IPv6 Addressing case studies

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Contributions

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Contributors

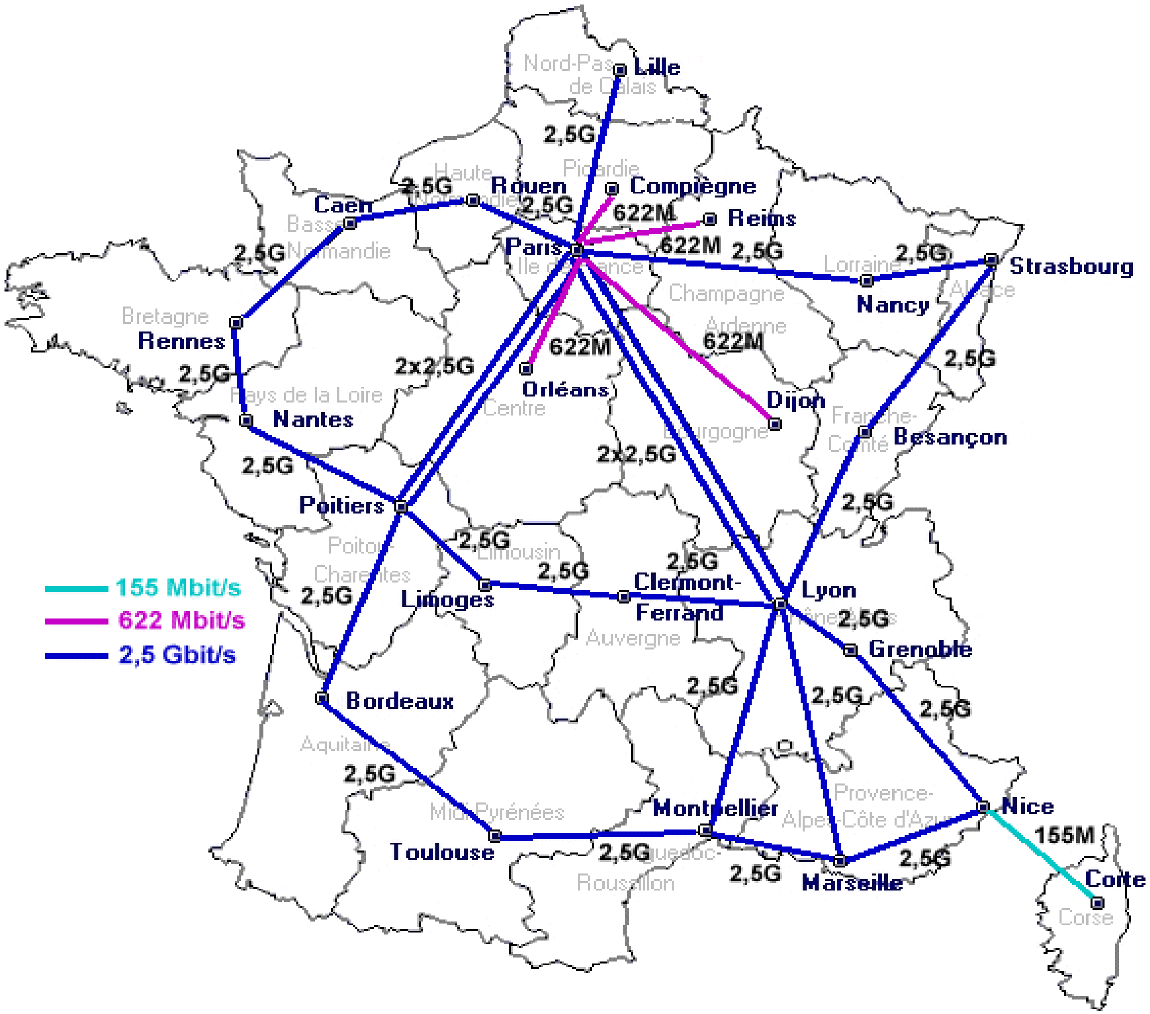
Outline

- Overview of RENATER’s network
- Case study of IPv6 address allocation at RENATER

