IPv6, in order to participate in the promotion of the protocol

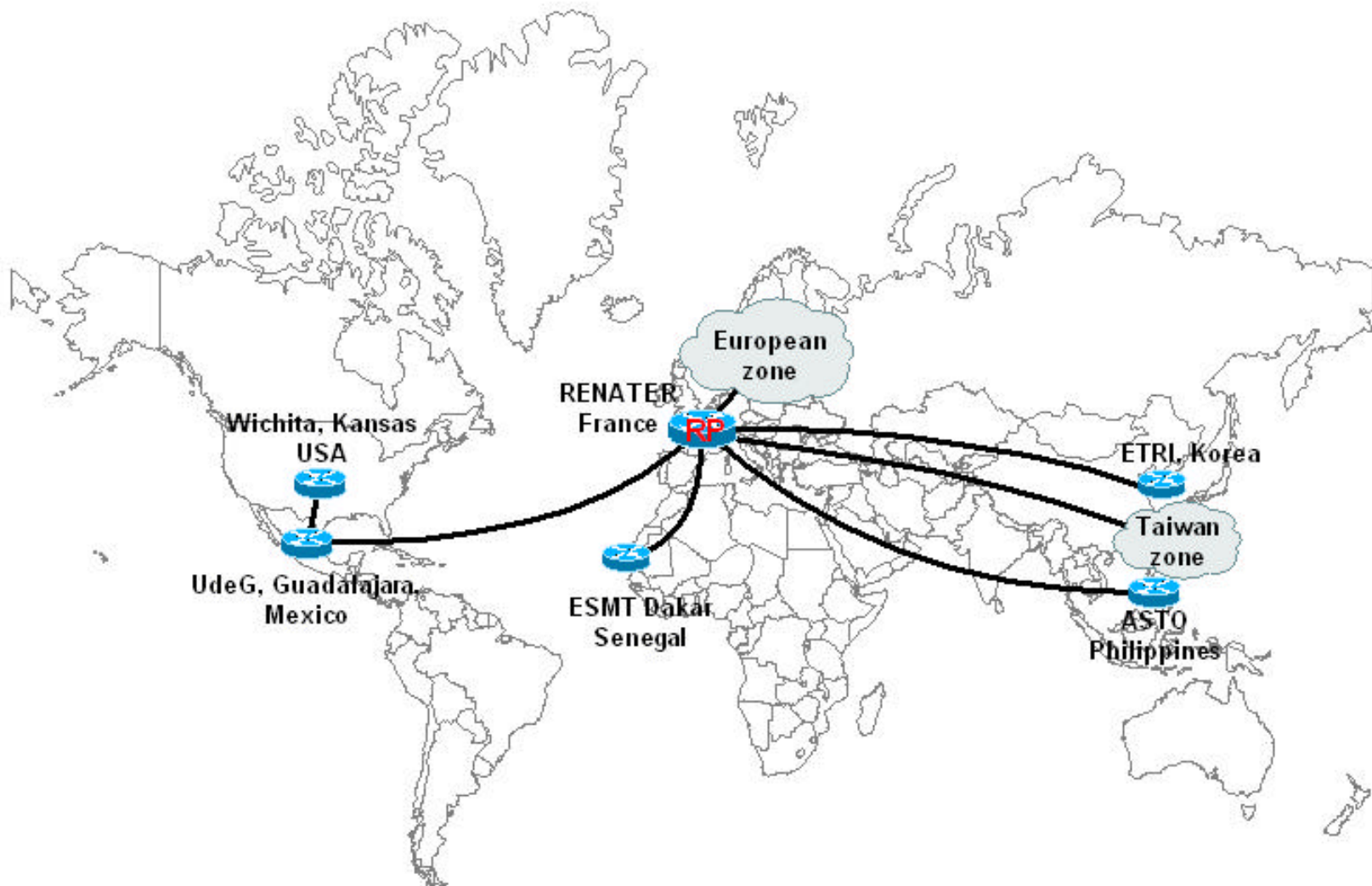
# Waiting for technology...



