Measurements of IPv6 penetration in Hungary

Aspects

- DNS (Name servers of .hu domains)
- Mail services (MX records of .hu domains)
- Web services (Top 500 web servers)
- IPv6 traffic at BIX

DNS

Name servers of .hu domains

Mail

Web

Top 500 web sites (according to Alexa)

BIX

Conclusions

There is a large topological diversity:
many ISPs have implemented IPv6 to some extent

There is much room for improvement
in case of all services

Even where IPv6 is available, diversity and therefore
probably reliability is much less than in case of IPv4

Quality of IPv6 assignment registered in the RIPE
database is much lower than in case of IPv4

Thank You!

János Zsakó
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RIPE 68 Warsaw
IPv6 WG 2014.05.15

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nic.hu

ISZT
Council of Hungarian Internet Providers

Prezi

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Very different measurement results for Hungary

Google
0.23%
https://www.google.com/intl/en/ipv6/statistics.html#tab=per-country-ipv6-adoption

Cisco
18.13%
http://6lab.cisco.com/stats/index.php

APNIC
0.12% flash IPv6 preferred
http://labs.apnic.net/ipv6-measurement/Economies/HU/

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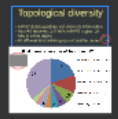
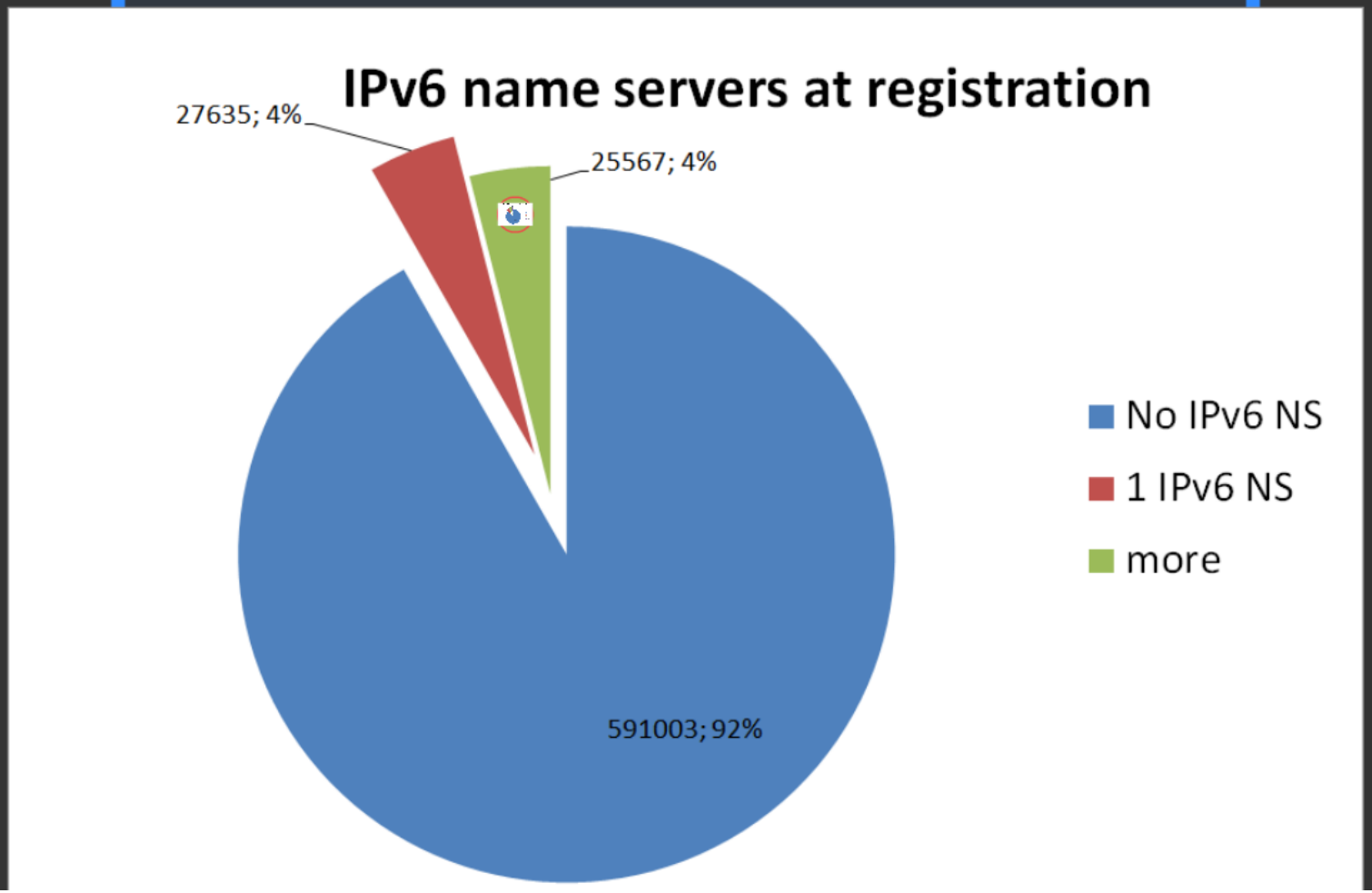
Name servers of .hu domains

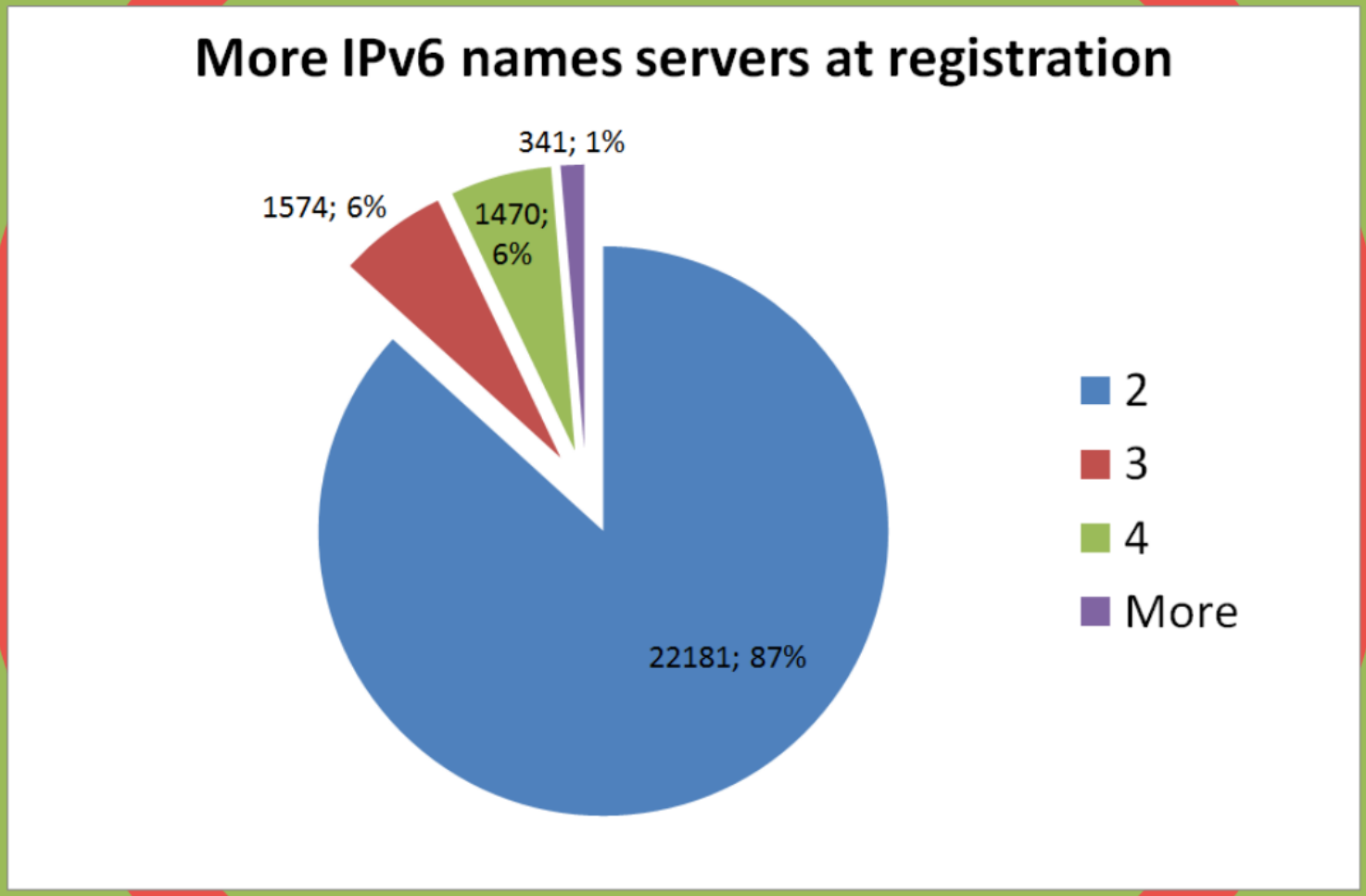



Name servers at delegation

The DNS must be set up properly at registration: at least two name servers




More IPv6 names servers at registration
341; 1%
1574; 6%
1470; 6%
22181; 87%
2
3
4
More

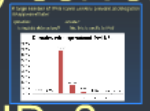
Looks good: 8% of domains had at least one name server with IPv6 address at delegation

Half of these had **several** name servers with IPv6

Operational IPv6 name servers

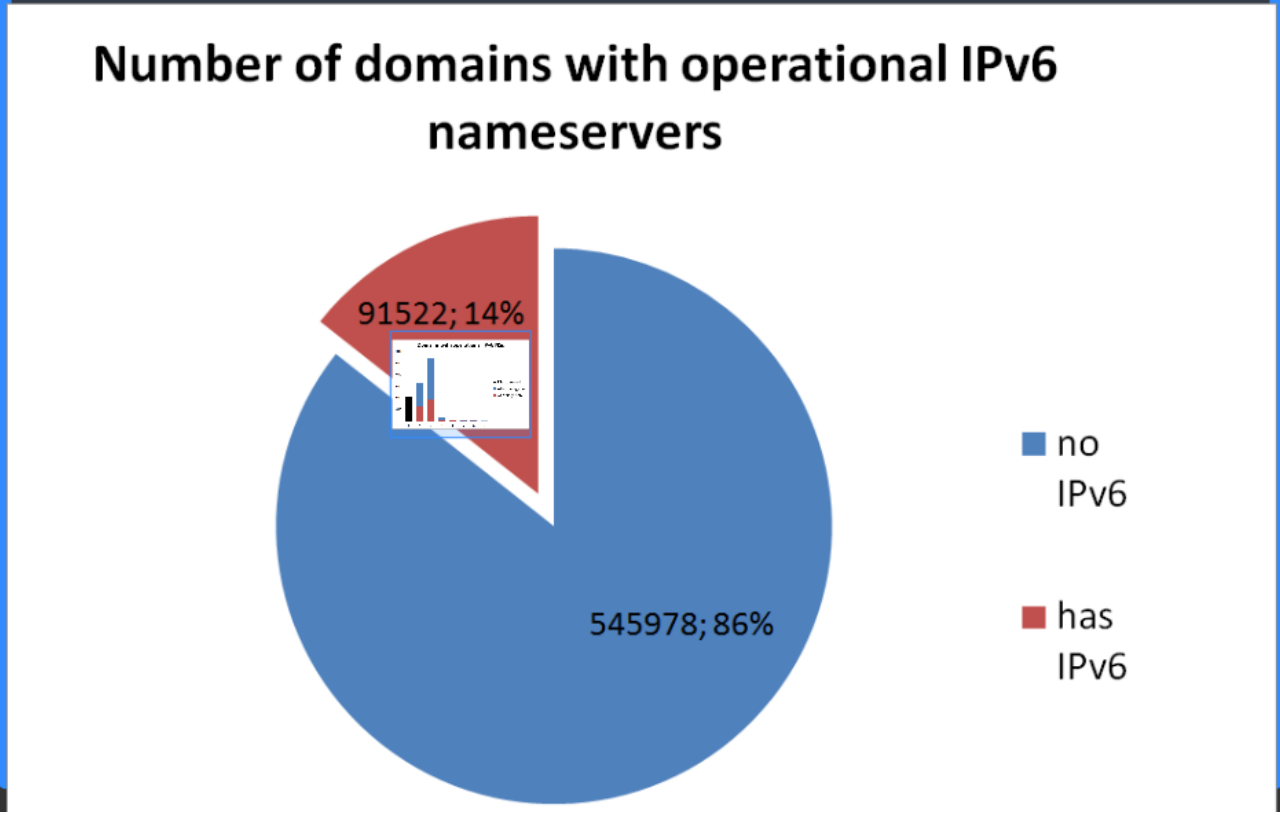
Name server configuration is checked before delegation

Surprise: many servers that **had** an IPv6 address, no longer have

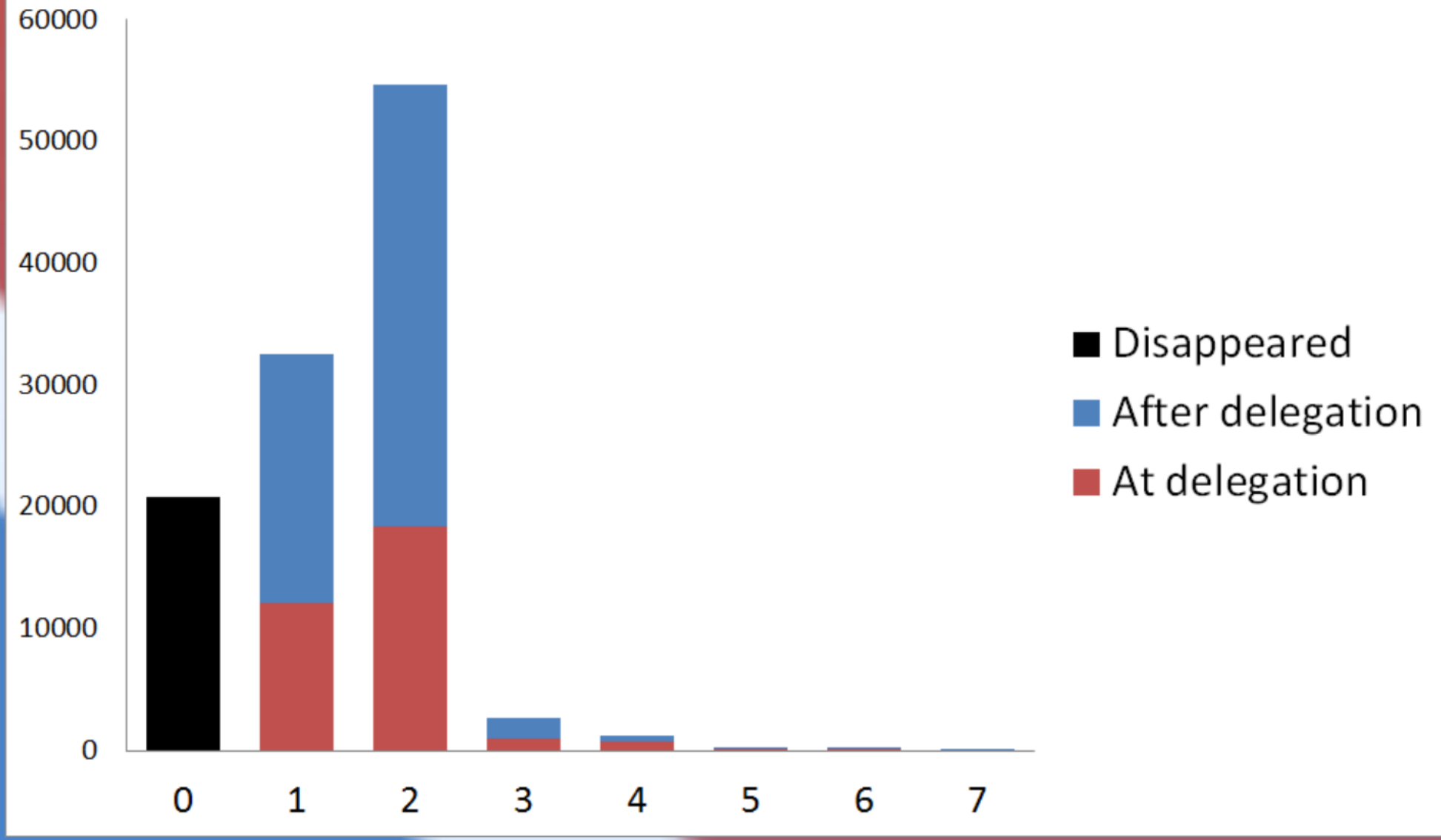


But many had IPv6 enabled at a later time:

14% of .hu domains have a name server with IPv6!