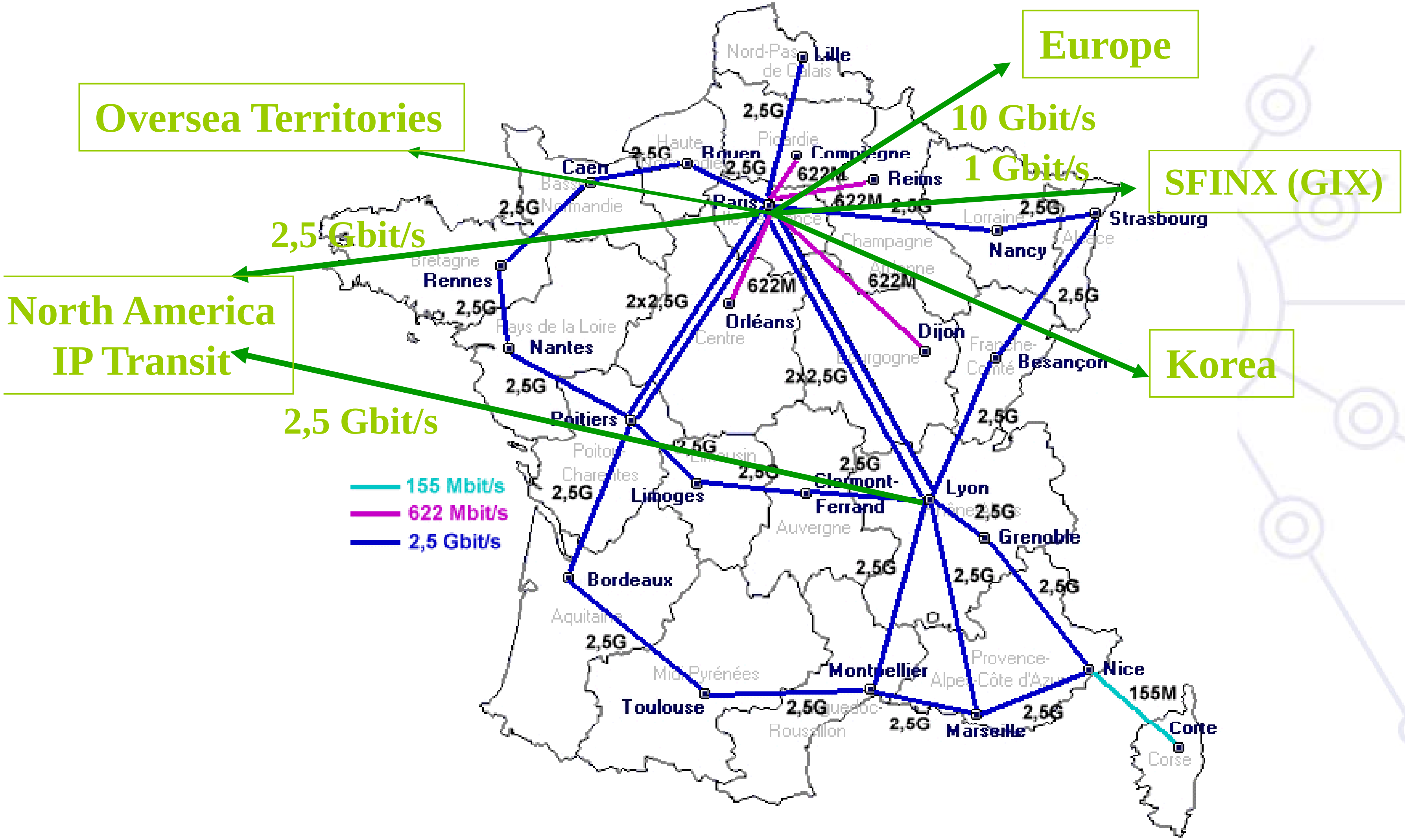
- Overview of NIIF/Hungarnet network
- Case study of IPv6 address allocation at NIIF/Hungarnet