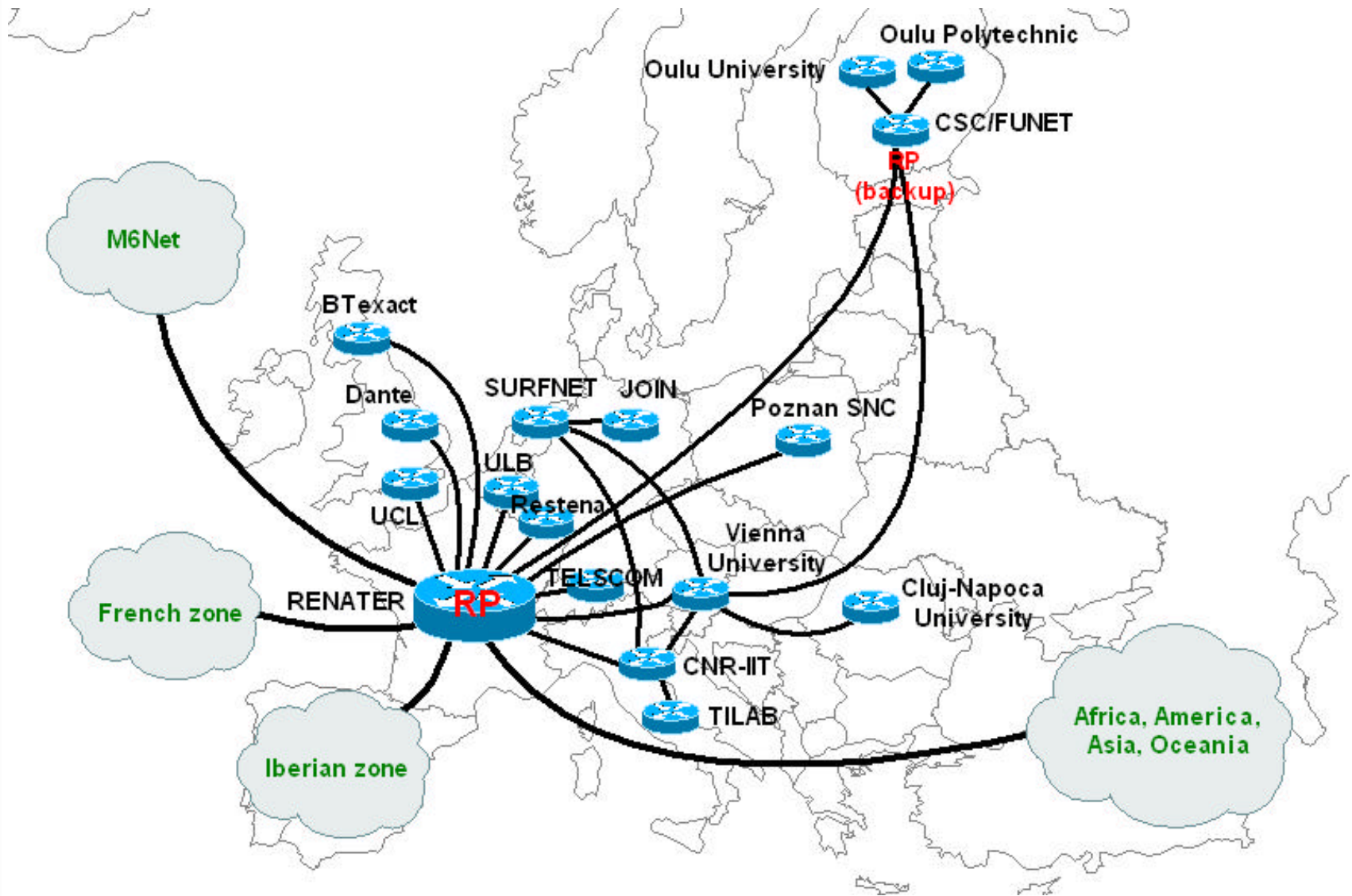
The initial deployment