Domains with operational IPv6 NSs



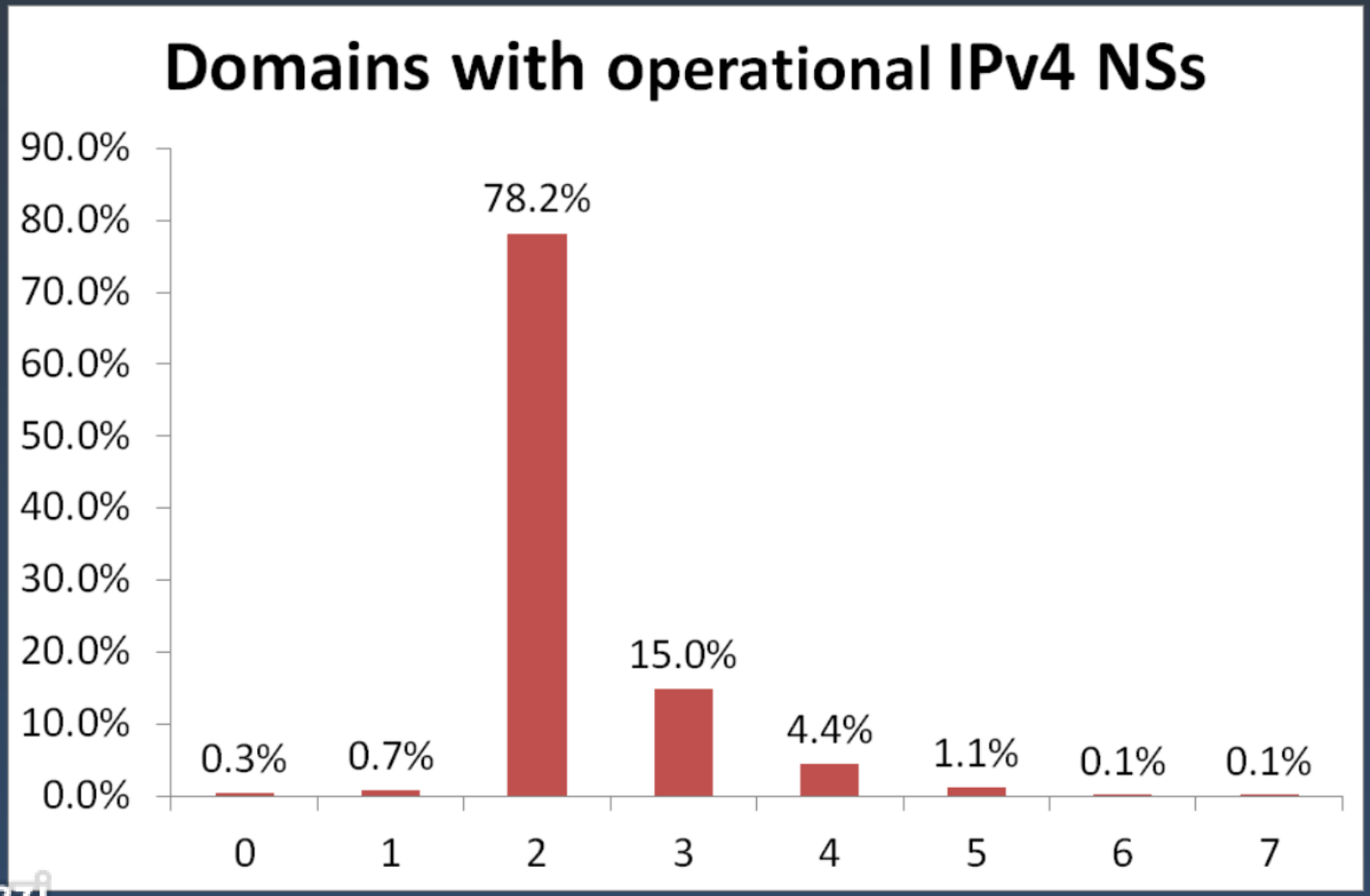
A large number of IPv6 name servers present at delegation disappeared later

Question:

is registry data so bad?

Answer:

No, this is secific to IPv6

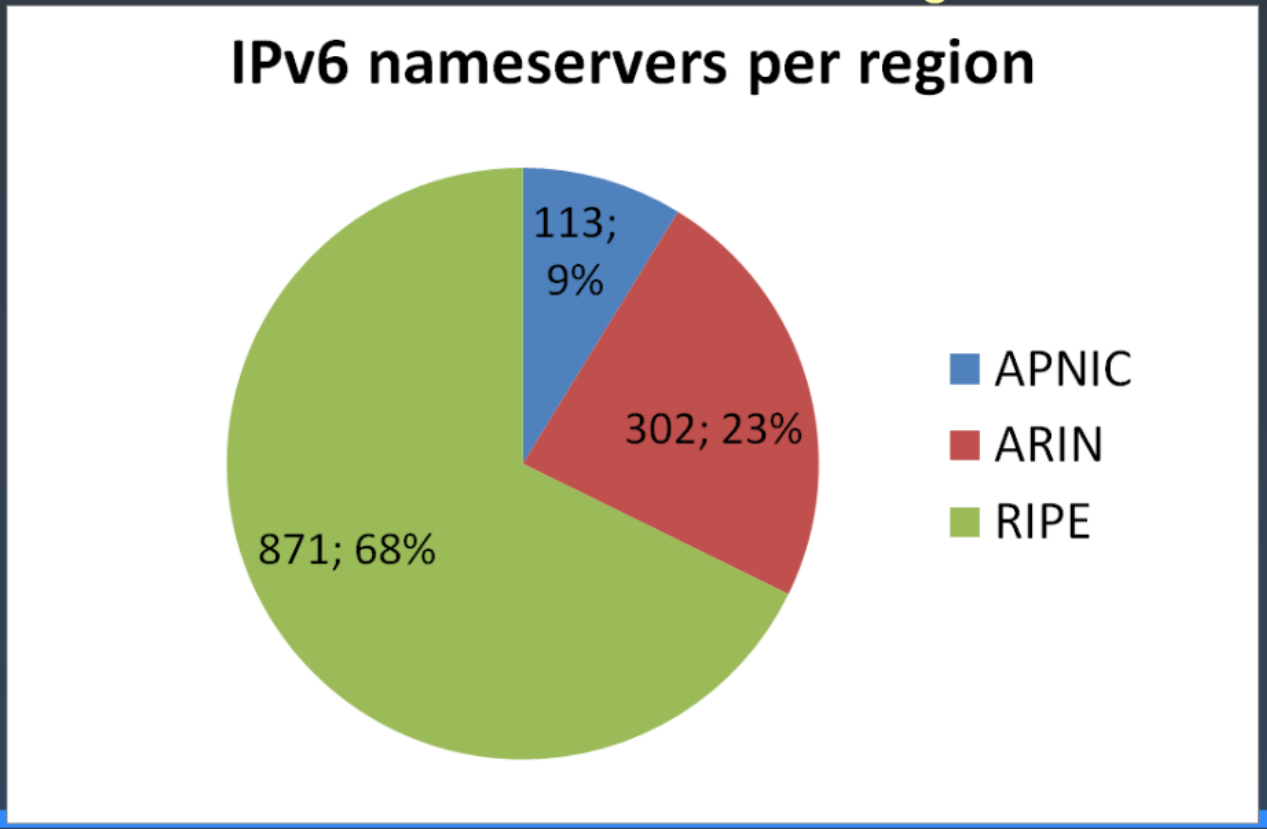


Regional diversity of IPv6 name servers

IPv6 name servers distributed over three regions

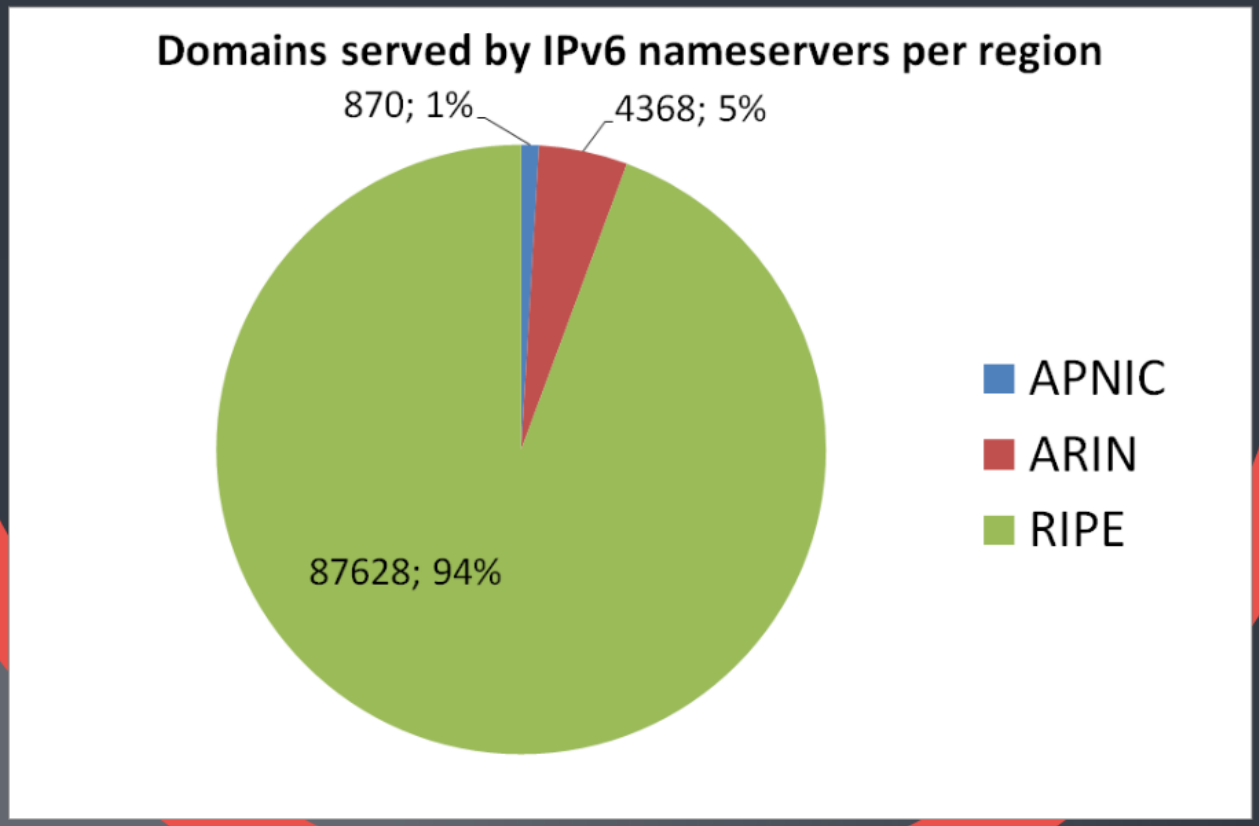
No name servers in LACNIC or AFRINIC region

32% of name servers outside RIPE region



Regional diversity

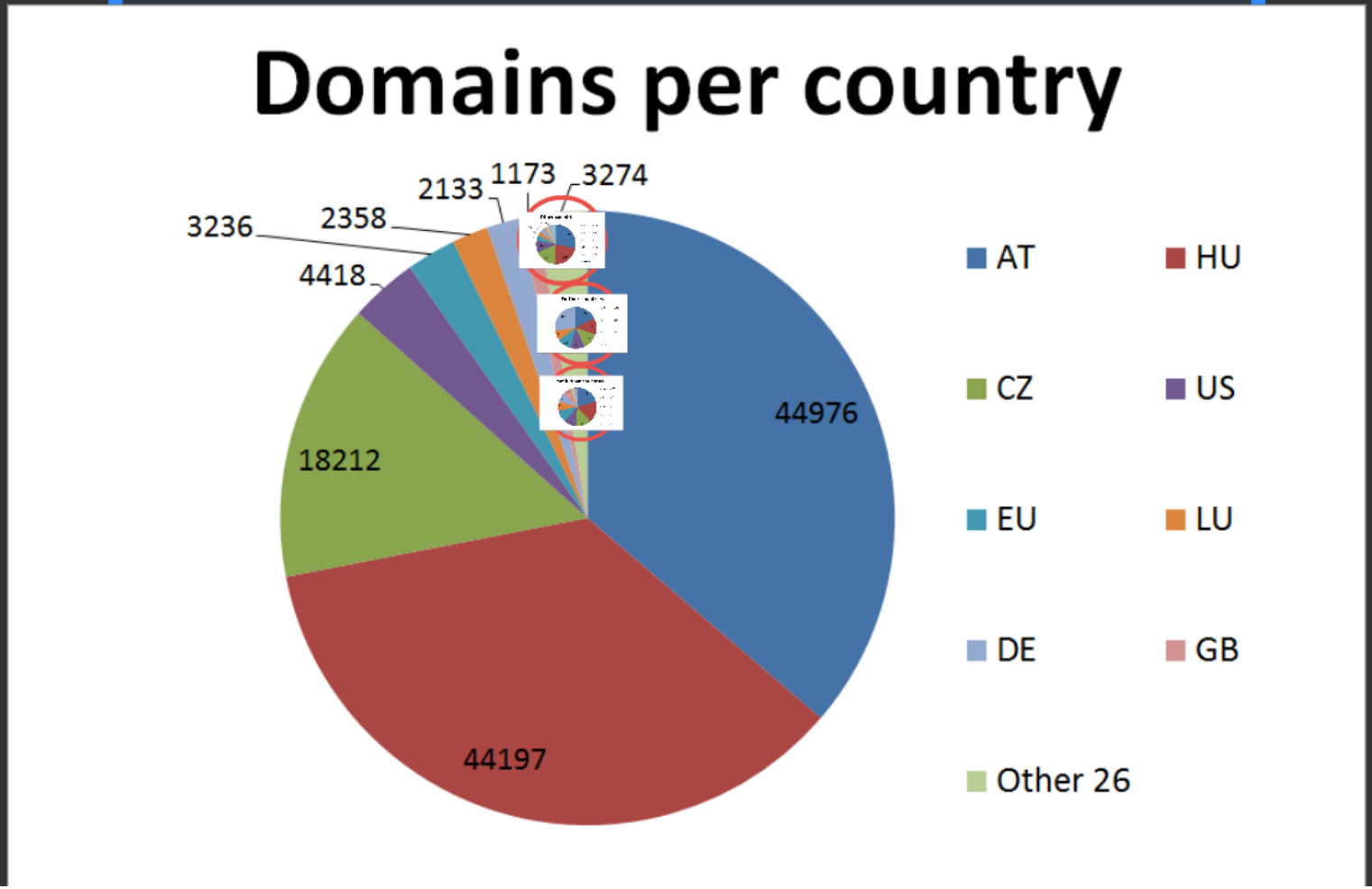
32% of name servers outside RIPE region, however, these serve only 6% of domains with NS reachable over IPv6