RENATER IPv6 numbering

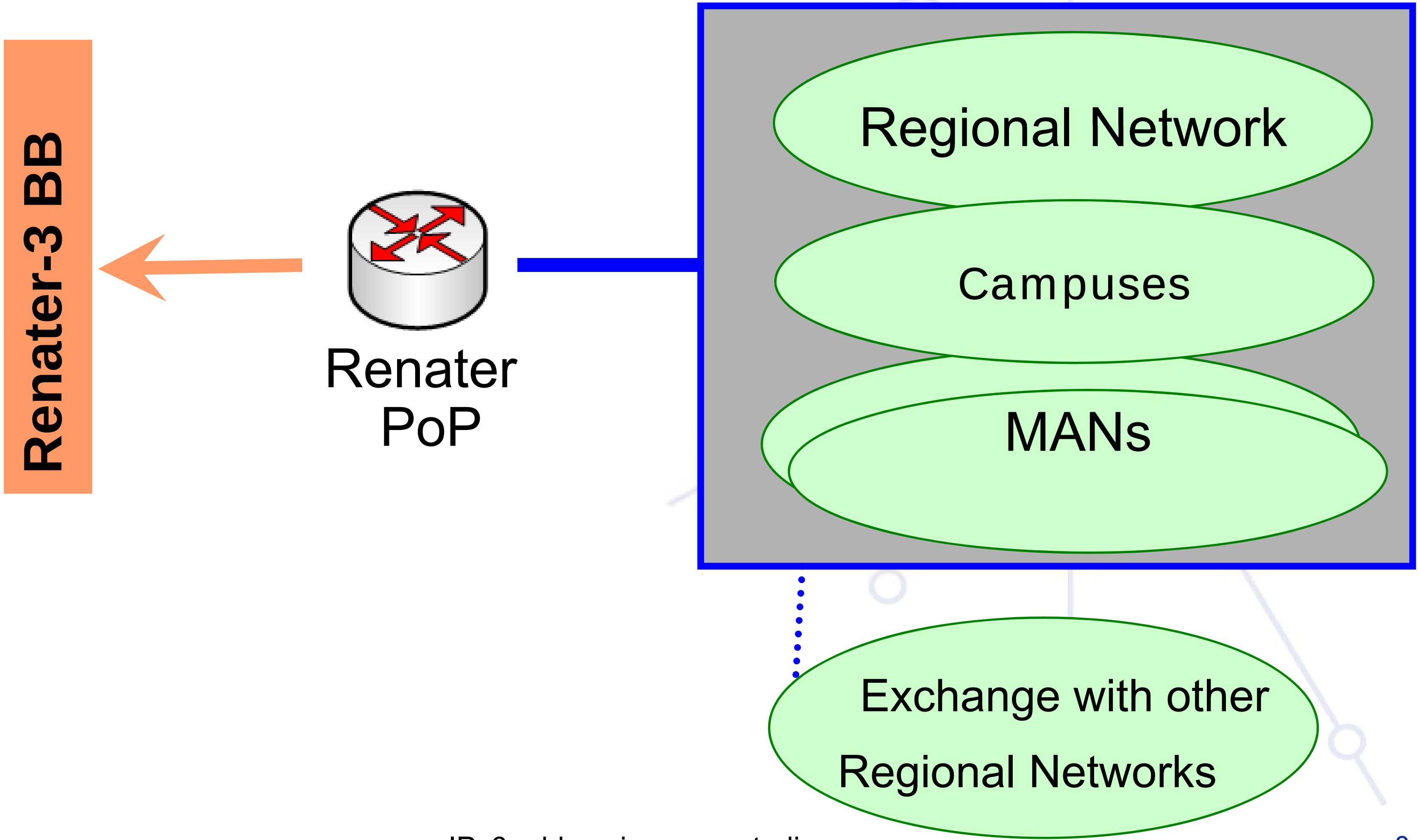
Renater-3: national backbone



Renater-3: international links



Renater-3 Architecture



RENATER's Production IPv6 service

Why a production-like IPv6 service ?