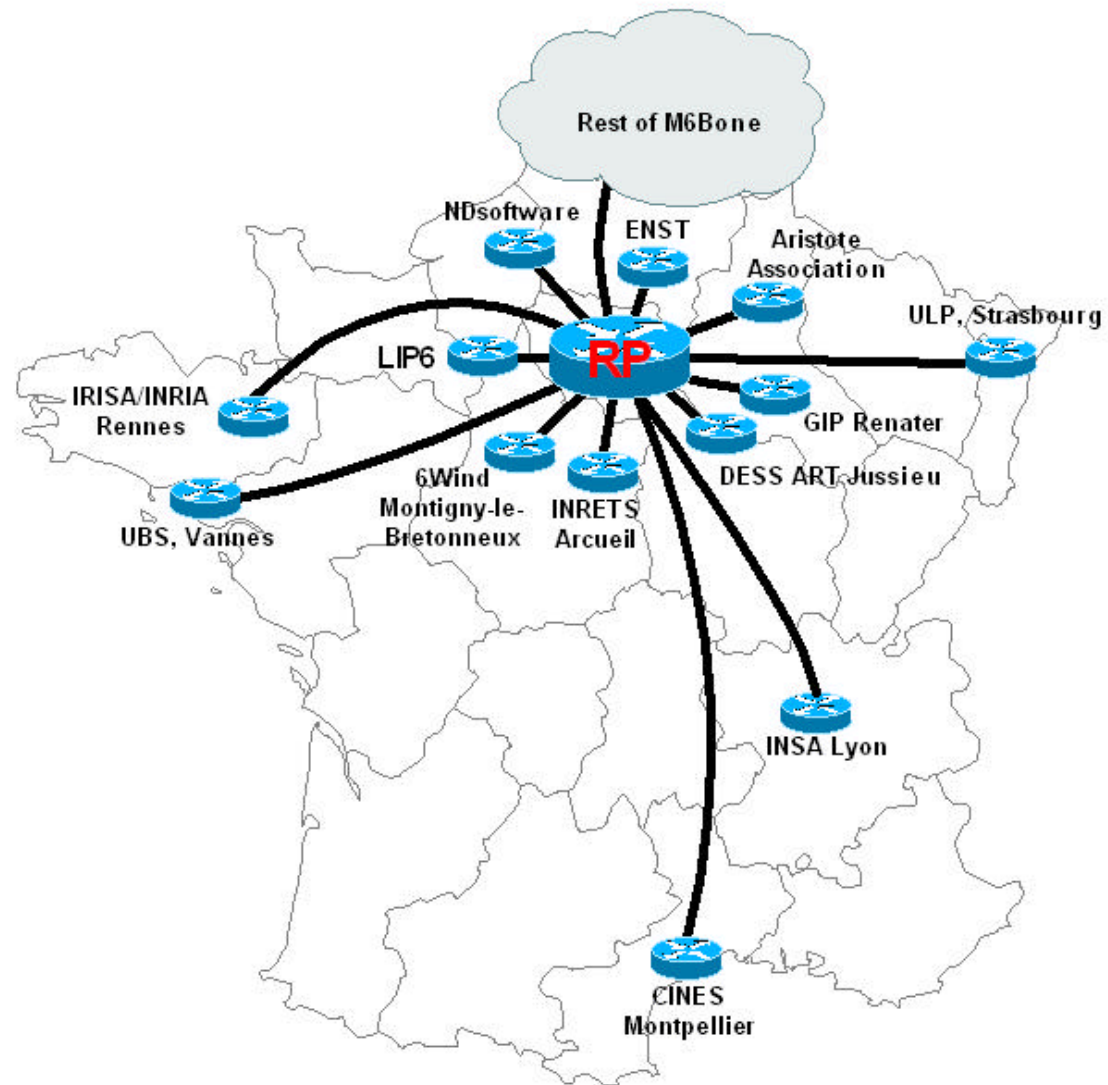
# M6Bone topology (International sites)