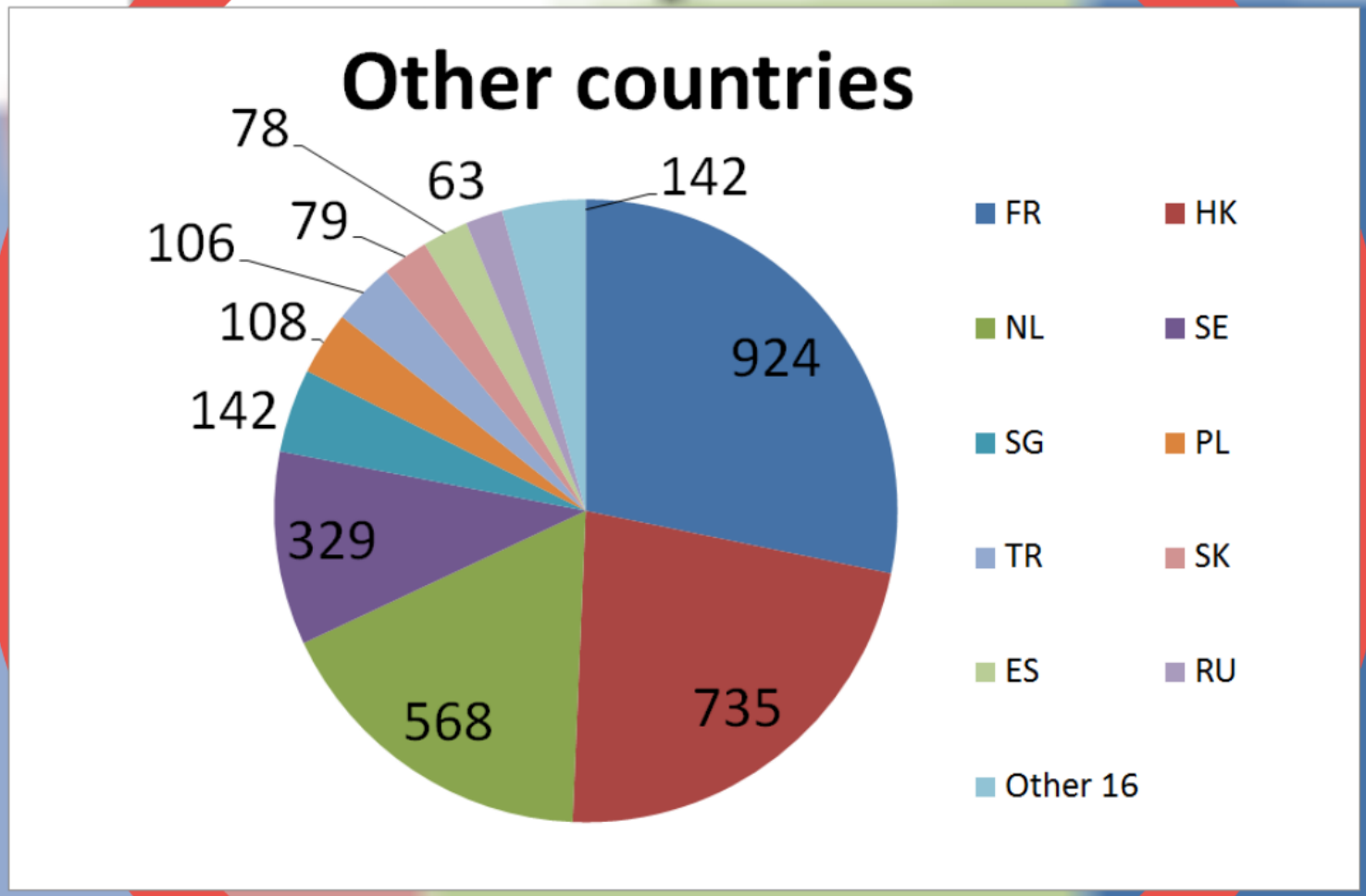


Geographical diversity

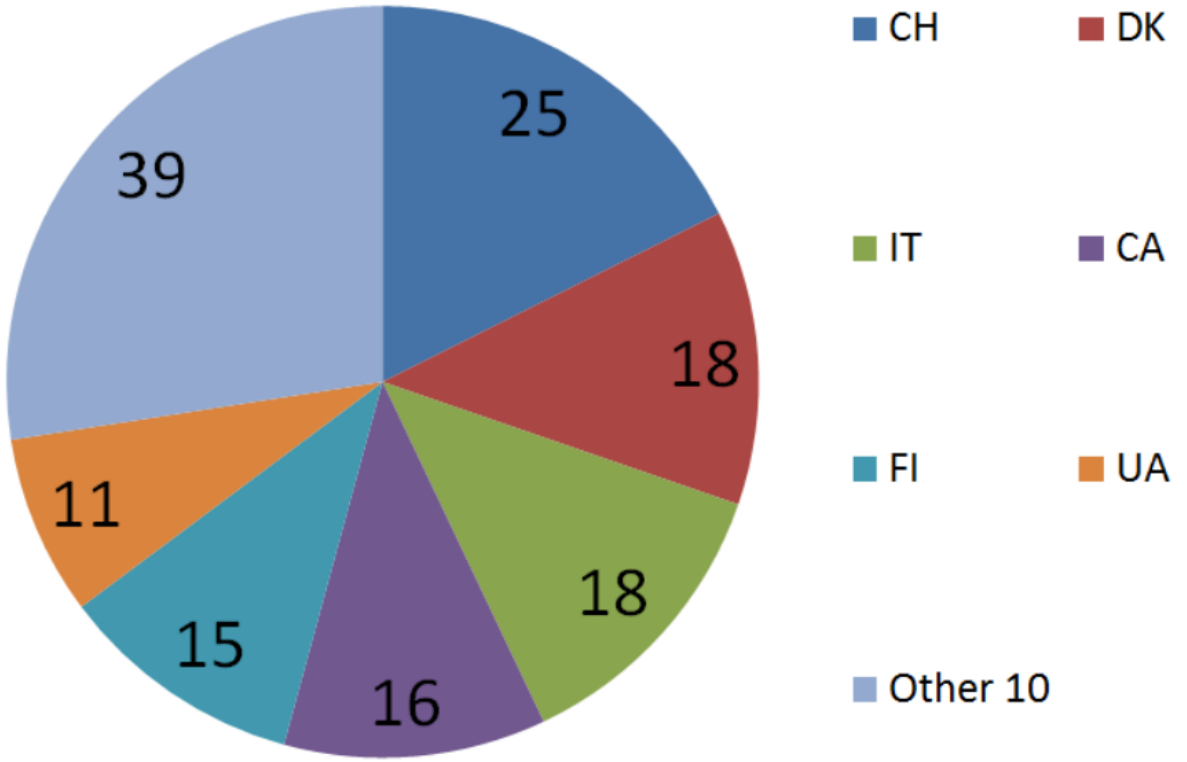
According to RIR databases: NSs from 34 different countries

Top 10 include US and Hong Kong

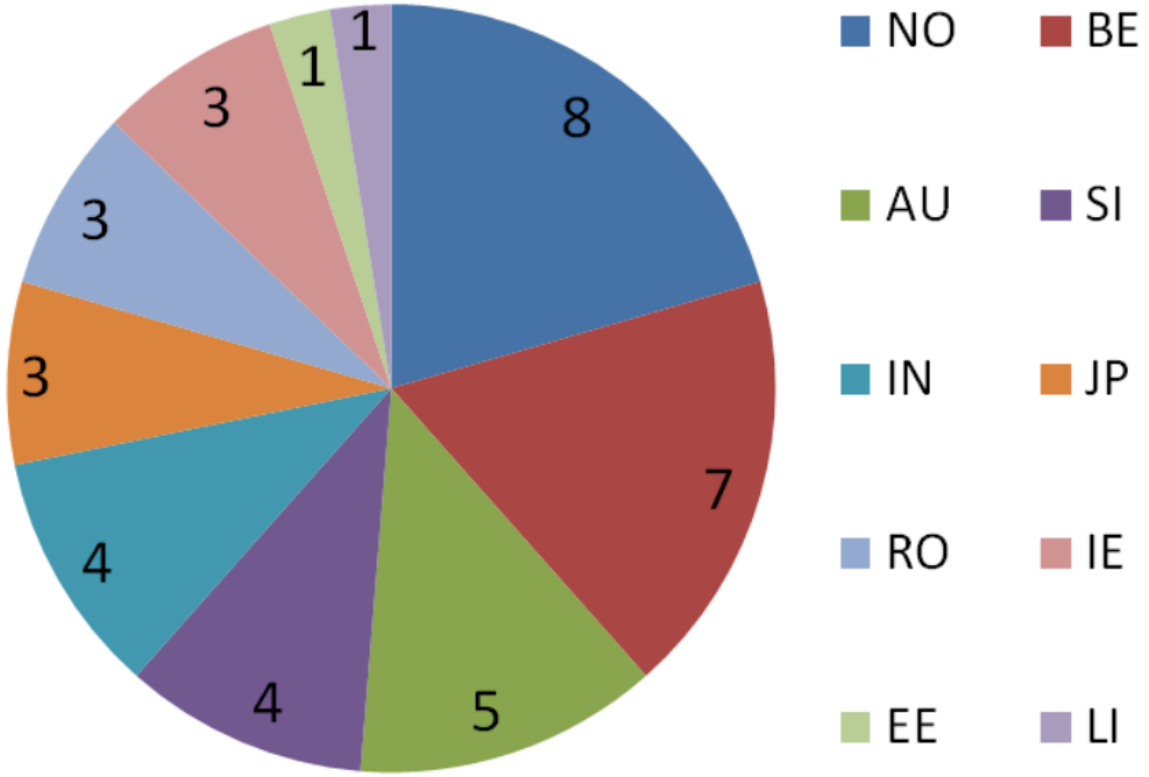



Other countries
78
63
142
79
106
108
142
924
329
568
735
FR
HK
NL
SE
SG
PL
TR
SK
ES
RU
Other 16

Further countries

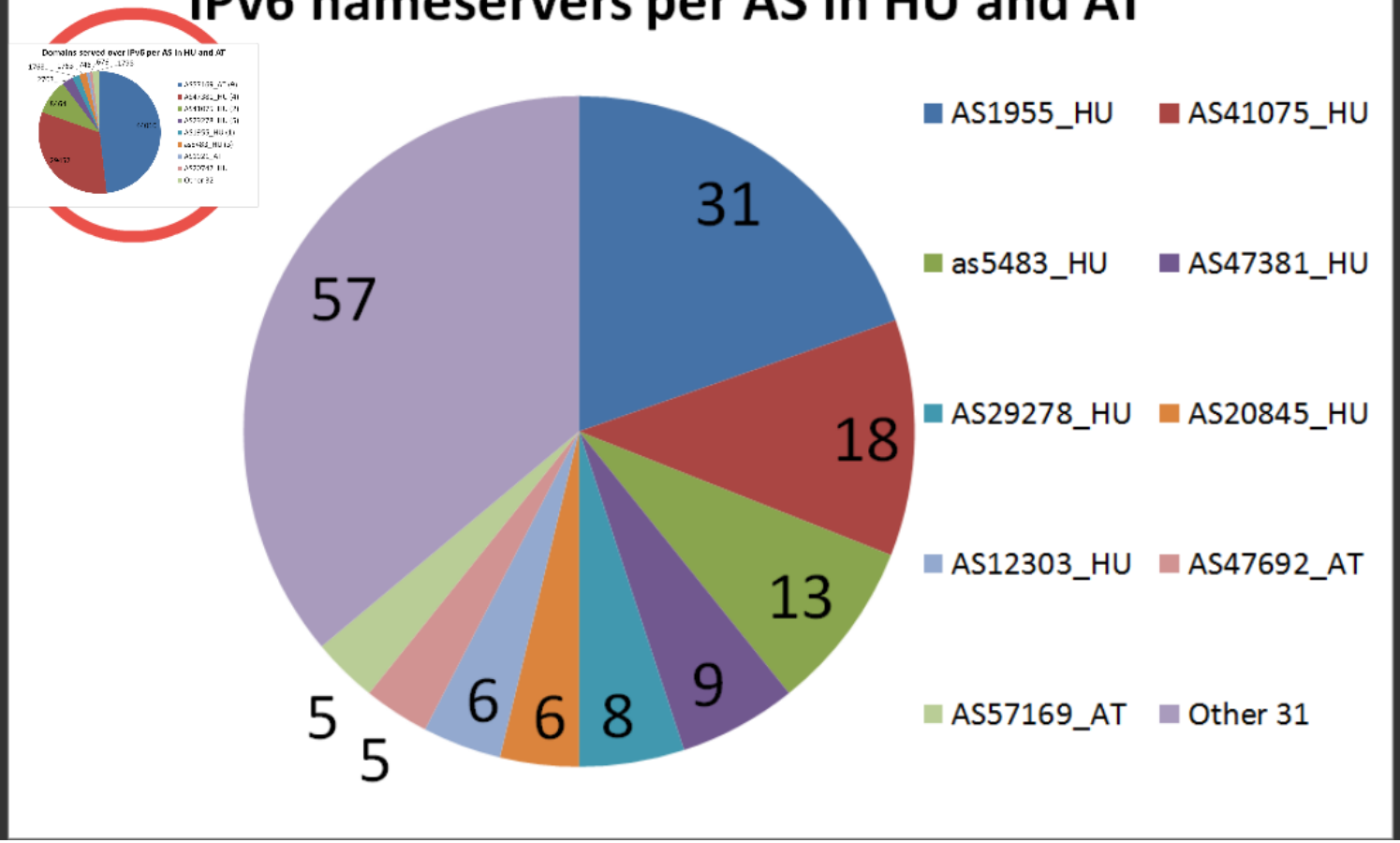


Yet further countries

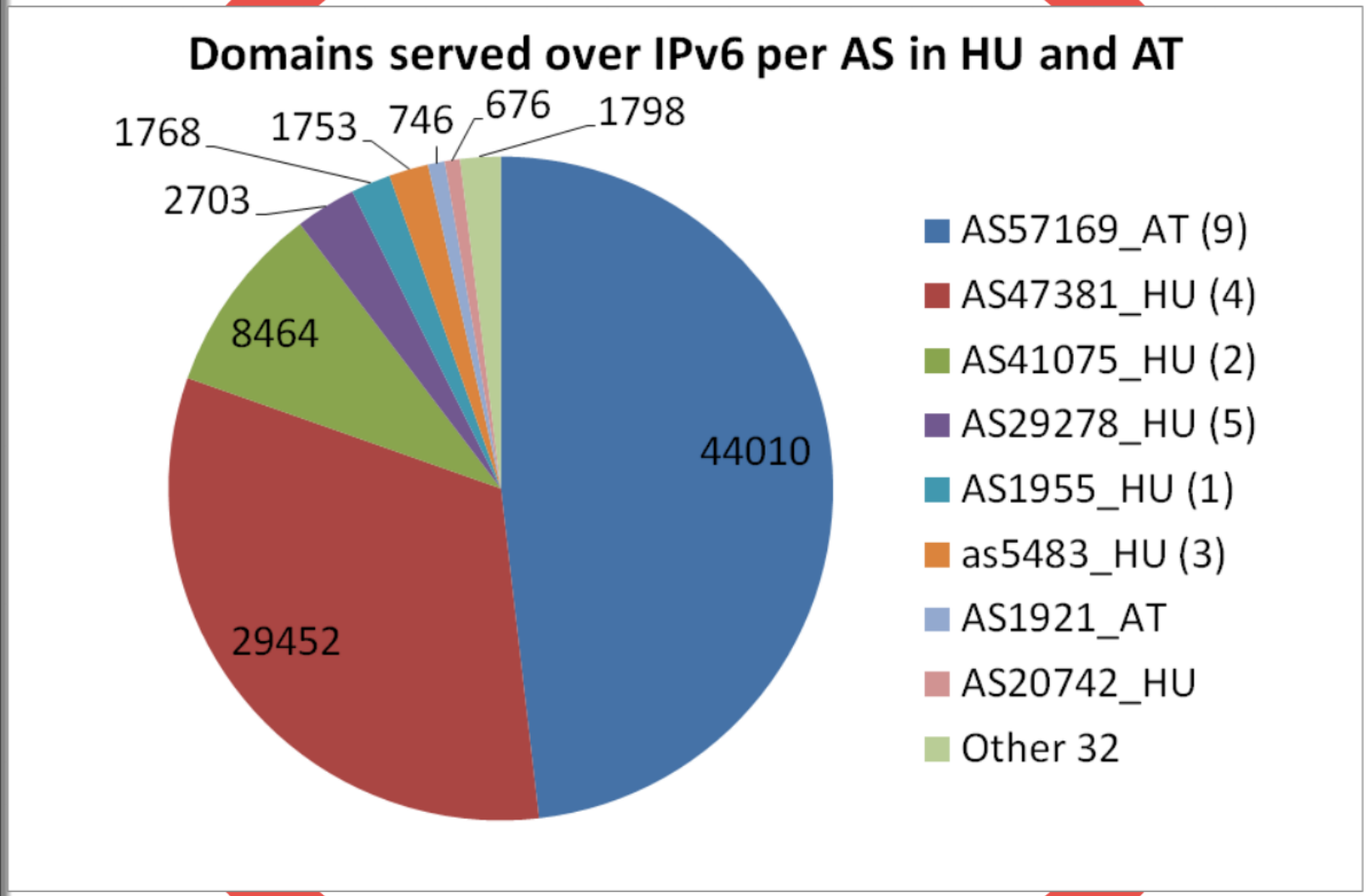


Topological diversity

- APNIC database does not show AS information
- Nice AS diversity: 295 ASs in RIPE region, 28 ASs in ARIN region
- 40 different ASs in Hungary and Austria alone!



Prezi

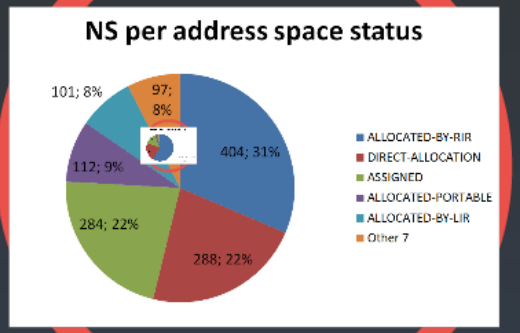

Domains served over IPv6 per AS in HU and AT
1768
1753
746
676
1798
2703
8464
44010
29452
AS57169_AT (9)
AS47381_HU (4)
AS41075_HU (2)
AS29278_HU (5)
AS1955_HU (1)
as5483_HU (3)
AS1921_AT
AS20742_HU
Other 32

Close to half of domains with NS with IPv6 address have an IPv6 NS in one of the Austrian ASs!

3 name servers serve 43000 .hu domains!