ATM removed ...

- Move all network services on a unique topology
- Do we want to forget about IPv6, IPv4 multicast ... ?

Needs for an IPv6 transport

- Research projects using IPv6
- Sites with native IPv6 network
- → install a native IPv6 core
- → run both versions of IP on the same equipments

Monitor the IPv6 service in the same operational way than IPv4

Renater 3 : IPv6 Native support

2.5 Gbits/s backbone

30 Regional Nodes (NR)

Native IPv6 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

Goal : achieve for both versions of IP an equal level of

- Performance
- Availability
- Management
- Support

Addressing

Hierarchical addressing

Renater

- Prefix = 2001:660::/32
- Allocated by the RIR (RIPE NCC)

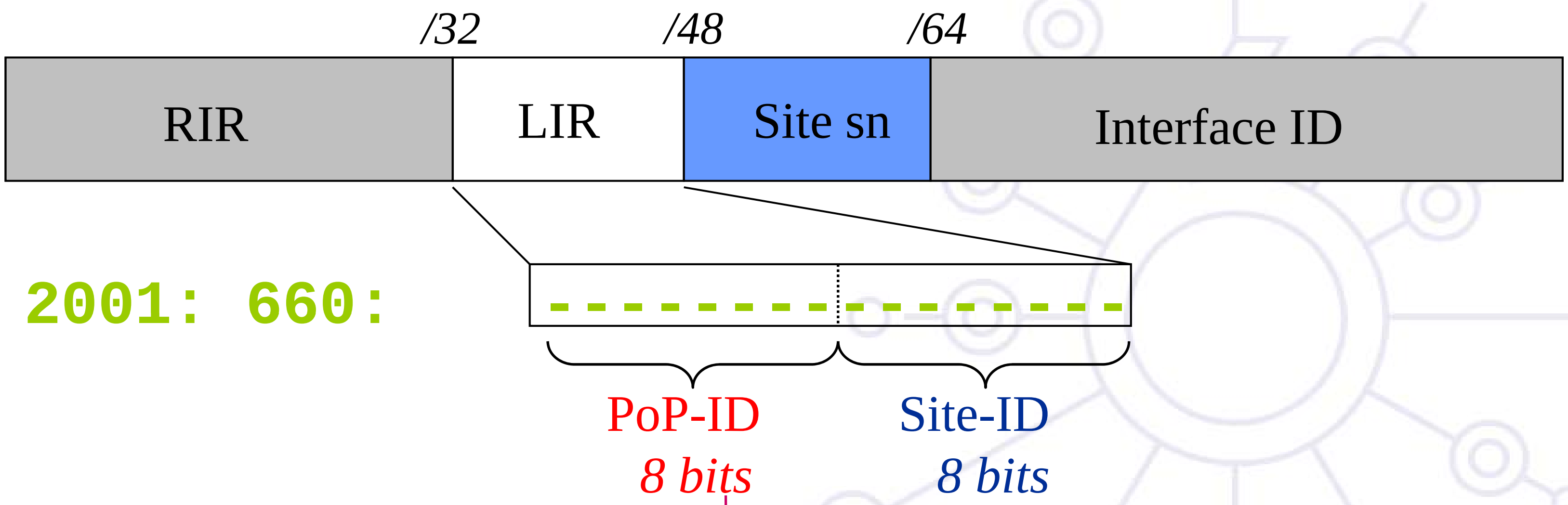
Regional Nodes

- PoP-ID =2001:660:xy::/40

Site

- Site-IDs allocated by Renater (LIR)
- Site-ID : Assign a /48 from RN's prefix (/40)
- 16 bits are reserved for the site topology