# M6Bone topology (European sites)



# M6Bone (French sites)





## The M6Bone dilemma

- Few routers implemented IPv6 multicast routing
  - >> Need to have different topologies for unicast and multicast
- IPv6 multicast specific routing table (MRIB) was not implemented
  - >> Need to have same topology for unicast and multicast



## The solution of the M6Bone

- Different routers for IPv6 unicast and IPv6 multicast
- IPv6 multicast routers connected together using tunnels
- PIM-SM on all the IPv6 multicast routers
- Global RP (ff00::/8) in Renater

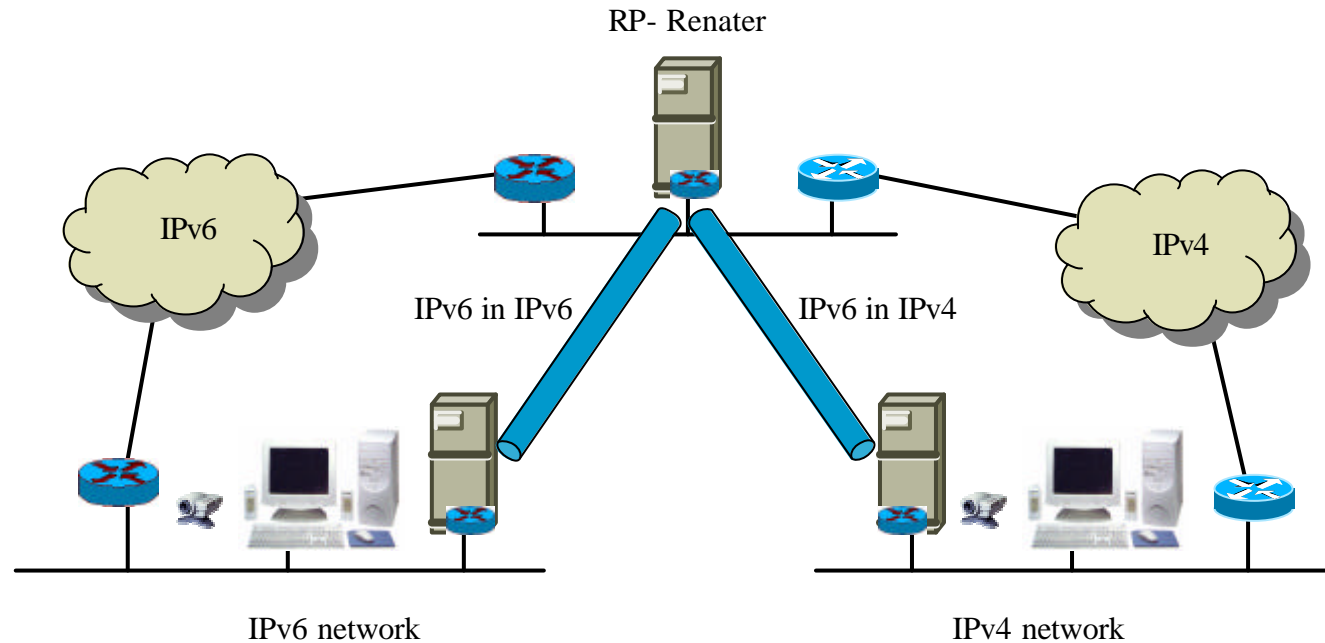
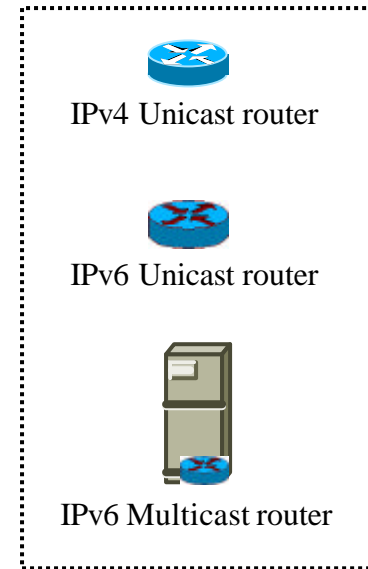