Reason: two major .hu registrars have a couple of name servers in that AS

Correctness of registration in RIR database



RIPE

Reference: **Documenting IPv6 Assignments in the RIPE Database**

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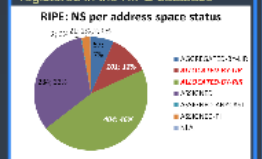
inetnum objects with "status: ASSIGNED" do not need to be created that are more specific to the AGGREGATED-BY-LIR **inetnum** objects"

58% of address space used by the name servers is not properly registered in the RIPE database



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Reference: **IPv6 Address Allocation and Assignment Policy**:
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Source: **Introduction to ARIN's Database:**
Direct Assignment: IP address space assigned directly from ARIN to an organization for its own exclusive use.
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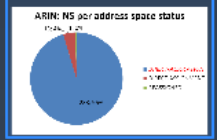
96% of assignments of address space used by the name servers is not registered in the ARIN database



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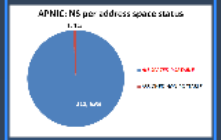
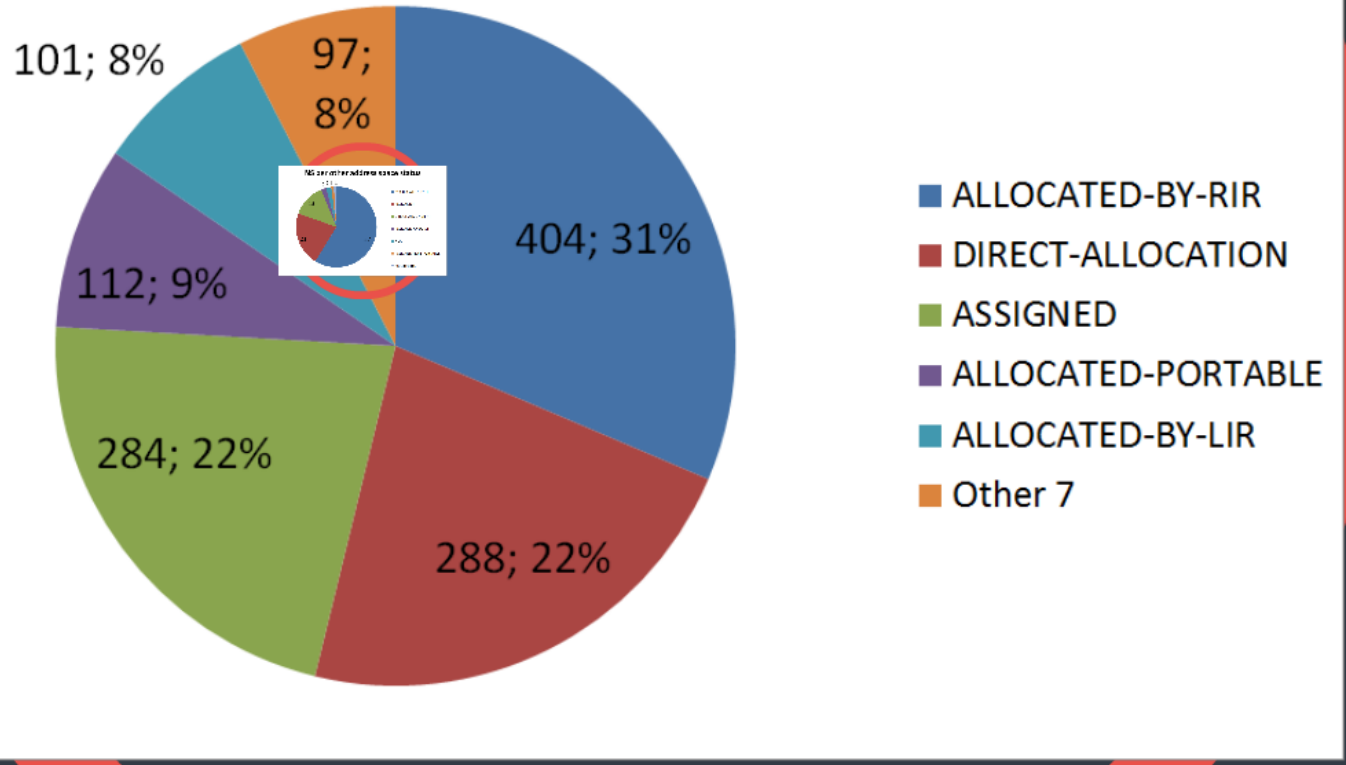
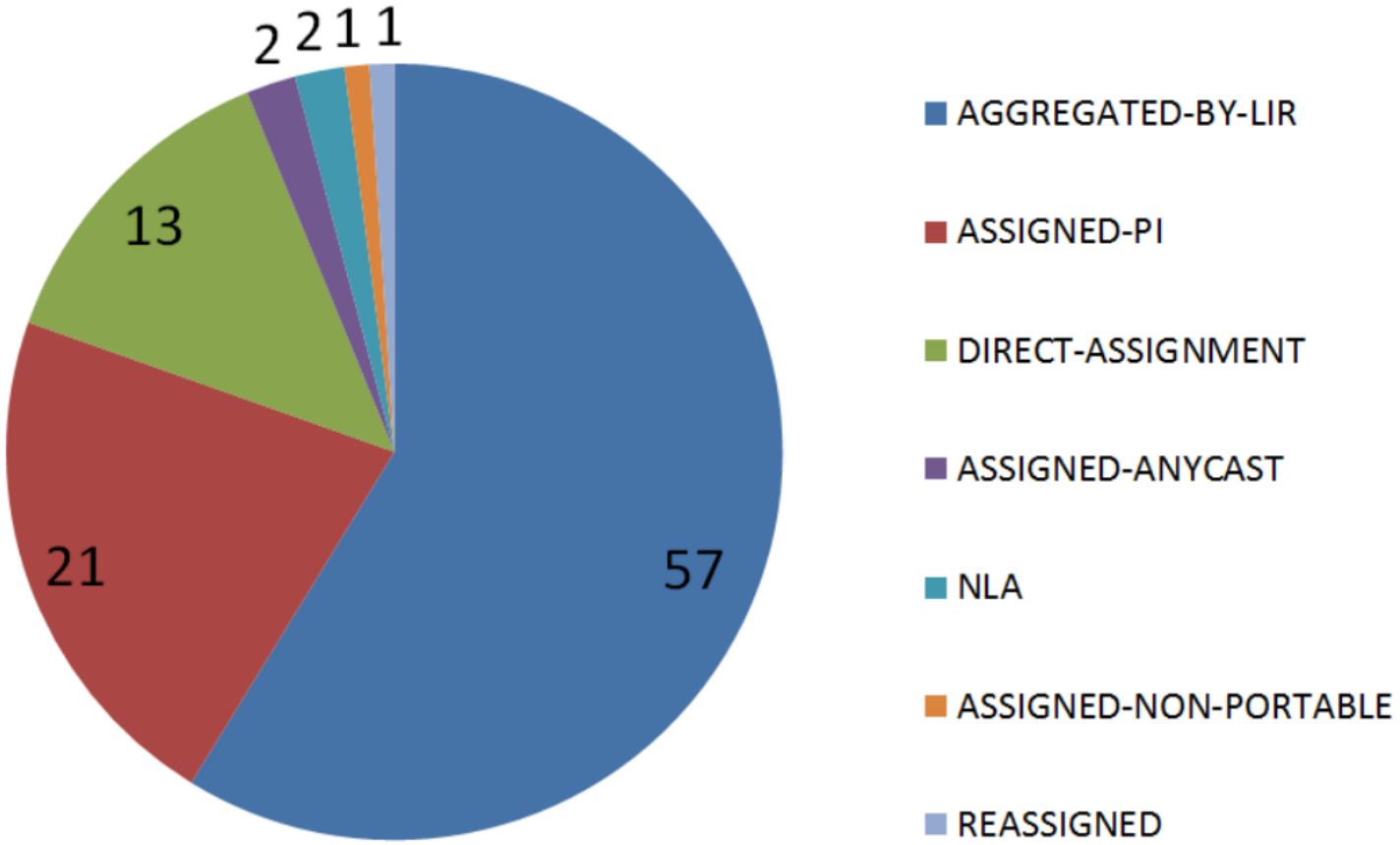


NS per address space status



NS per other address space status



PORTABLE
BY-LIR

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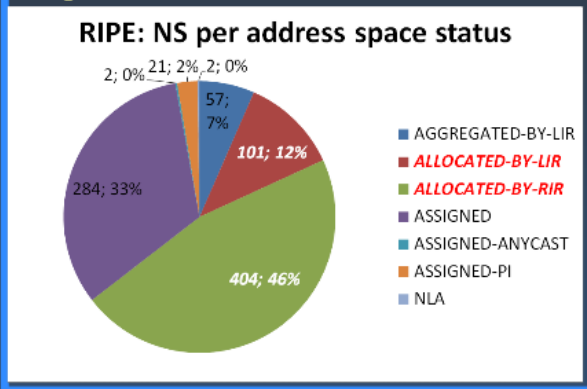

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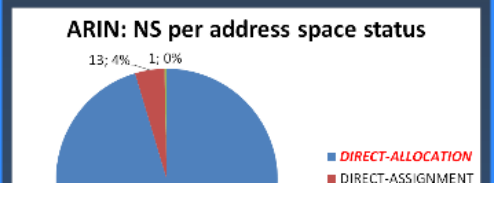

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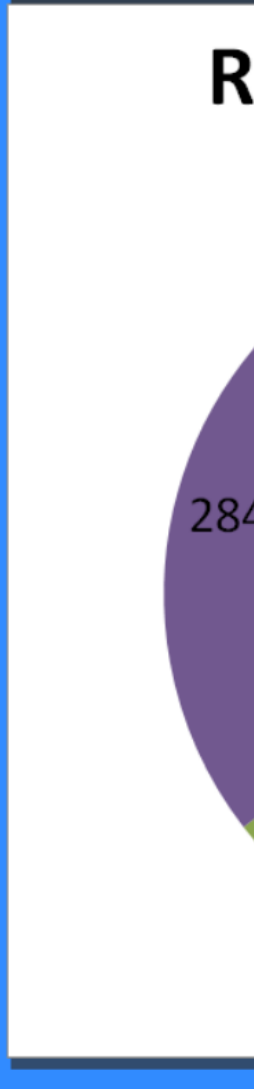

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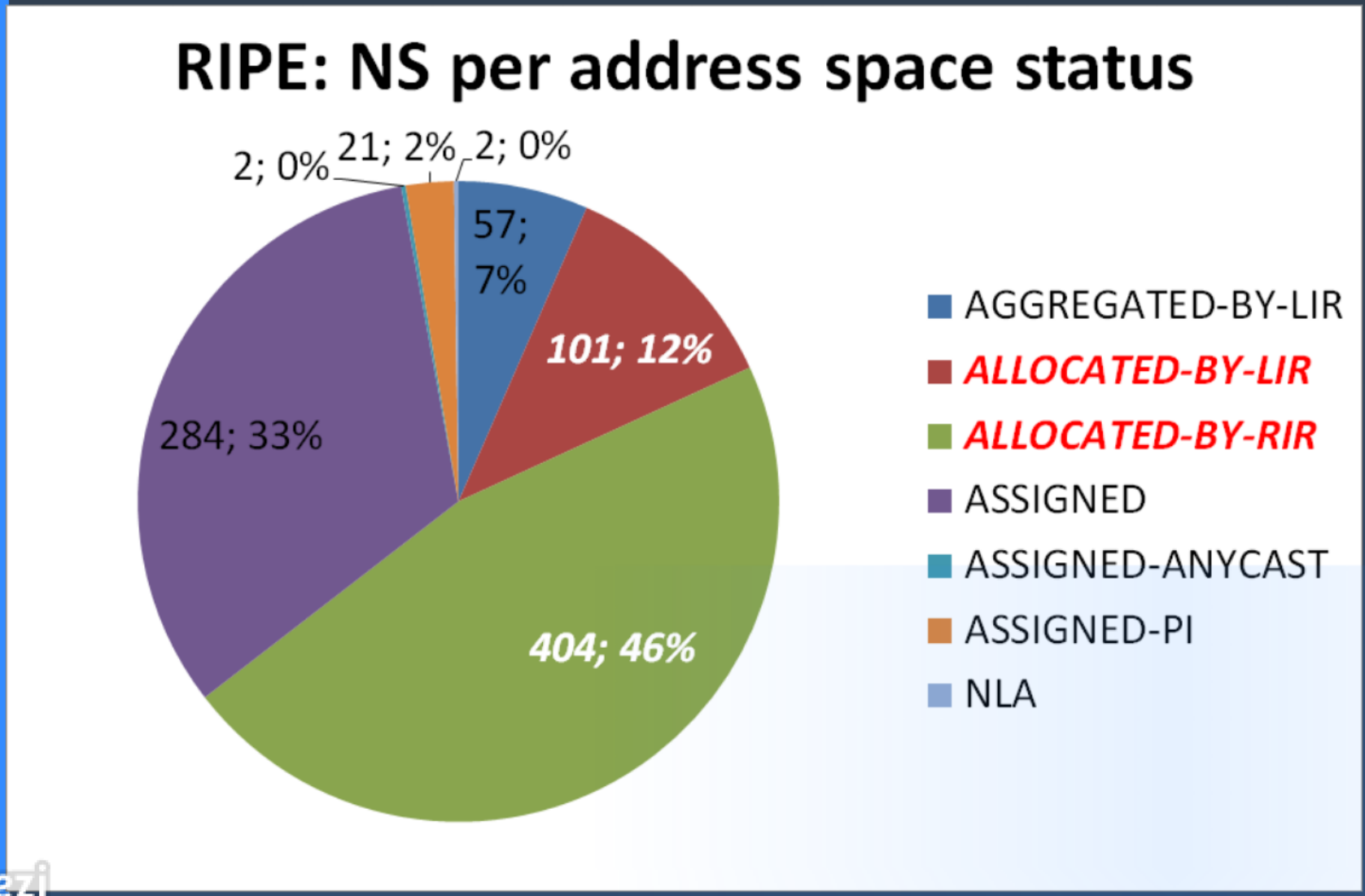

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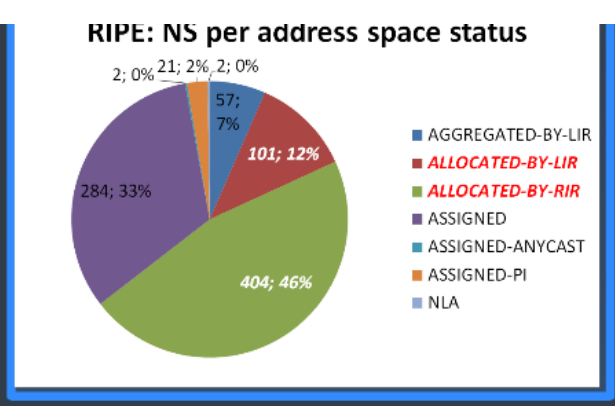

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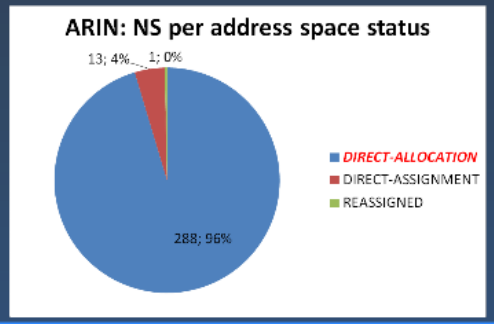

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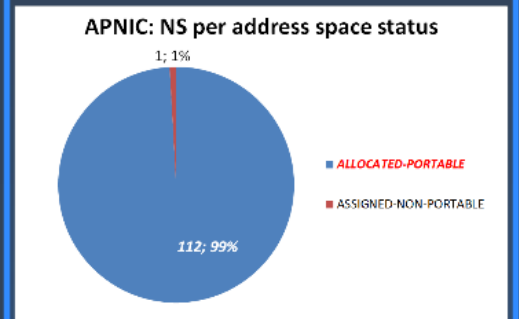