Addressing




```
2001:0660:3000:/40     Paris NRI
2001:0660:3300:/40     Paris Jussieu RI
2001:0660:4400:/40     Lille RI
2001:0660:4700:/40     Strasbourg
2001:0660:5400:/40     Marseille RI
(…)
```

```
2001:0660:300x:/48
```

Example

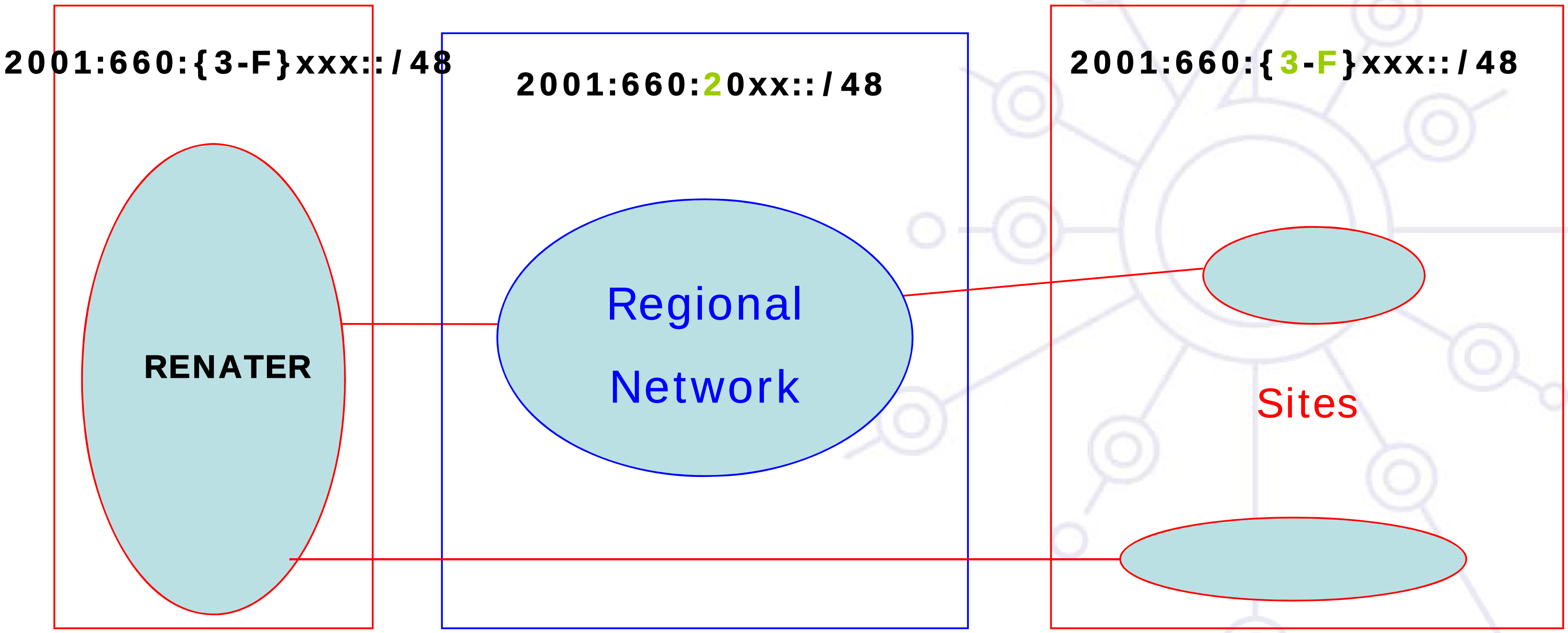
Renater prefix	2001:660::/32
PoP-ID *Strasbourg*	2001:660:4700::/40
Sites connected to *Strasbourg* RI	2001:660:4701::/48 2001:660:4702::/48 …