## The solution of the M6Bone

- RIPng between all the IPv6 multicast routers
  - >> each site announces its prefix
- No IPv6 multicast interdomain protocol is implemented
  - >> Only one PIM domain
  - >> RP information learnt with BSR

# IPv6 Multicast connection

- Connection by tunnels
  - IPv6 in IPv6
  - IPv6 in IPv4
- Rendezvous Point (RP): Renater





## Used equipments

- Routers:
  - Mainly BSD + Kame stack
  - Few 6WIND and CISCO routers
- Workstations : more or less every workstation with IPv6 stack

## Used protocols

- PIM SM : Pim Sparse Mode (RFC 2362)
- MLDv1 : Multicast Listener Discovery (RFC 2710)





## Steps to connect

1. Setup an IPv6 multicast router
2. Connect to an M6Bone site using tunnel  
IPv6 in IPv6  
IPv6 in IPv4
3. Run PIM Sparse Mode  
BSR  
Static configuration
4. Run RIPng  
announce your prefix  
Receive M6Bone prefixes

# And then came implementations



The new deployment



# End of M6Bone dilemma

- MRIB implemented

- Static multicast routes
- MBGP (IPv6 multicast SAFI)

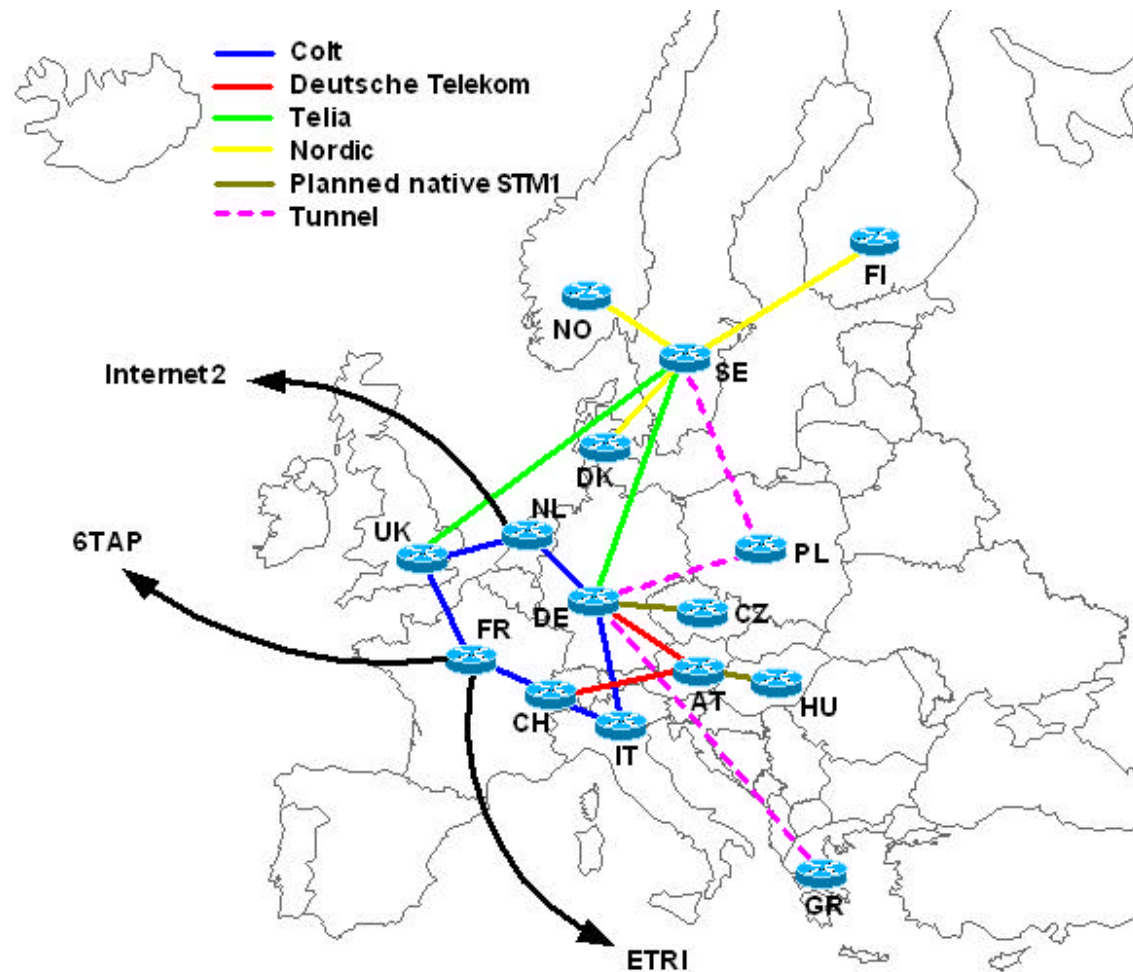
- Equipments

- CISCO
- JUNIPER
- 6WIND

>> Equipments can now be used for both IPv6 multicast and unicast

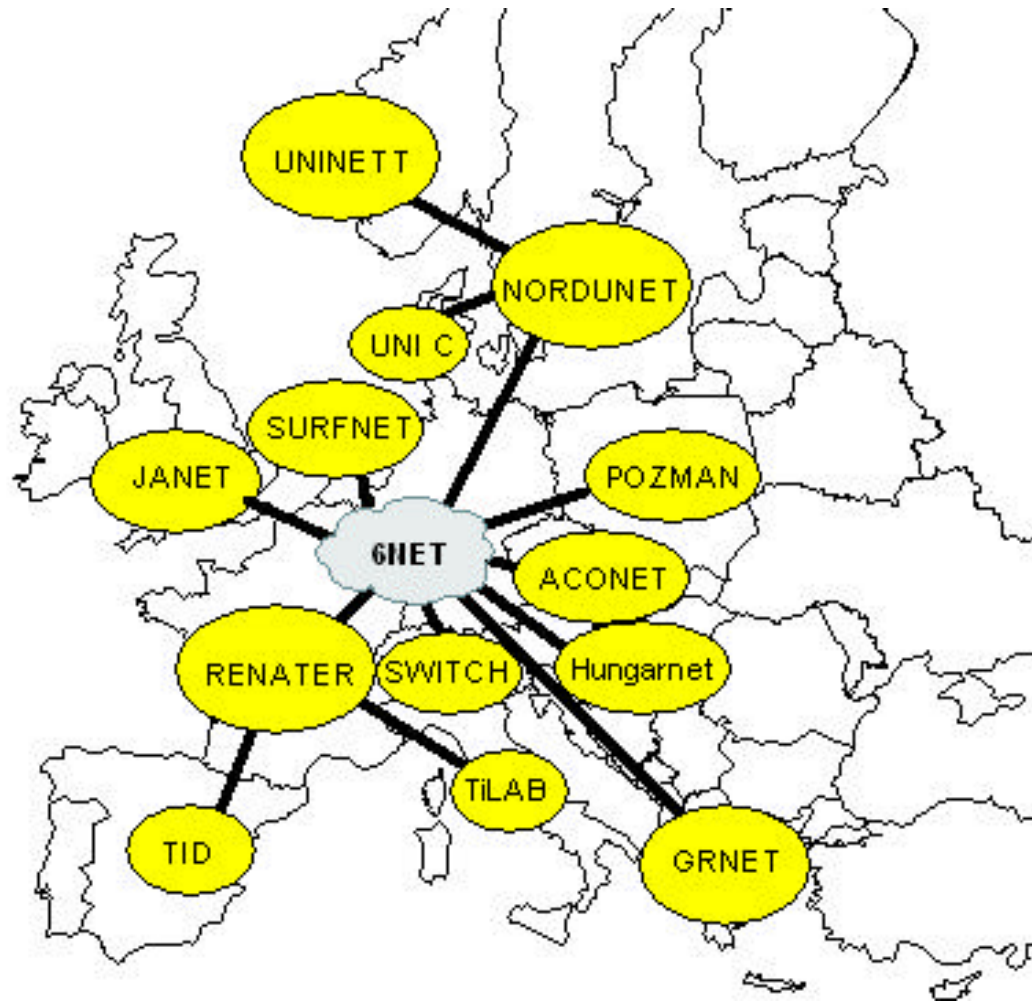