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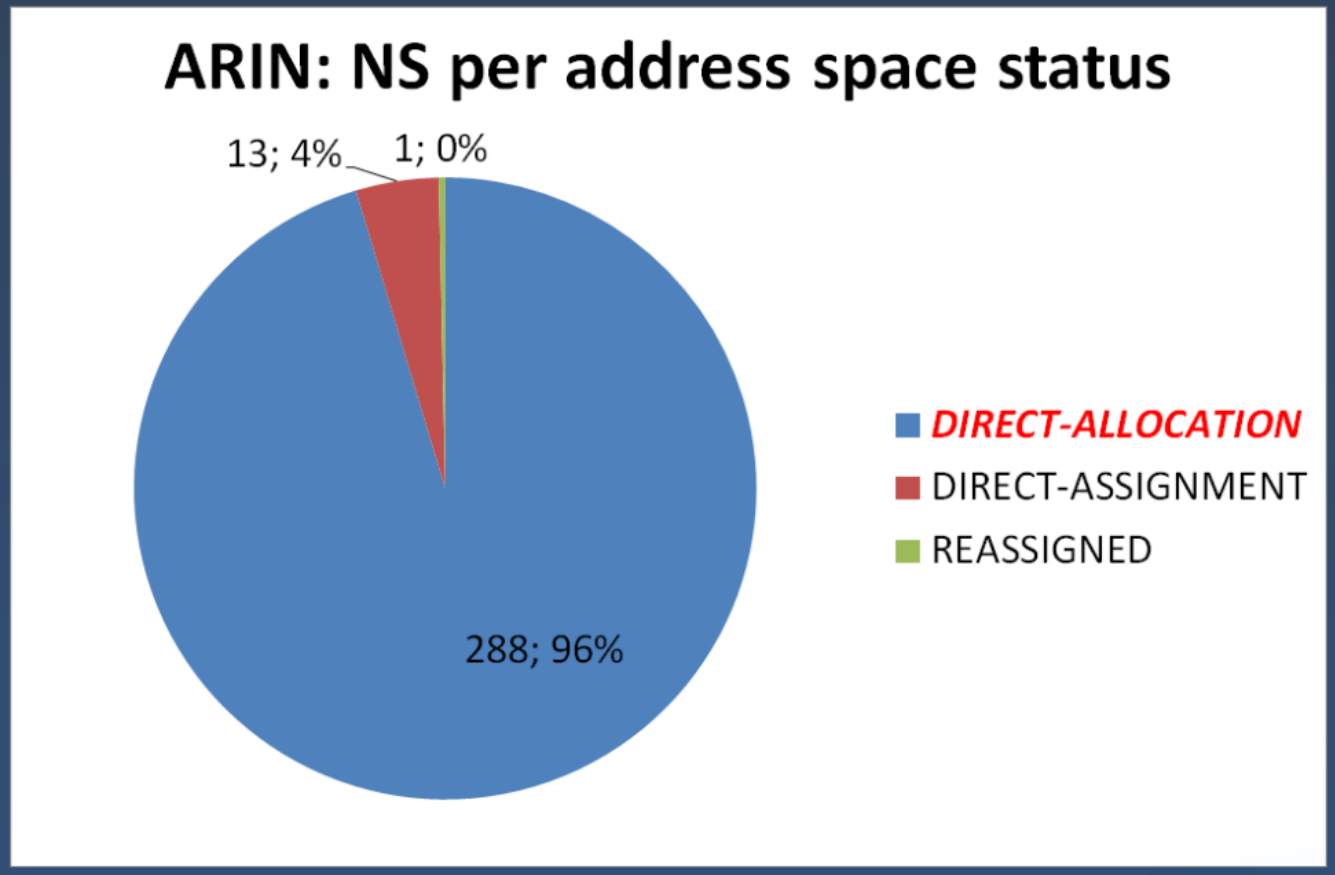

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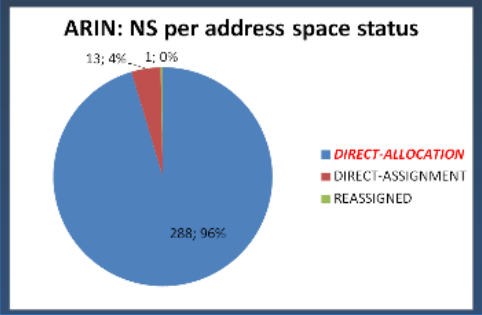

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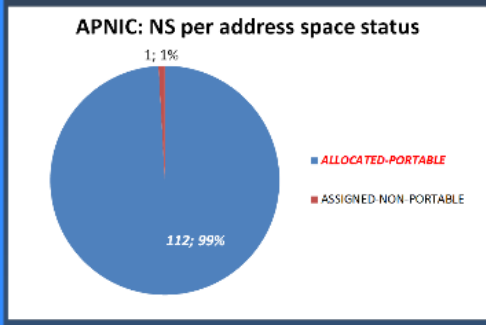

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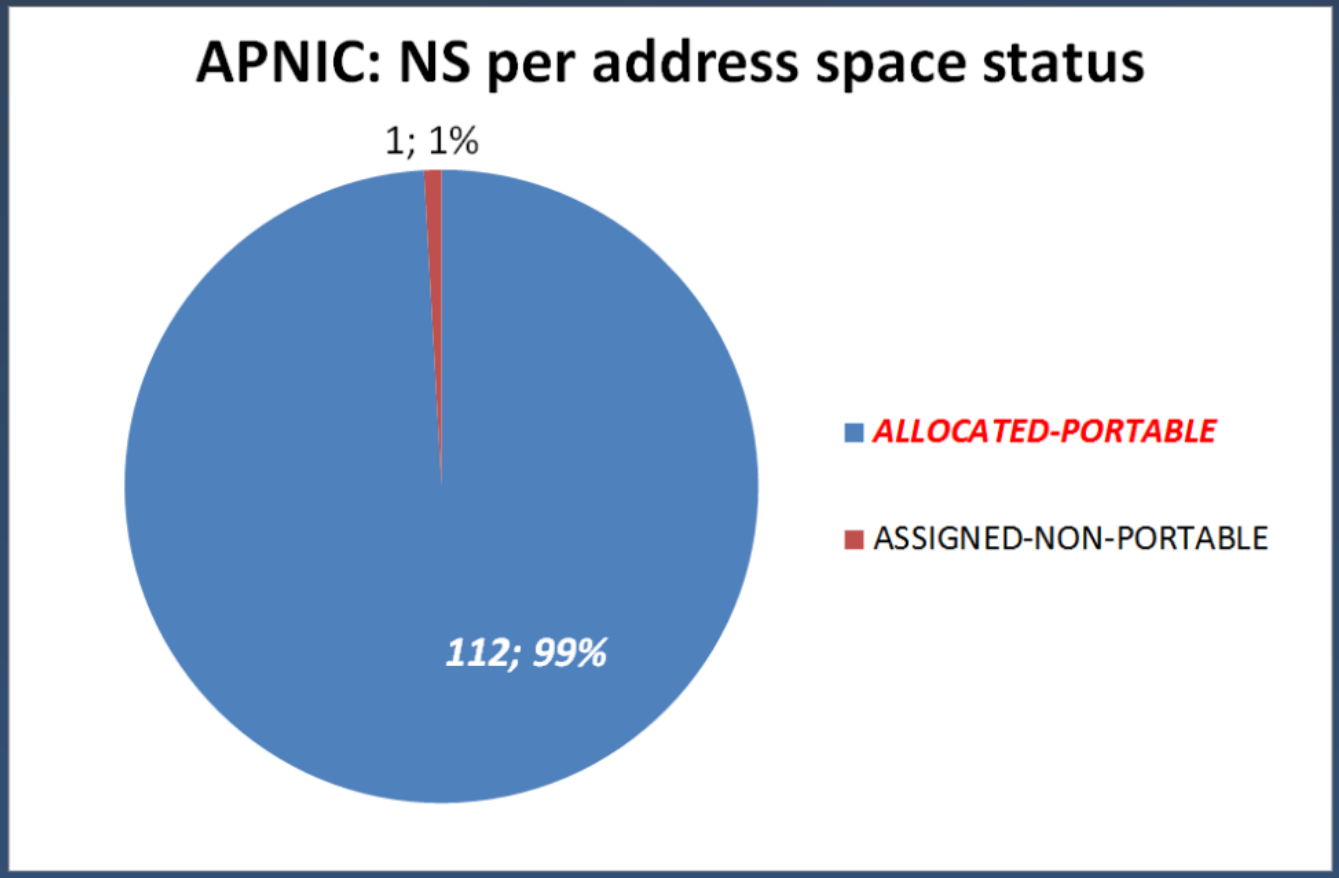
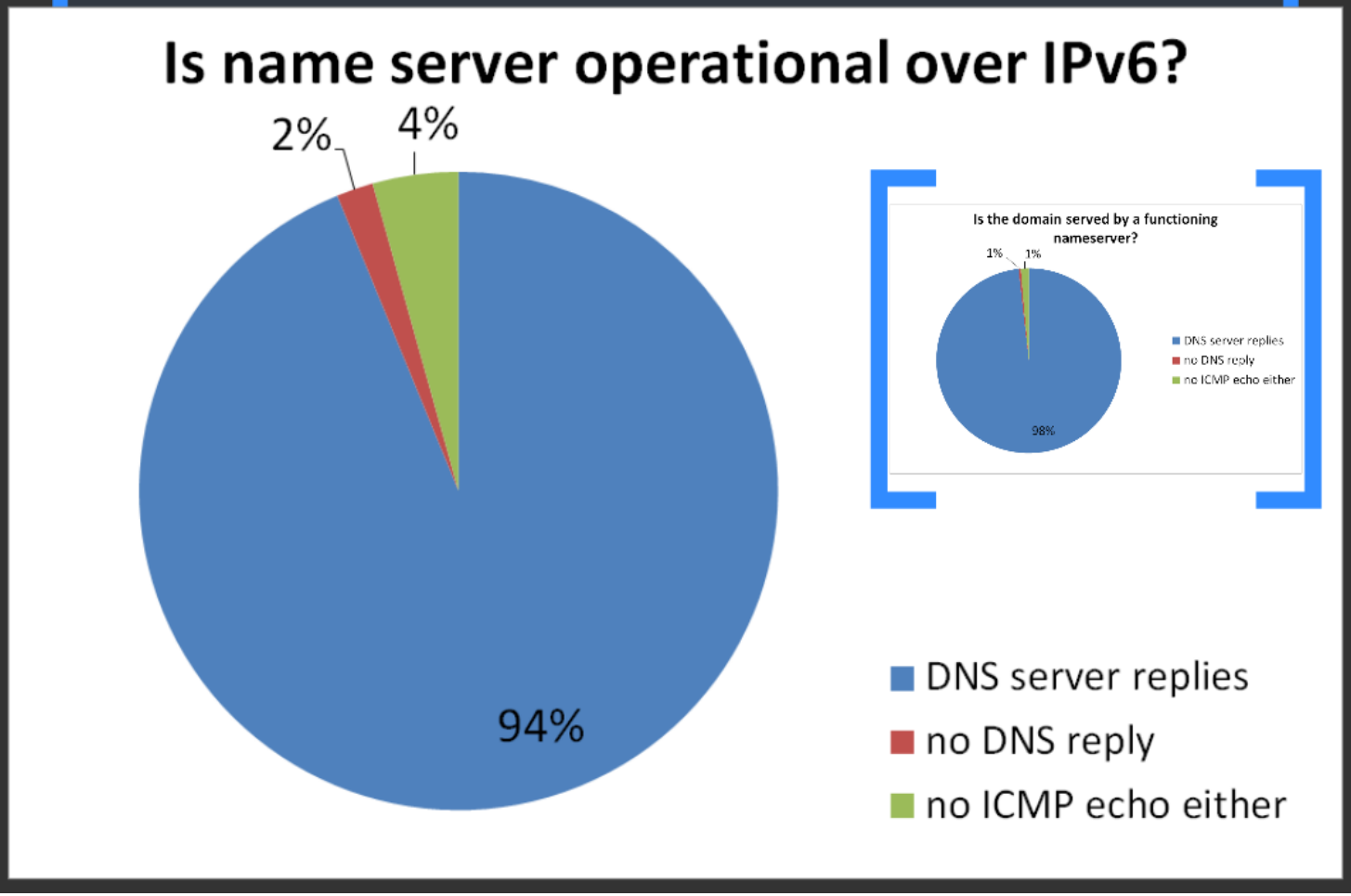
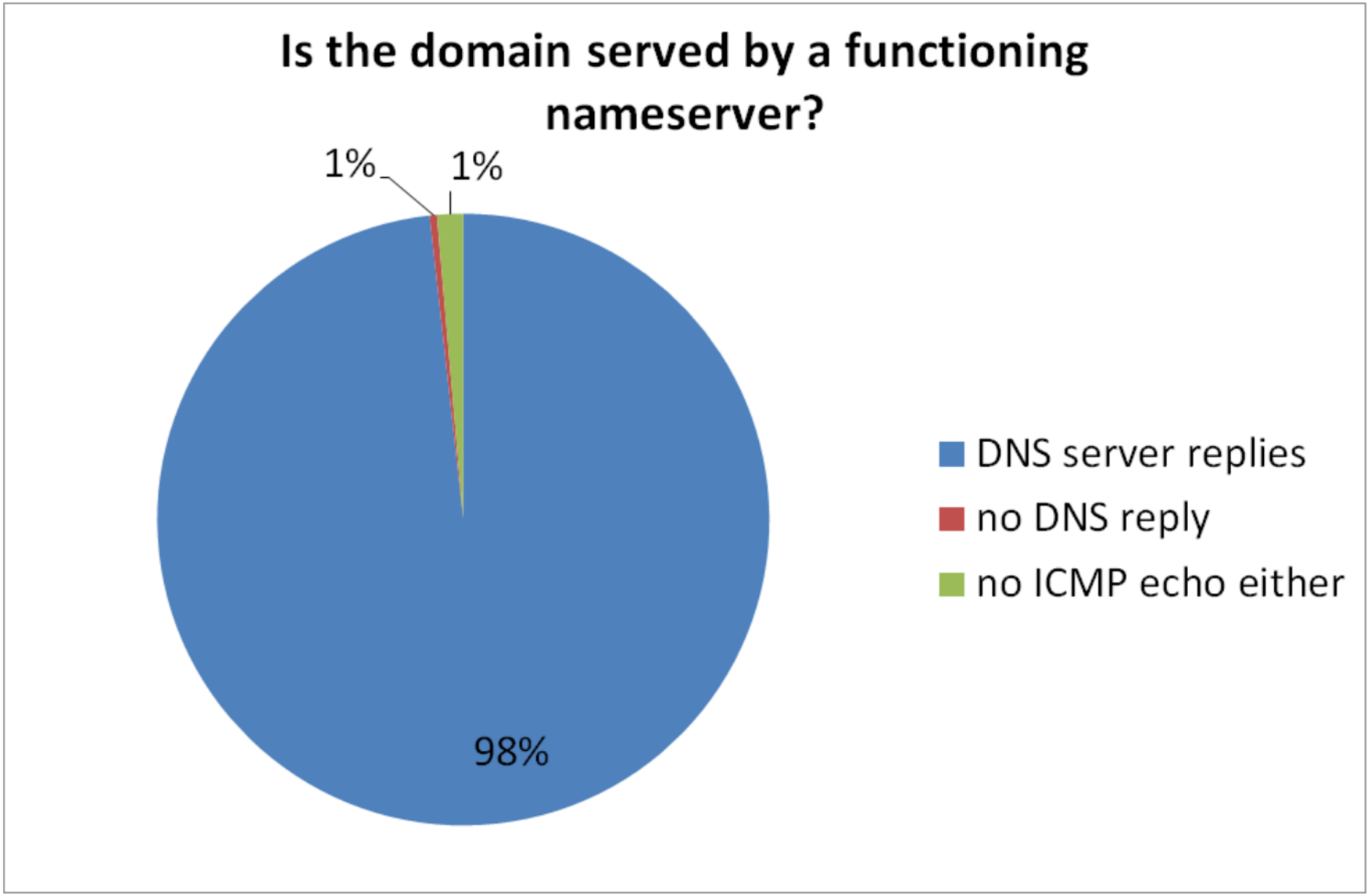


Query replies over IPv6

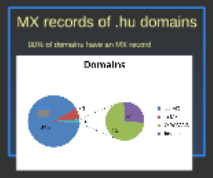
Do these name servers reply to DNS queries over IPv6?