Regional Network Addressing

Two possibilities

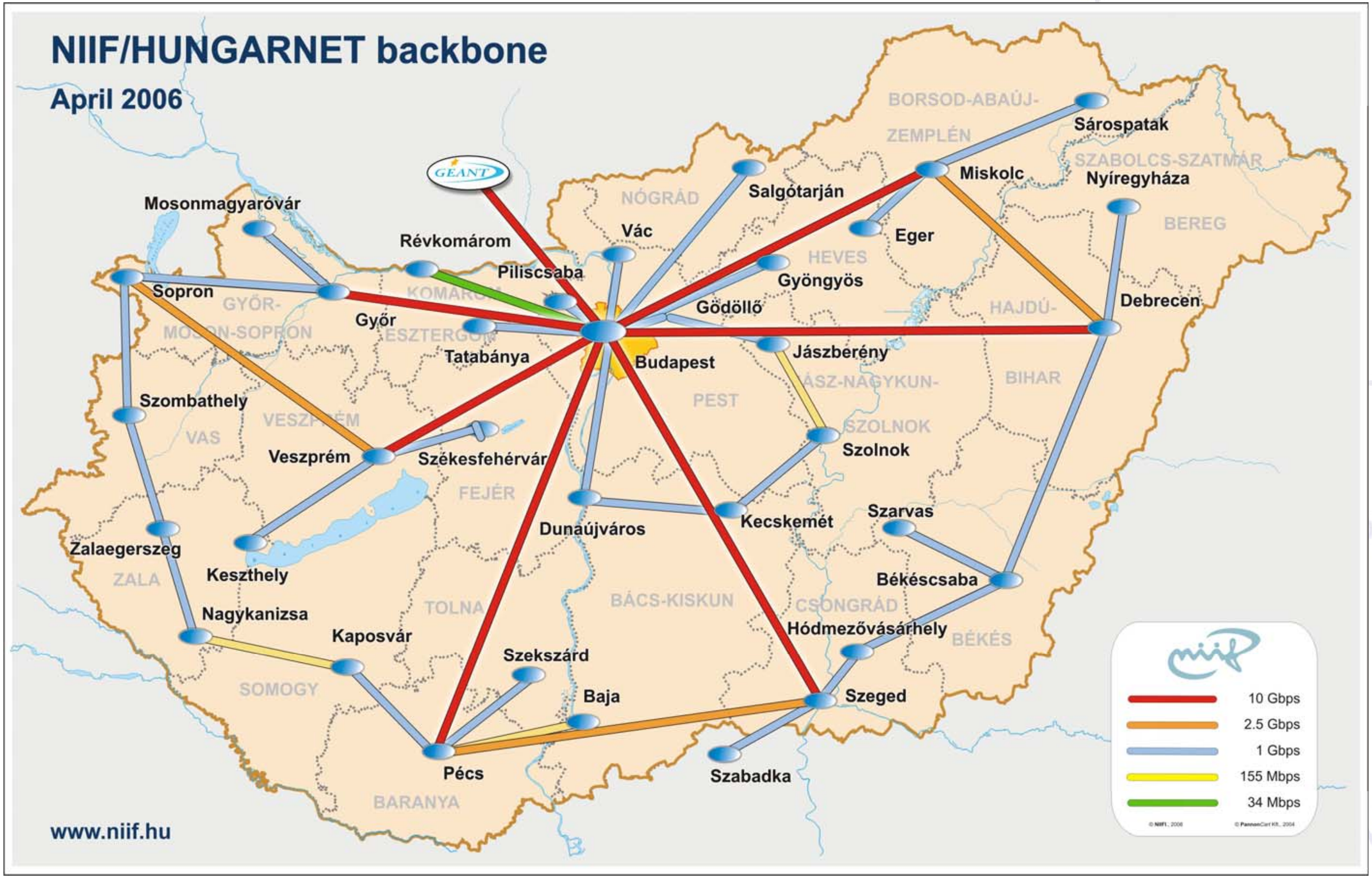
- Uses its own prefix (Commercial ISP)
- Uses Renater's address space
  - 2001:660:2---::/48
- In both cases
  - Sites are addressed in Renater's sTLA
  - 2001:660:{3-F}---::/48
  - Interco Network (site – Regional / MAN)
    - First /64 from the NLA-ID