# Deployment status

- 6NET core IPv6 multicast enabled:



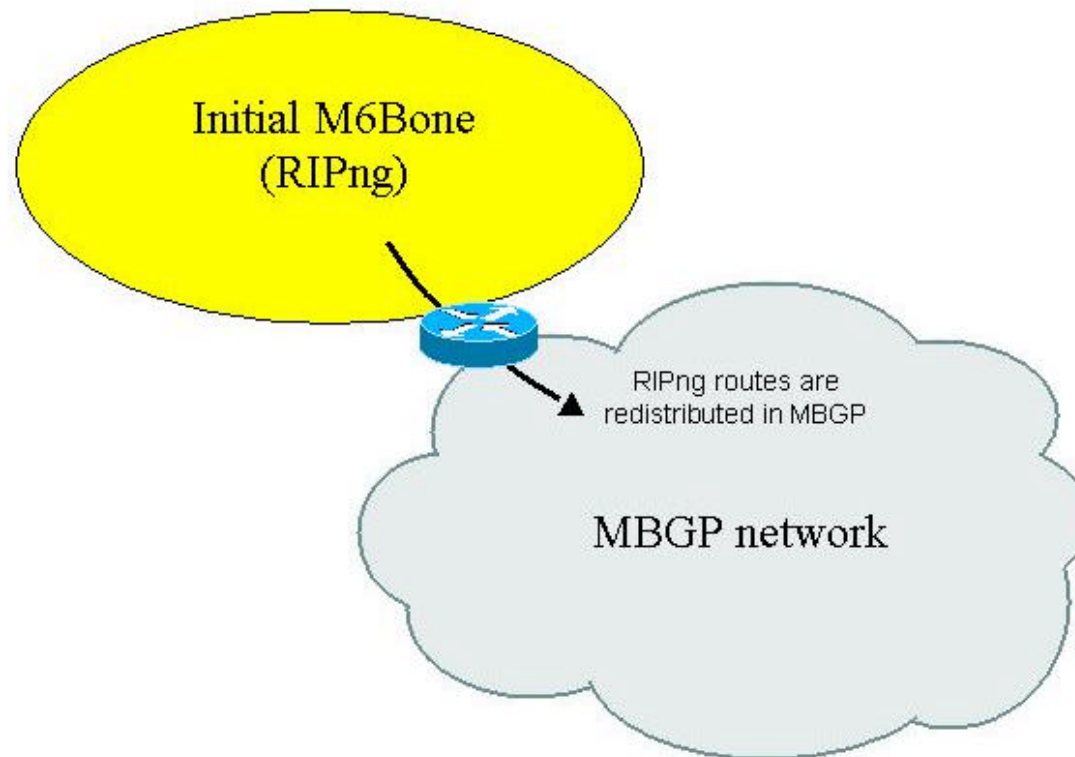
# Deployment status

- MBGP deployment:



# Interconnection with initial M6Bone

- Interconnection done at RENATER





# Interdomain multicast

- No MSDPv6 available
  - Will never be as bottleneck in IPv4 world
- M6Bone is a single PIM domain
  - Works as few sites connected
  - Static RP configuration
  - BSR in some parts of the network
- Hierarchical RPs for the moment
  - Global RP managed by RENATER
  - 6NET RP managed at SURFnet
  - Initial M6Bone RP
  - Site RP in Université de Bretagne Sud
  - ...