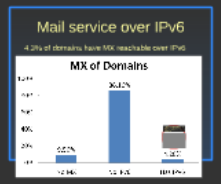
- 94% appear to be functioning normally
- 4% unreachable
- 98% of domains have a functioning IPv6 NS

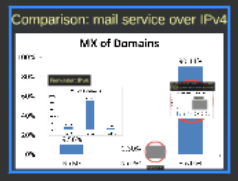


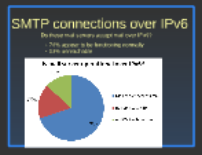

Is the domain served by a functioning nameserver?
1%
1%
98%
DNS server replies
no DNS reply
no ICMP echo either

Mail


MX records of .hu domains
Domains

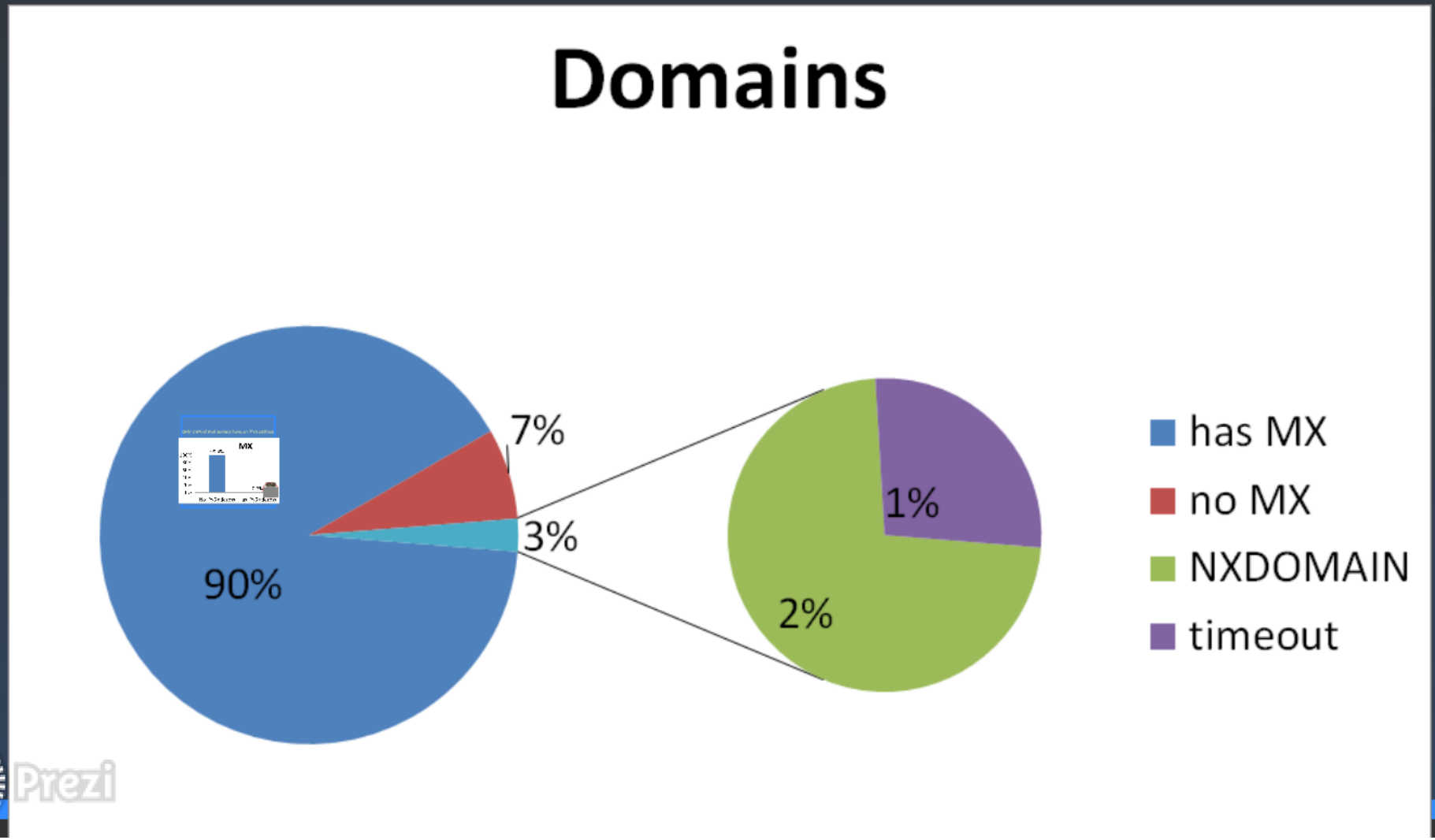

Mail service over IPv6
MX of Domains


Comparison: mail service over IPv4
MX of Domains

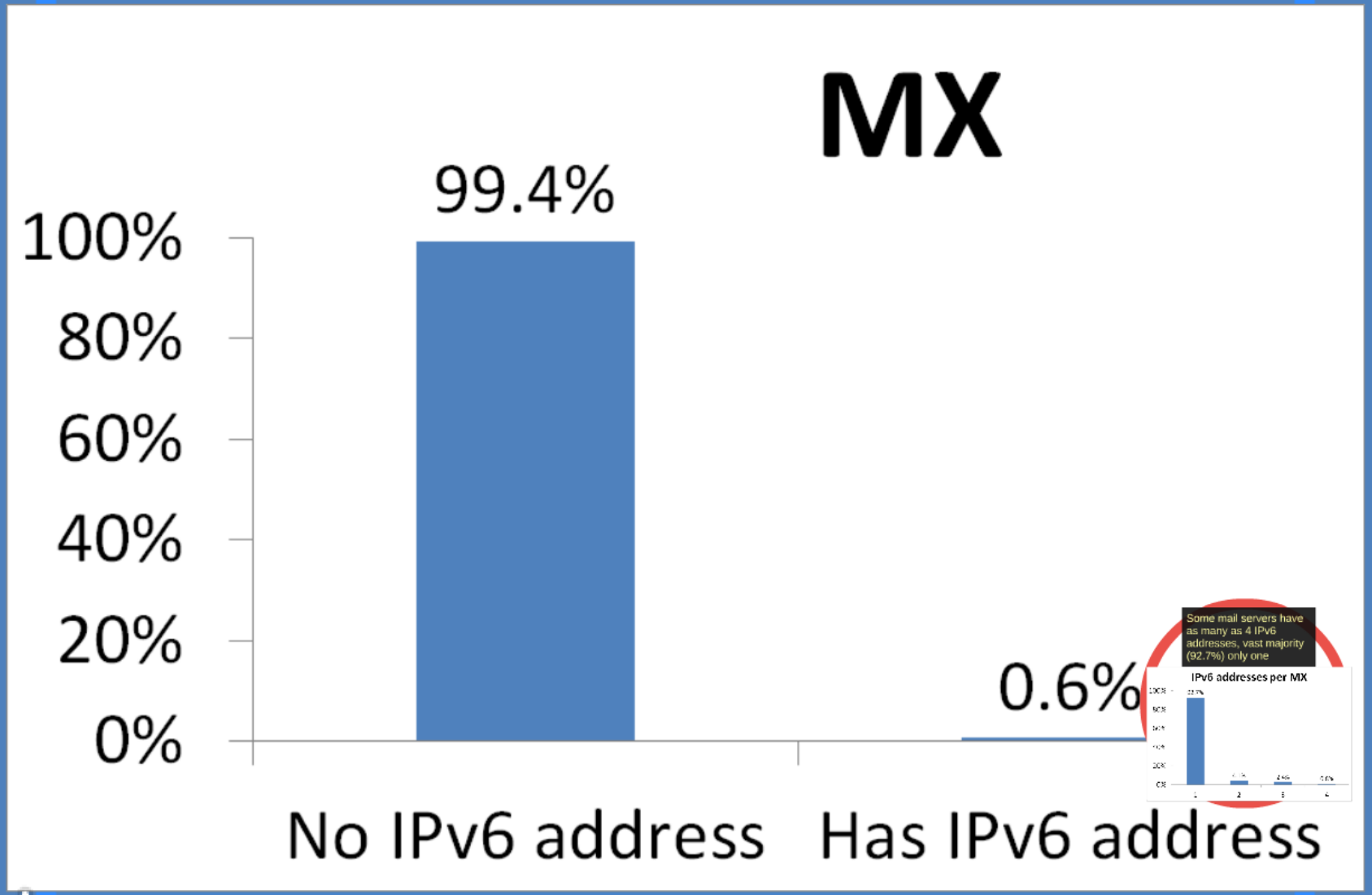

SMTP connections over IPv6

MX records of .hu domains

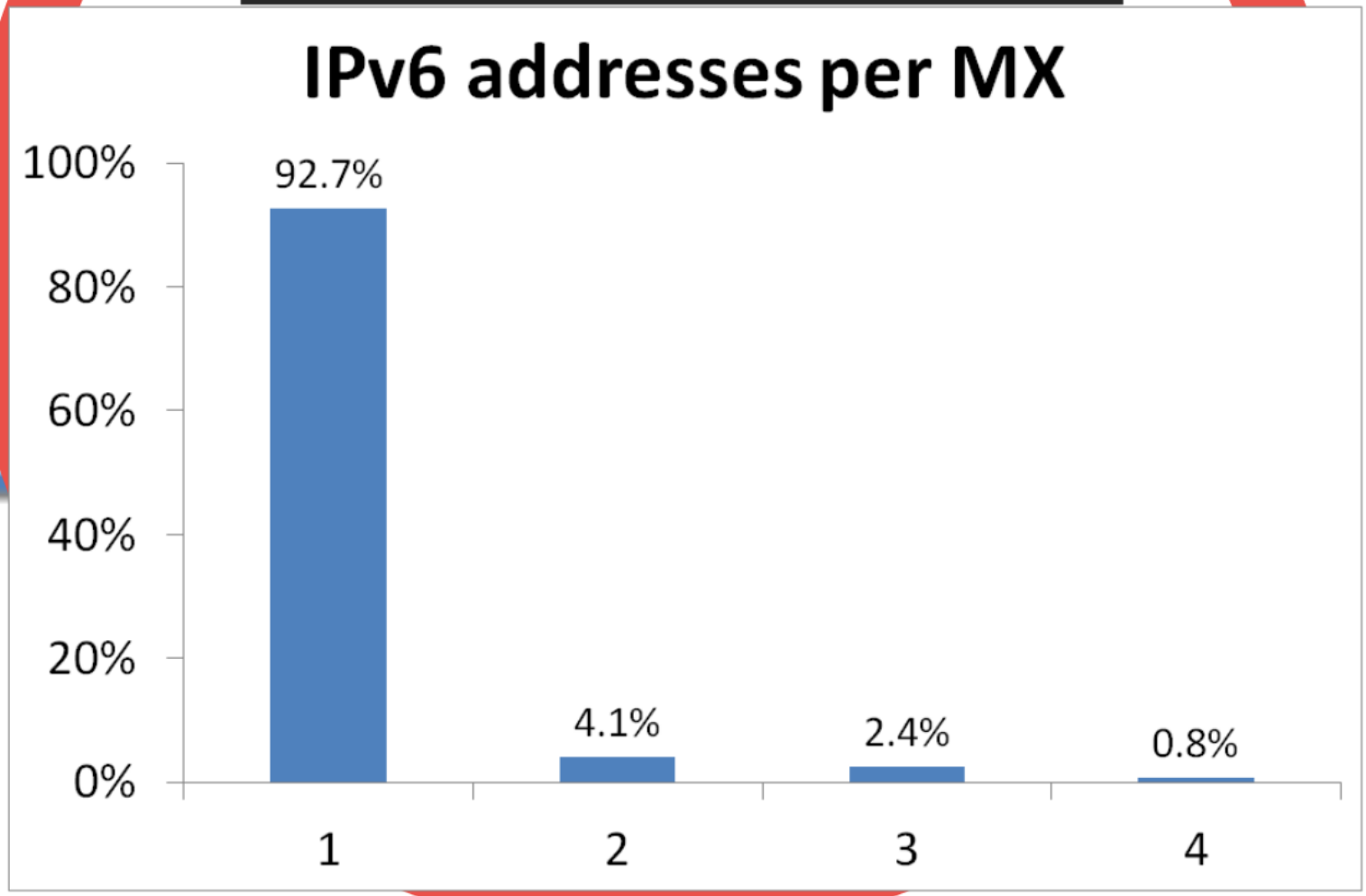
90% of domains have an MX record



Only 0.6% of mail servers have an IPv6 address

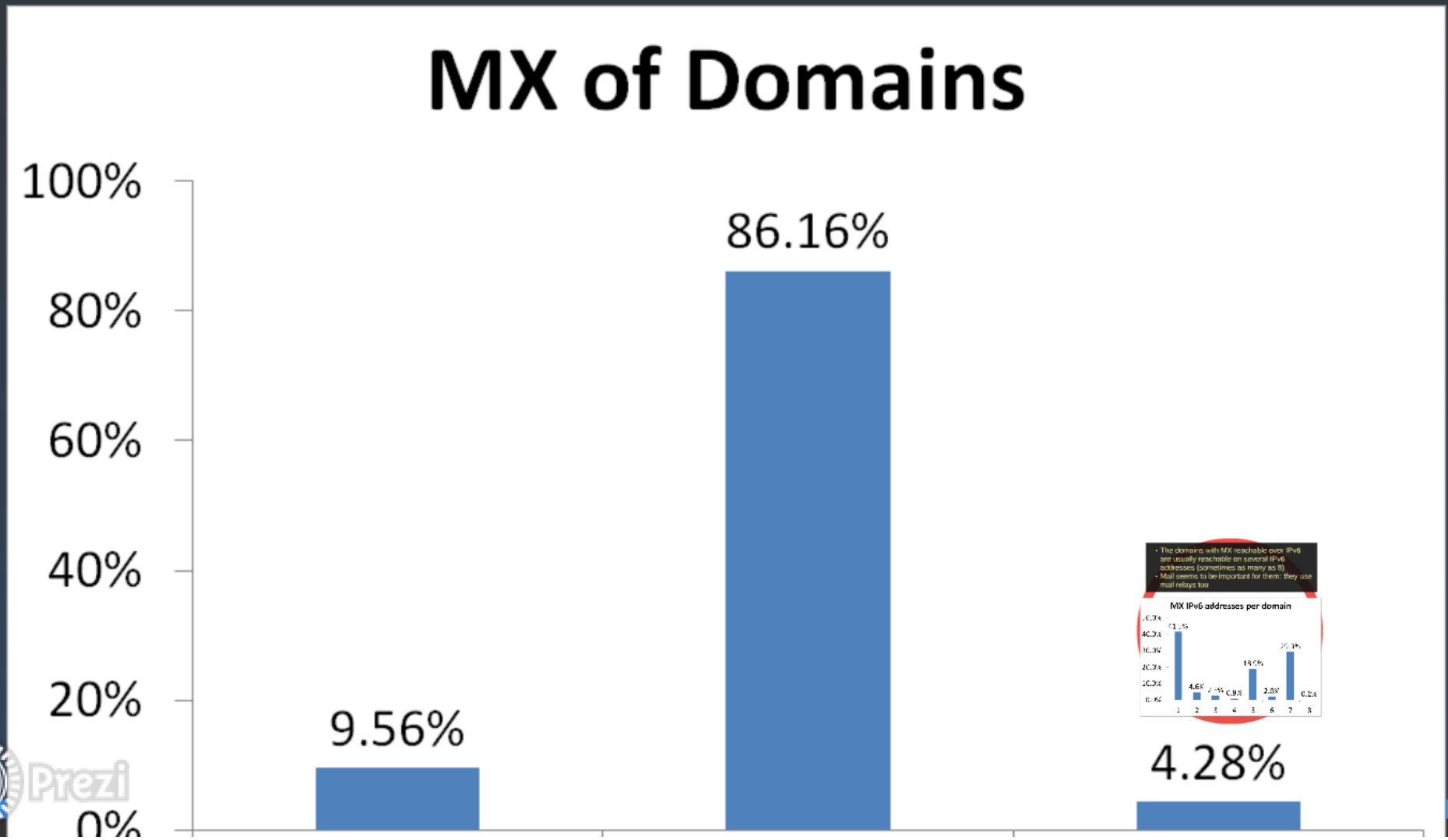


Some mail servers have as many as 4 IPv6 addresses, vast majority (92.7%) only one