Addressing scheme



NIFF/HUNGARNET IPv6 numbering

NIIF/HUNGARNET network



IPv6 deployment at NIIF/Hungarnet

Initial IPv6 deployment:

- MPLS based backbone: 6PE with additional dual stack routers + sometimes tunnels at connected institutions

Second phase (2004):

- Router upgrade for HW based IPv6 forwarding
- Used features
  - Routing: IPv4 (unicast, multicast), IPv6 (unicast only), OSPFv2, OSPFv3, BGP, MPLS VPNs
  - Netflow, minimal QoS
  - IPv6 multicast with additional dual stack routers with tunnels

Third phase (2008):

- Software upgrade for IPv6 multicast support
- Netflow v9 support

IPv6 address space – based on flexible address allocation RFC3531

Location	IPv6 PoP addressing:
CNTRL (Central)	2001:0738:0::/36
Gödöllő (Szent István University)	2001:0738:58::/44
BME	2001:0738:2000::/44
KFKI (Research Institute on Physics)	2001:0738:5000::/44
SZEGED (University of Szeged)	2001:0738:7000::/44
MISKOLC (University of Miskolc)	2001:0738:6000::/44
PECS (University of Pécs)	2001:0738:7800::/44

Site addressing

Each site (including site infrastructure) gets /48:

- each NIIF managed site the 16 bit SLA is allocated based on the following convention: <SLA> = Address segmentation within the PoP
- Where for <SLA>:
  - Range: 0000 till 00FF: Loopback addresses
  - Range: 0100 till 01FF: Intra-pop point-to-points (if it necessary to number it)
  - Range: 0200 till 02FF: connections to HUNGARNET member of institution
  - Range: 0300 till 03FF: external IPv6 connectivity (e.g. local IPv6 peering)
  - Range: 0400 till 04FF: PoP Local Ethernets

IPv6 loopback addresses

- Loopback address will also be used for operational and management actions on the equipment, and for routing protocols like iBGP, which will use these addresses for terminating the peering-sessions.
- Loopback addresses have typically a prefix mask of /128. This will avoid unnecessary unused addresses although address conservation is not really an issue in IPv6.

Link IPv6 addresses?

Not necessary!

- OSPFv3 is working with link-local
- IS-IS not necessary

IGP table can be quite small!

- Reduces the convergence time

Customer network is propagated into BGP (even if static routes are used)

- not with redistribute
- with network statement

Drawback:

- Traceroute can pick up arbitrary IPv6 address as a reply source -
- Avoid - configure on each point-to-point links:
  - `ipv6 unnumbered loopback0`

Link IPv6 addresses -other options

/64: based on RFC 3513

- Allows to use EUI-64 addressing
- advisable for point-multipoint and broadcast link scenarios

/112: alignment is on a nice colon boundary

/120: no clashes with top 128 anycast addresses

/126: works

- although the top 128 addresses are reserved for anycast stuff

/127: not a good idea

- the all-zeros address is supposed to be the any router anycast address although this is not widely implemented today (RFC3627)

Customers' Nets Addressing

Two possibilities

- Uses its own prefix (Commercial ISP)
- Uses NIIF/Hungarnet's address space
  - 2001:738:<Customer id>::/48 (/44 pre-allocated, /48 assigned)

Conclusion

Preparing an IPv6 addressing plan is a bit complex

Plan it in advance ...

- Not forgetting your PoPs equipment (loopbacks, admin LANs, interconnects ...)

Draw benefit from aggregation

- Smaller routing tables to manage (even in the core)
- Less prefixes to advertise to BGP peers

Lot of people have an experience yet ...

- Not necessary to reinvent the wheel ;)

Questions ...