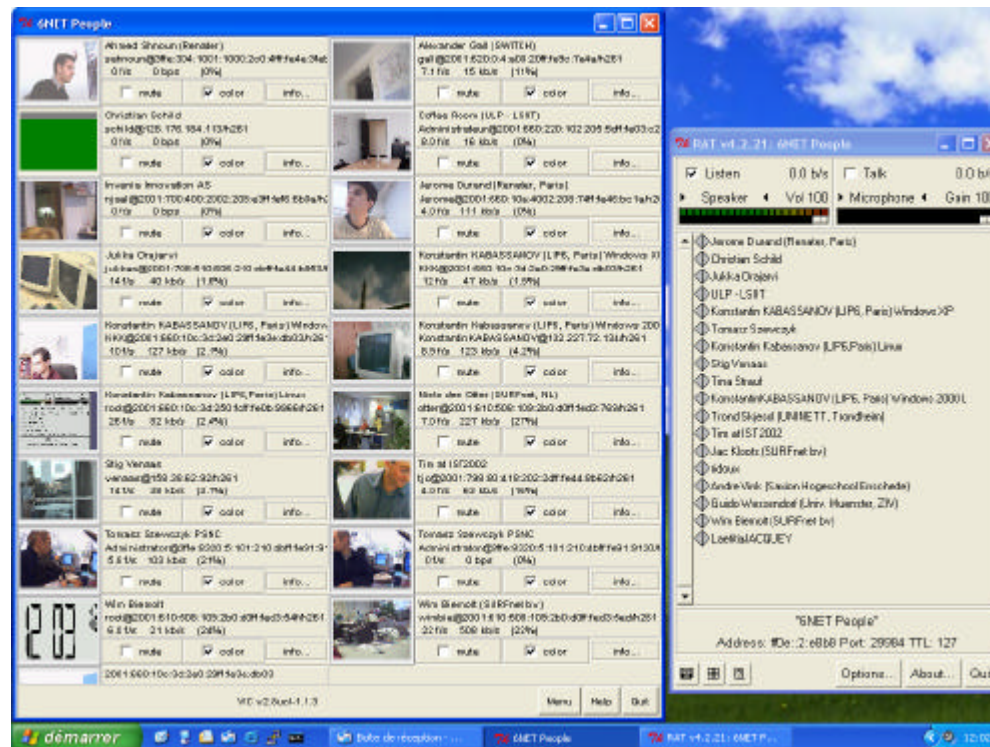
# Interdomain multicast

- Embedded RP for the future
  - I-D under discussion at IETF
  - A new group-to-RP mapping mechanism
  - RP address embedded in IPv6 multicast address
  - FF7X::
- Tests being made within 6NET project framework
- Flattens the model
  - Need to understand consequences for ISPs and clients



# Applications and services

- Videoconferencing : SDR, VIC, RAT...
- Radio broadcast: Freeamp...
- Text exchange : NTE...
- Reflectors:
  - To IPv4 multicast
  - To IPv6 and IPv4 unicast

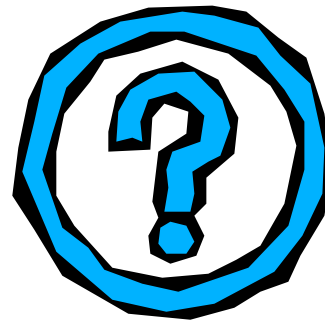




## Contacts

- M6bone-team@renater.fr
- Web-site : <http://www.m6bone.net>
  - Architecture of the network
  - Information about equipment's configuration
  - Subscription form
- Mailing list : m6bone@ml.renater.fr
  - More than 140 active and experienced people ready to help you

# Questions



See you soon on the M6Bone !