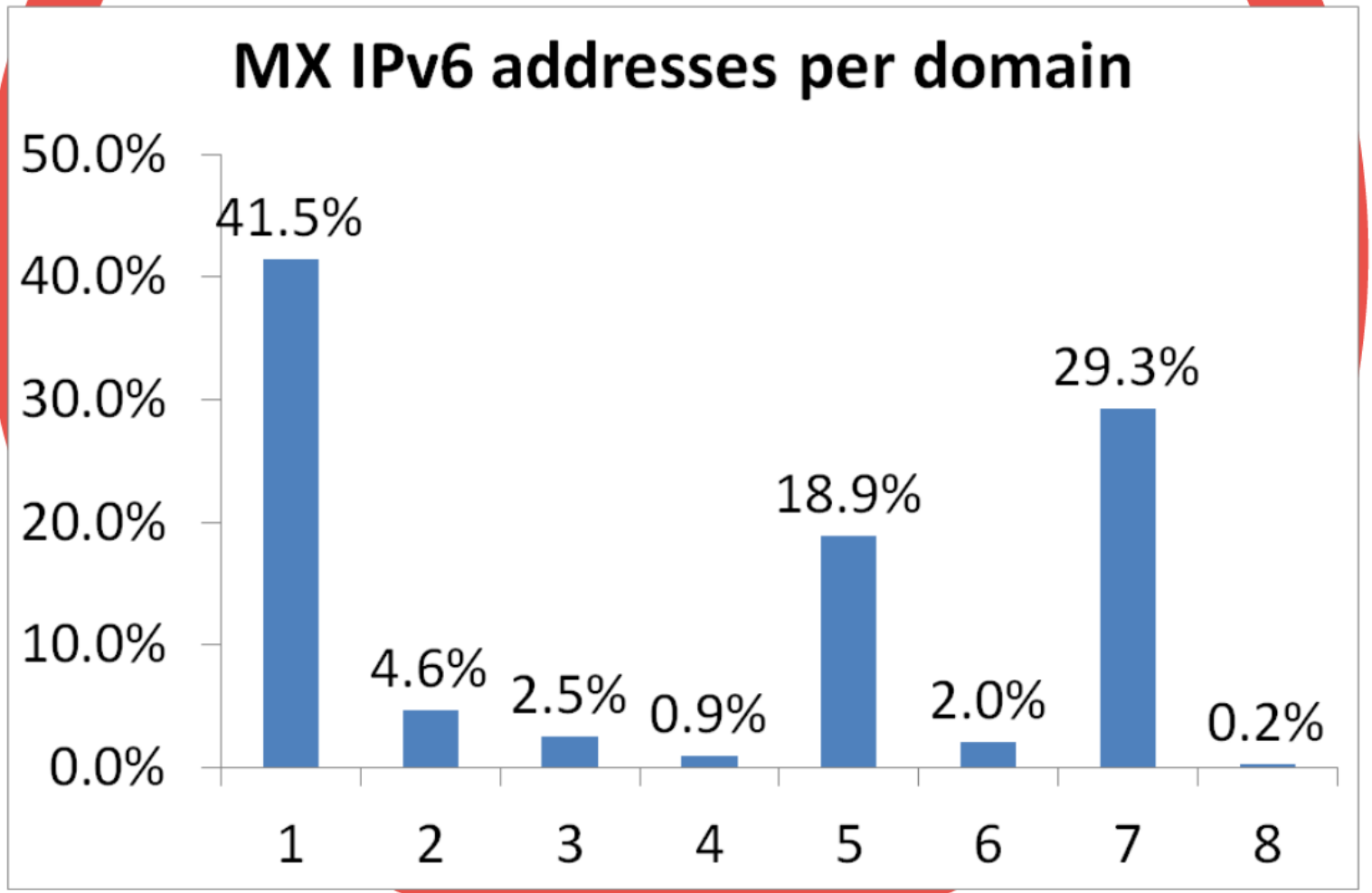


Mail service over IPv6

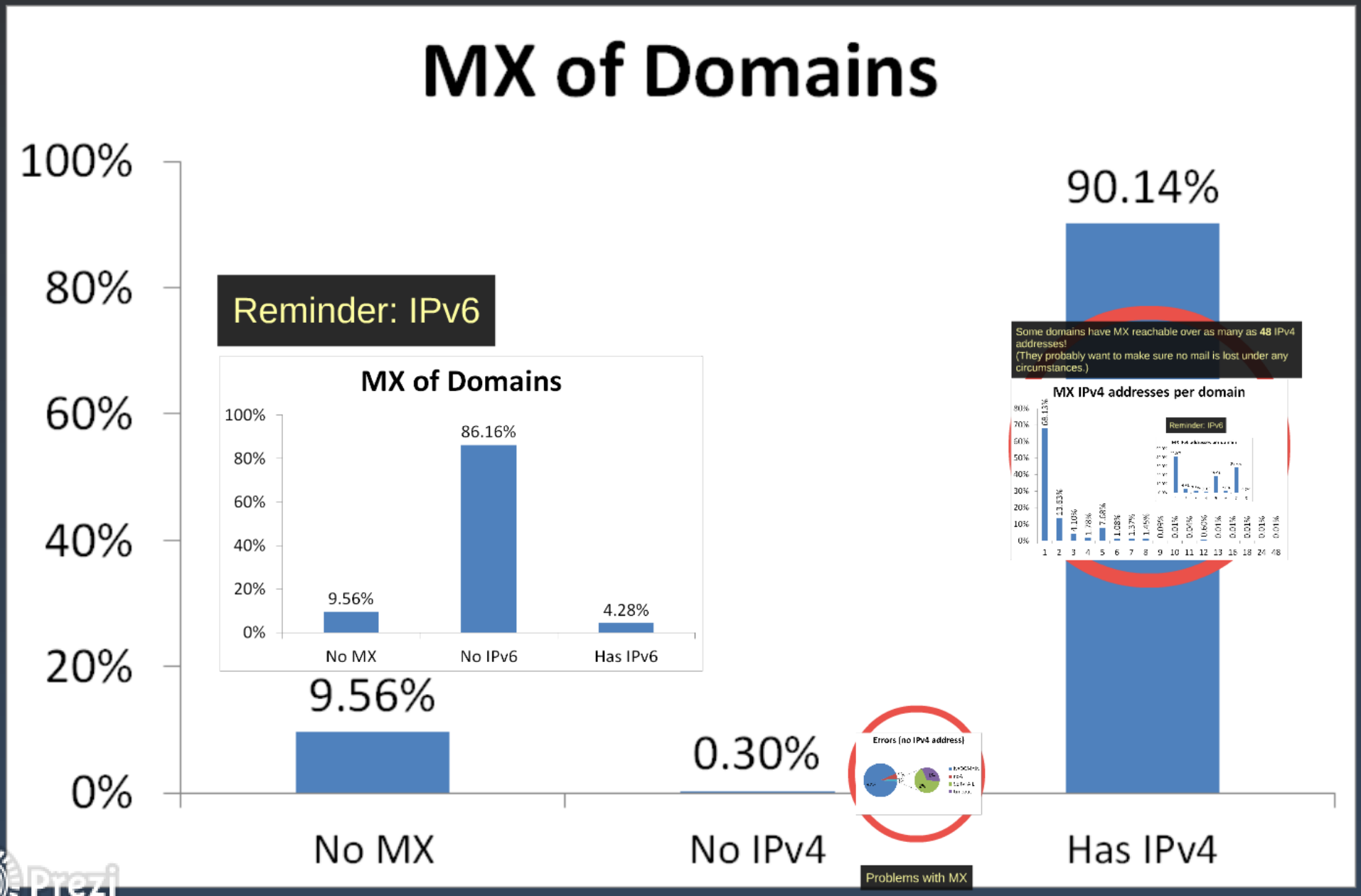
4.3% of domains have MX reachable over IPv6



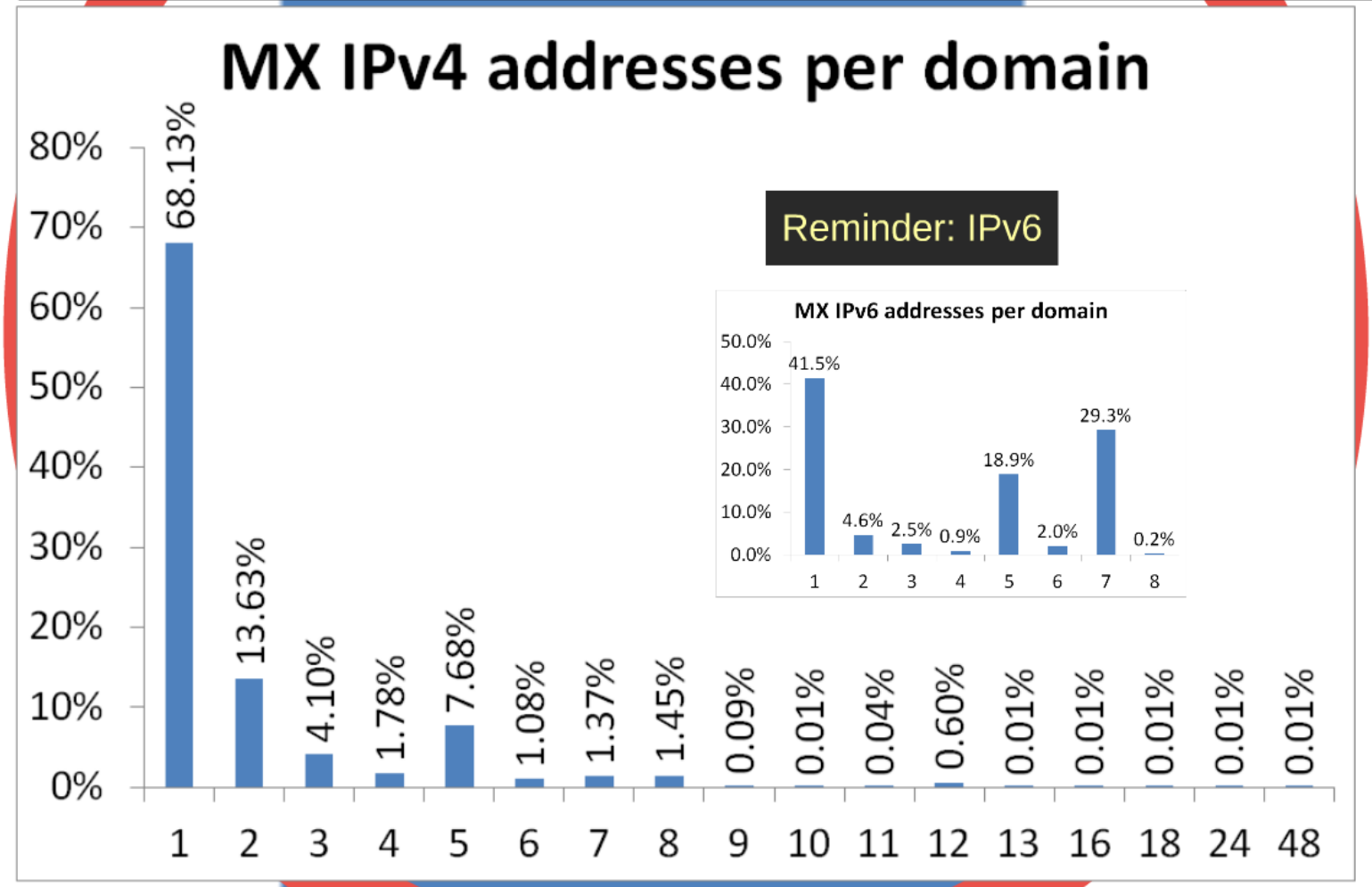
- The domains with MX reachable over IPv6 are usually reachable on several IPv6 addresses (sometimes as many as 8)
- Mail seems to be important for them: they use mail relays too

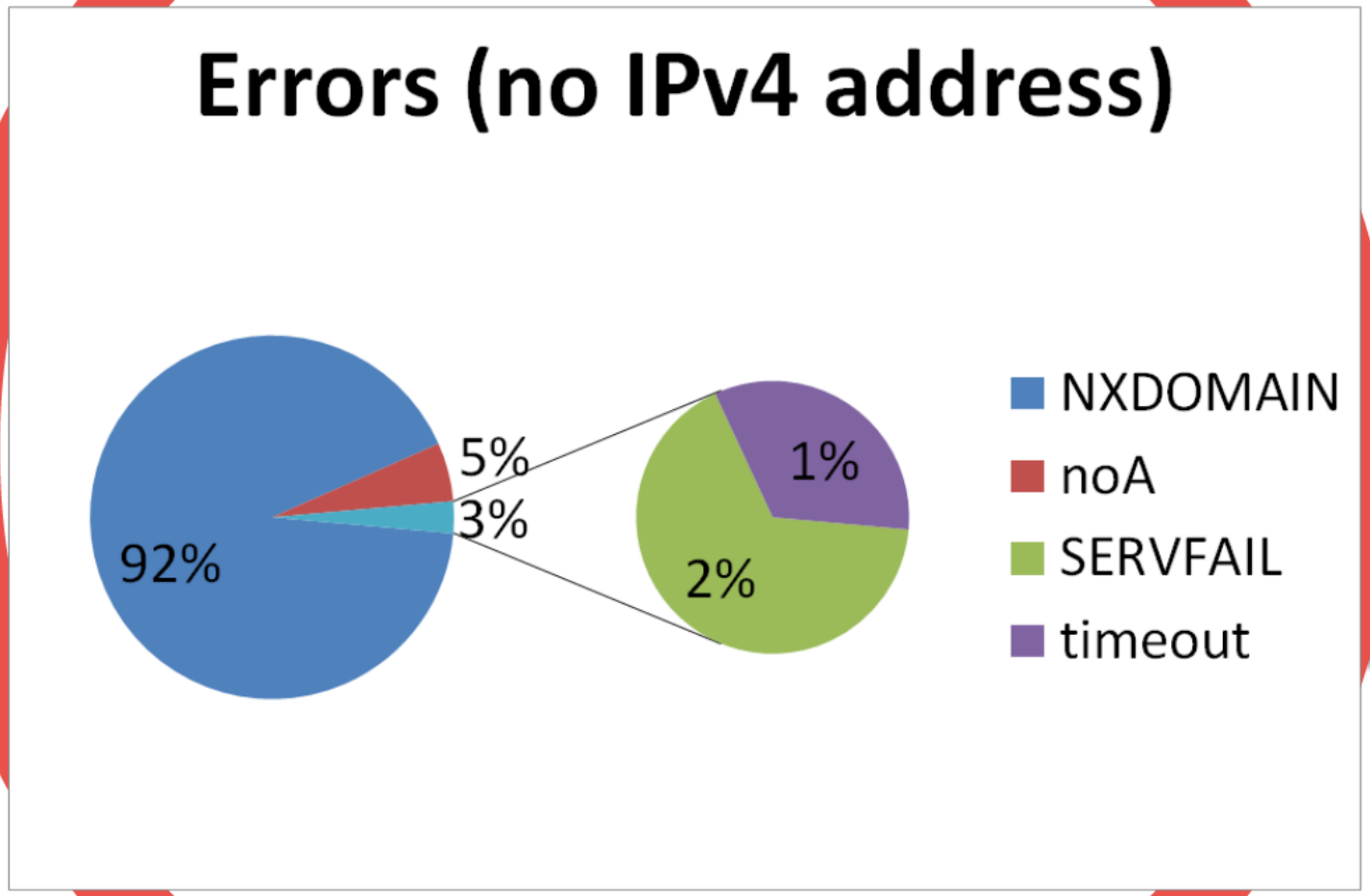


Comparison: mail service over IPv4



Some domains have MX reachable over as many as **48** IPv4 addresses!
(They probably want to make sure no mail is lost under any circumstances.)

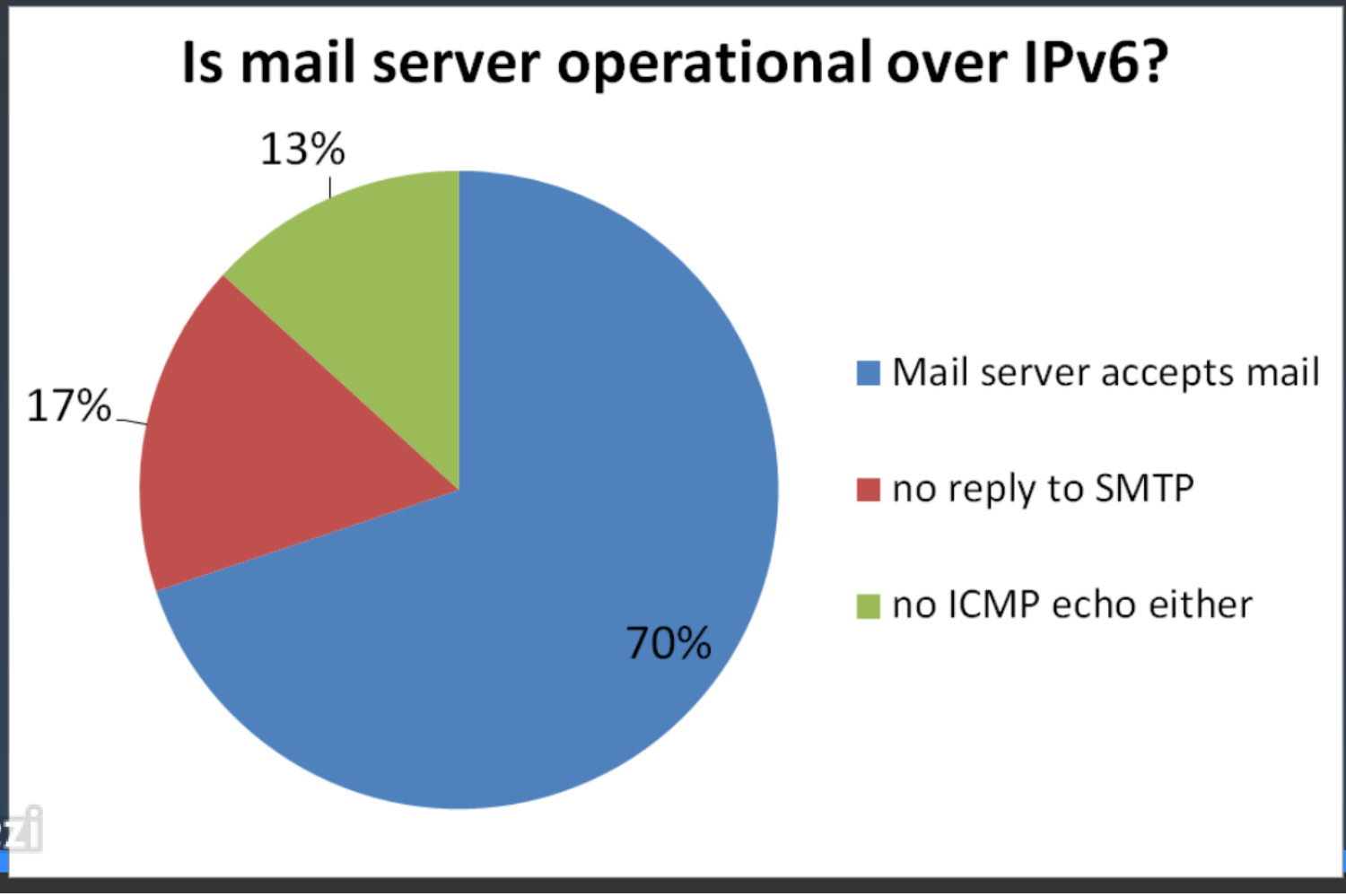



Errors (no IPv4 address)
92%
5%
3%
1%
2%
NXDOMAIN
noA
SERVFAIL
timeout

SMTP connections over IPv6

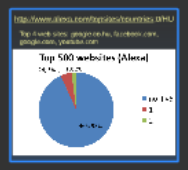
Do these mail servers accept mail over IPv6?

- 70% appear to be functioning normally
- 13% unreachable



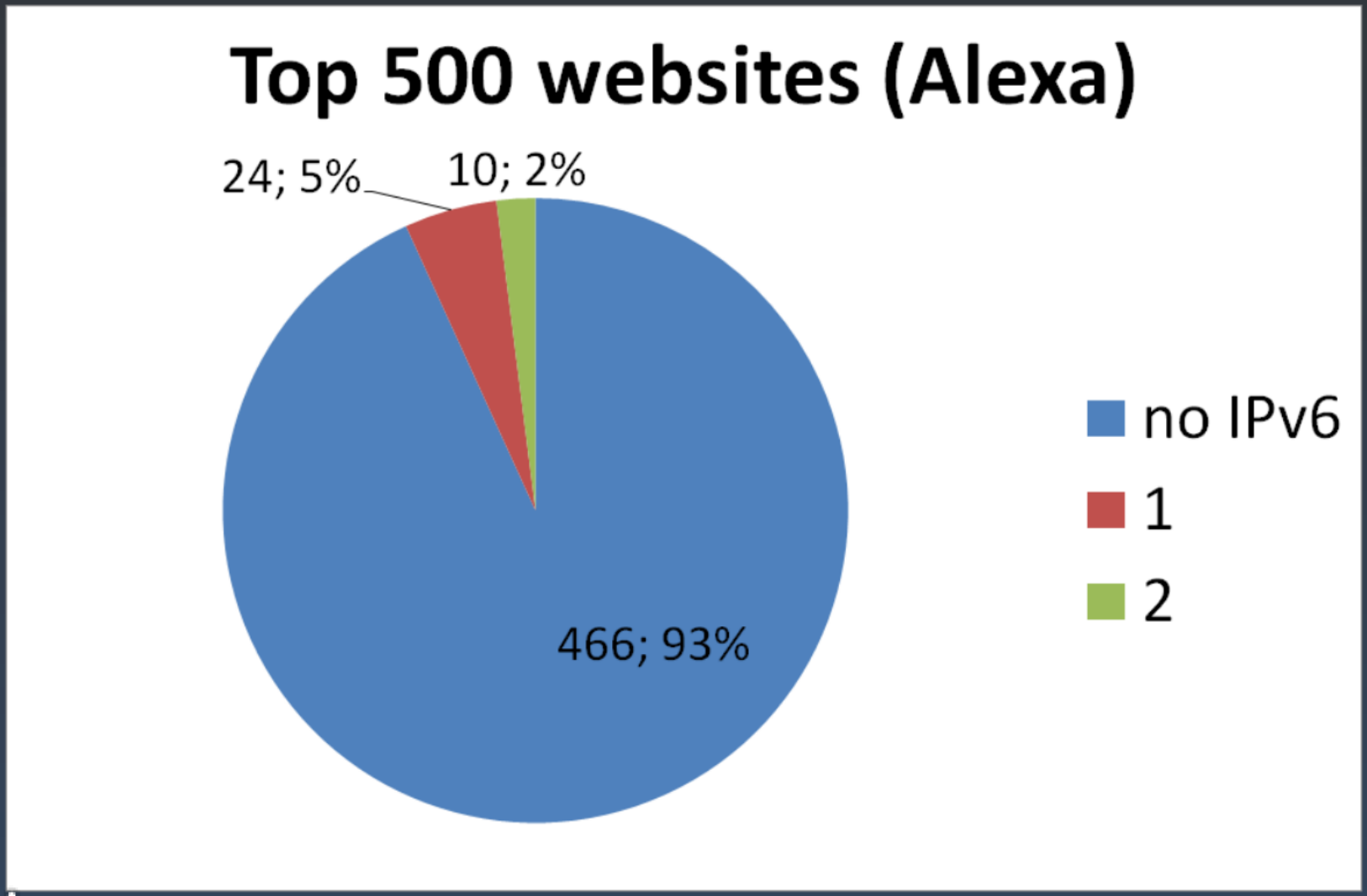
Web

Top 500 web sites (according to Alexa)

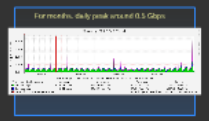


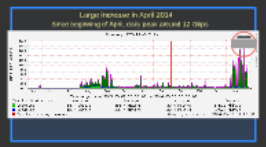
http://www.alexa.com/topsites/countries;0/HU

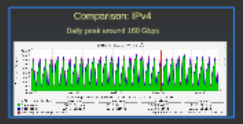
Top 4 web sites: google.co.hu, facebook.com, google.com, youtube.com



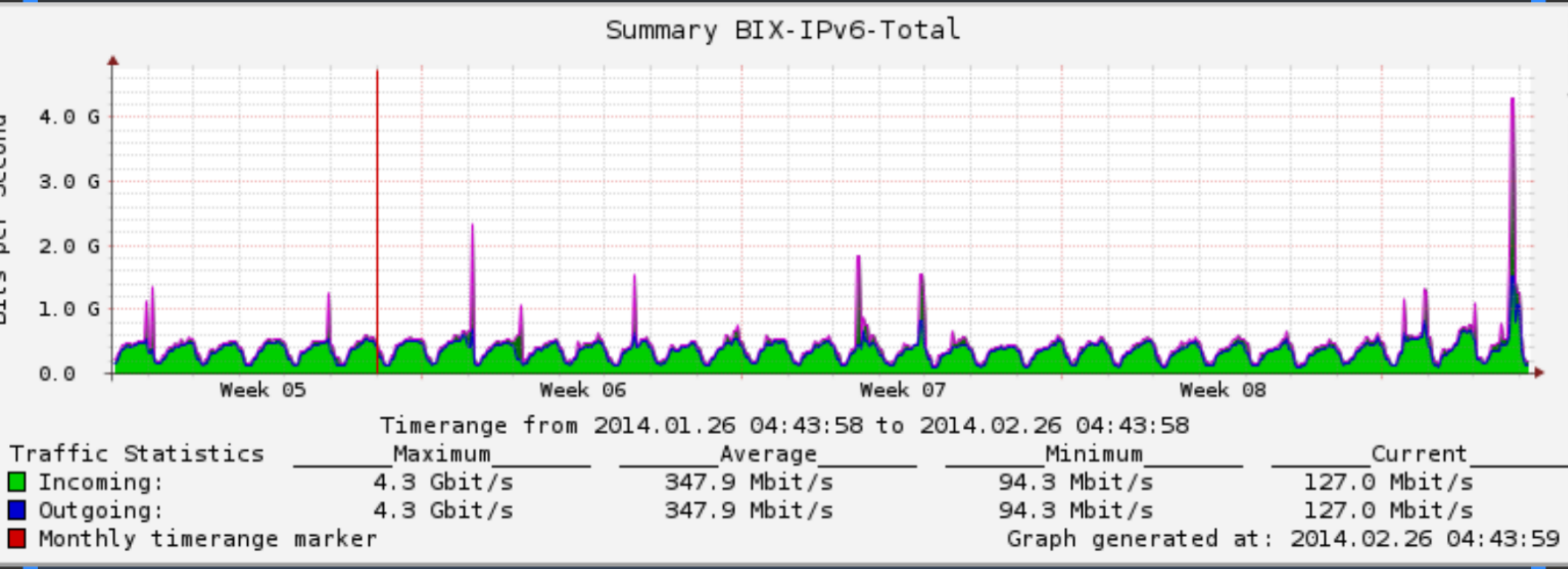
BIX


For months, daily peak around 0.5 Gbps


Large increase in April 2014
Since beginning of April, daily peak around 12 Gbps

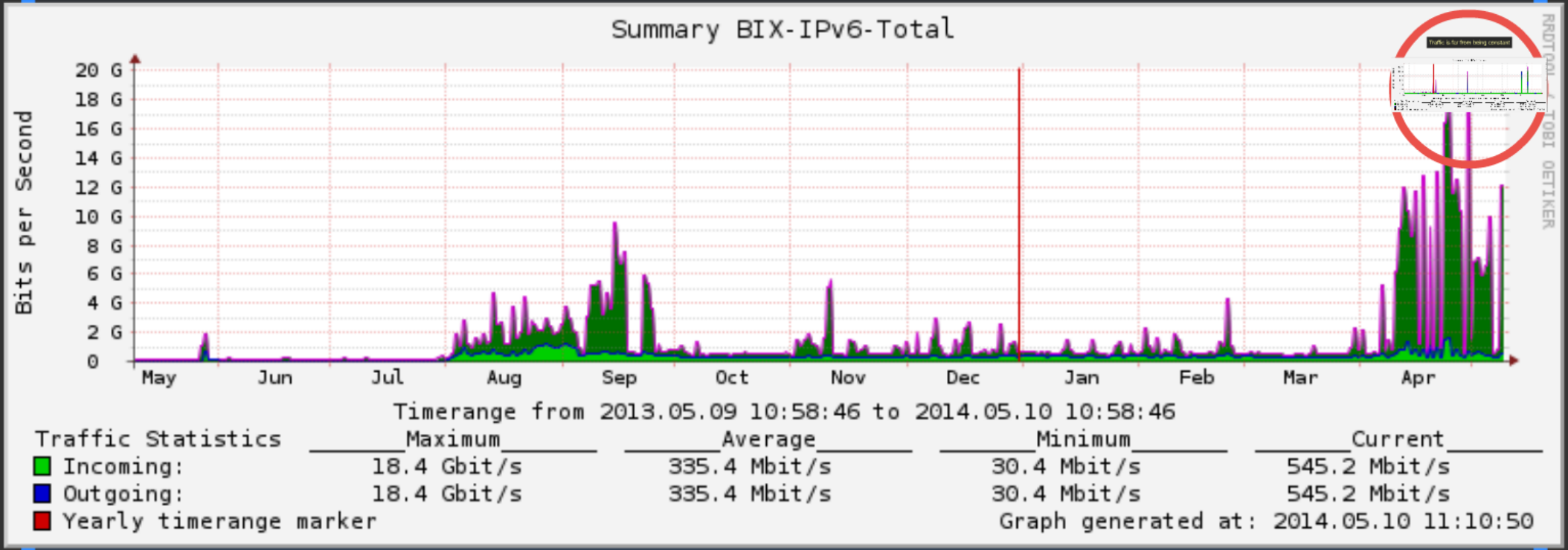

Comparison: IPv4
Daily peak around 100 Gbps

For months, daily peak around 0.5 Gbps

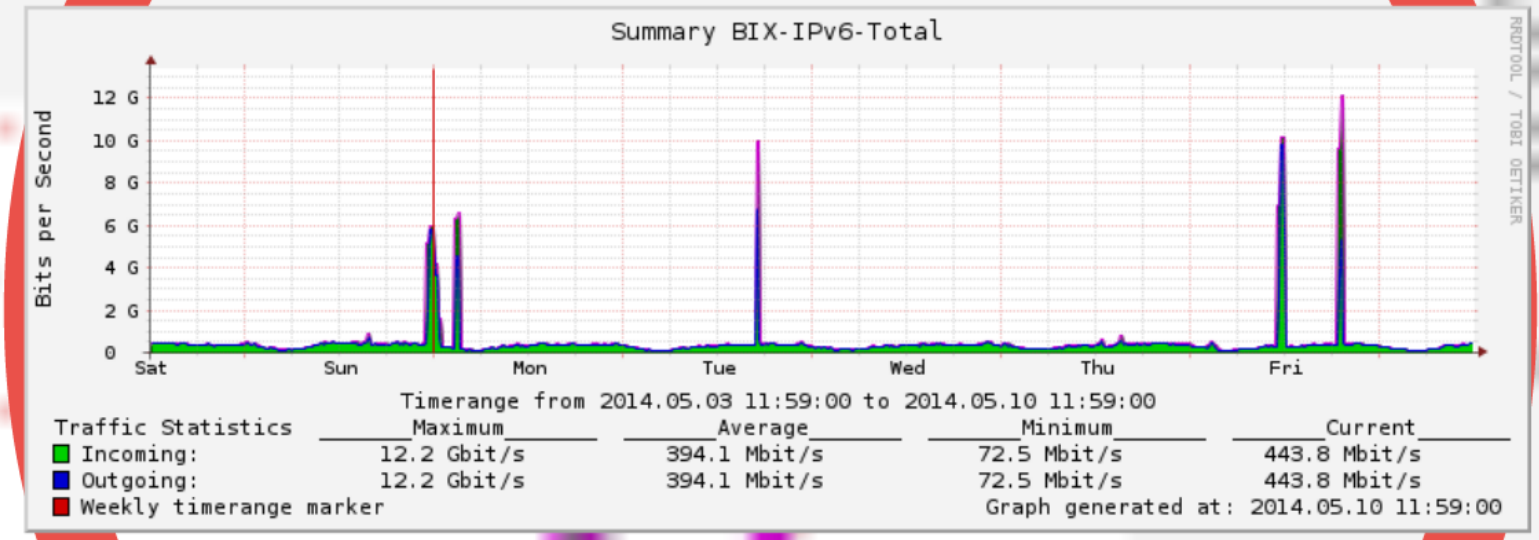


Large increase in April 2014

Since beginning of April, daily peak around 12 Gbps

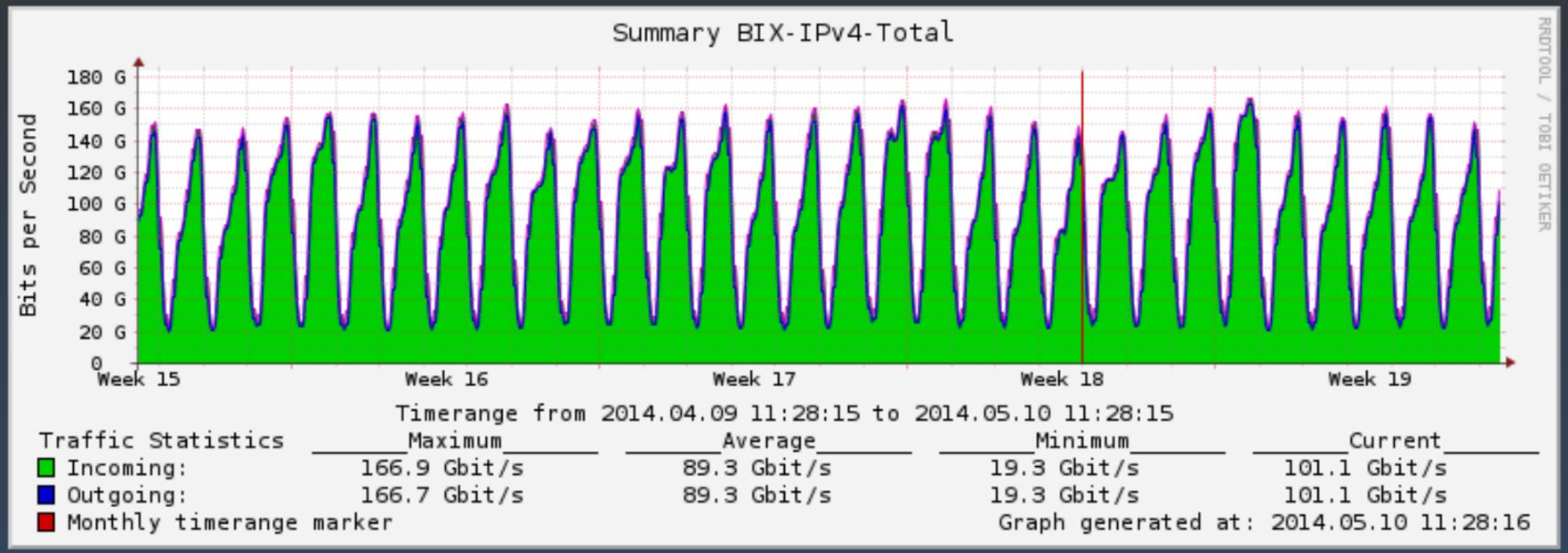


Traffic is far from being constant



Comparison: IPv4

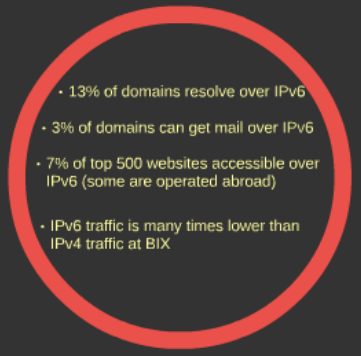
Daily peak around 160 Gbps



Conclusions

There is a large topological diversity:
many ISPs have implemented IPv6 to some extent

There is much room for improvement
in case of all services



Even where IPv6 is available, diversity and therefore probably reliability is much less than in case of IPv4

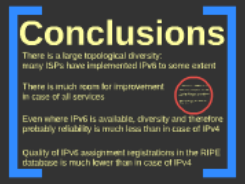
Quality of IPv6 assignment registrations in the RIPE database is much lower than in case of IPv4

- 13% of domains resolve over IPv6
- 3% of domains can get mail over IPv6
- 7% of top 500 websites accessible over IPv6 (some are operated abroad)
- IPv6 traffic is many times lower than IPv4 traffic at BIX

Thank You!

János Zsakó
zsako@iszt.hu

Measurements of IPv6 penetration in Hungary



RIPE 68 Warsaw
IPv6 WG 2014.05.15

János Zsakó CHIP

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