HRVATSKA REGULATORNA AGENCIJA
ZA MREŽNE DJELATNOSTI

IPv6 transition in Croatia

Zagreb, 2024

17 April 2024

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About HAKOM

- HAKOM is an independent national regulatory body in the field of electronic communications postal and railway services;
- HAKOM is governed by the Collegiate Body - the Council, headed by its expert team.
- HAKOM's task is to ensure:
  - market competition, stable growth and room for innovation in the electronic communications and postal service markets,
  - protection of consumer interests and the possibility of selection among several communication and postal services at affordable prices,
  - sustainable competitive conditions for operators and service providers with fair conditions for ROI,
  - support to economic growth, public services and quality of life in Croatia through the introduction of modern technologies.

IPv4 run-out

"Today, at 15:35 (UTC+1) on 25 November 2019, we made our final /22 IPv4 allocation from the last remaining addresses in our available pool. We have now run out of IPv4 addresses."

*Tayfun Ozaltin, RIPE NCC - Basic IPv6, NOG.hr -Tutorial

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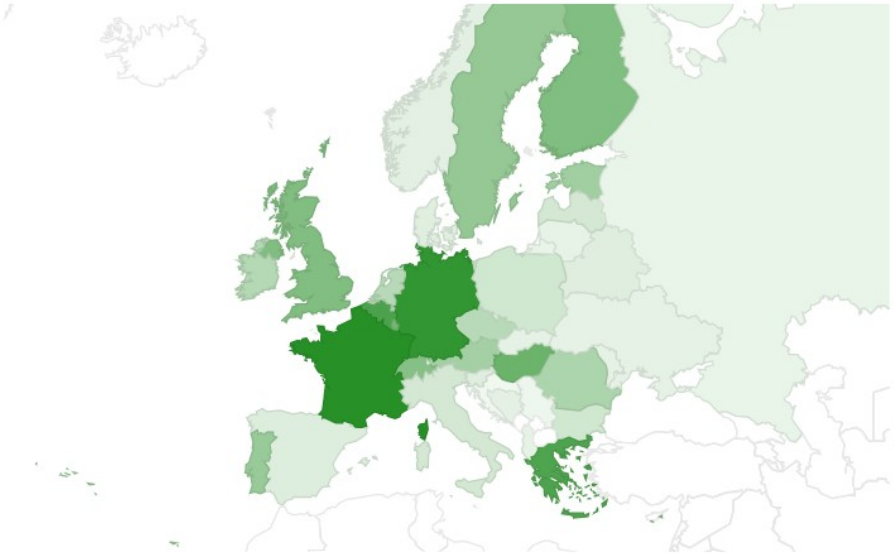
IPv6 adoption statistic

Per-Country IPv6 adoption



World | Africa | Asia | Europe | Oceania | North America | Central America | Caribbean | South America

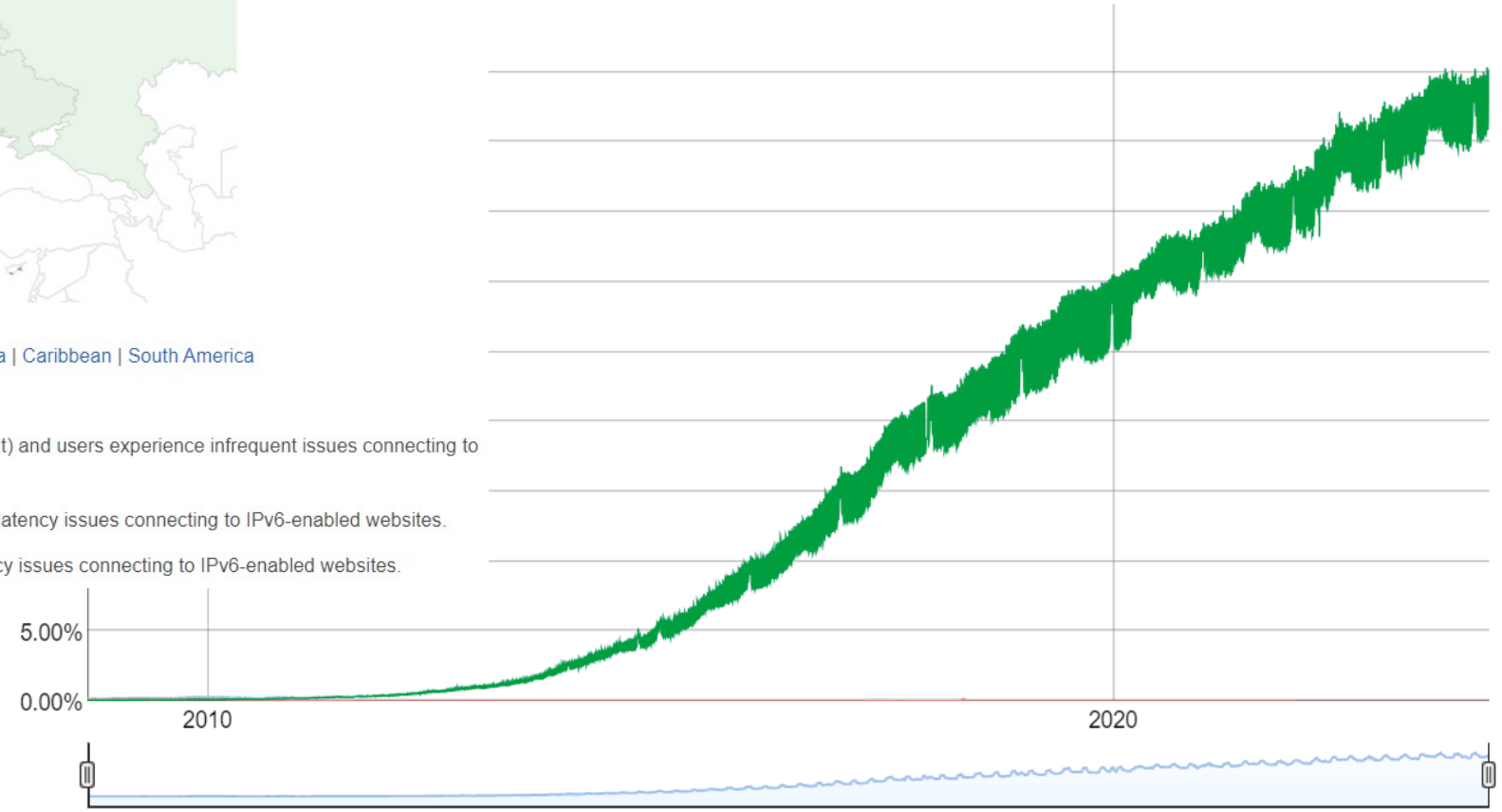
The chart above shows the availability of IPv6 connectivity around the world.

- Regions where IPv6 is more widely deployed (the darker the green, the greater the deployment) and users experience infrequent issues connecting to IPv6-enabled websites.
- Regions where IPv6 is more widely deployed but users still experience significant reliability or latency issues connecting to IPv6-enabled websites.
- Regions where IPv6 is not widely deployed and users experience significant reliability or latency issues connecting to IPv6-enabled websites.

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

connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.

Native: 43.36% 6to4/Teredo: 0.00% Total IPv6: 43.36% | Feb 25, 2024



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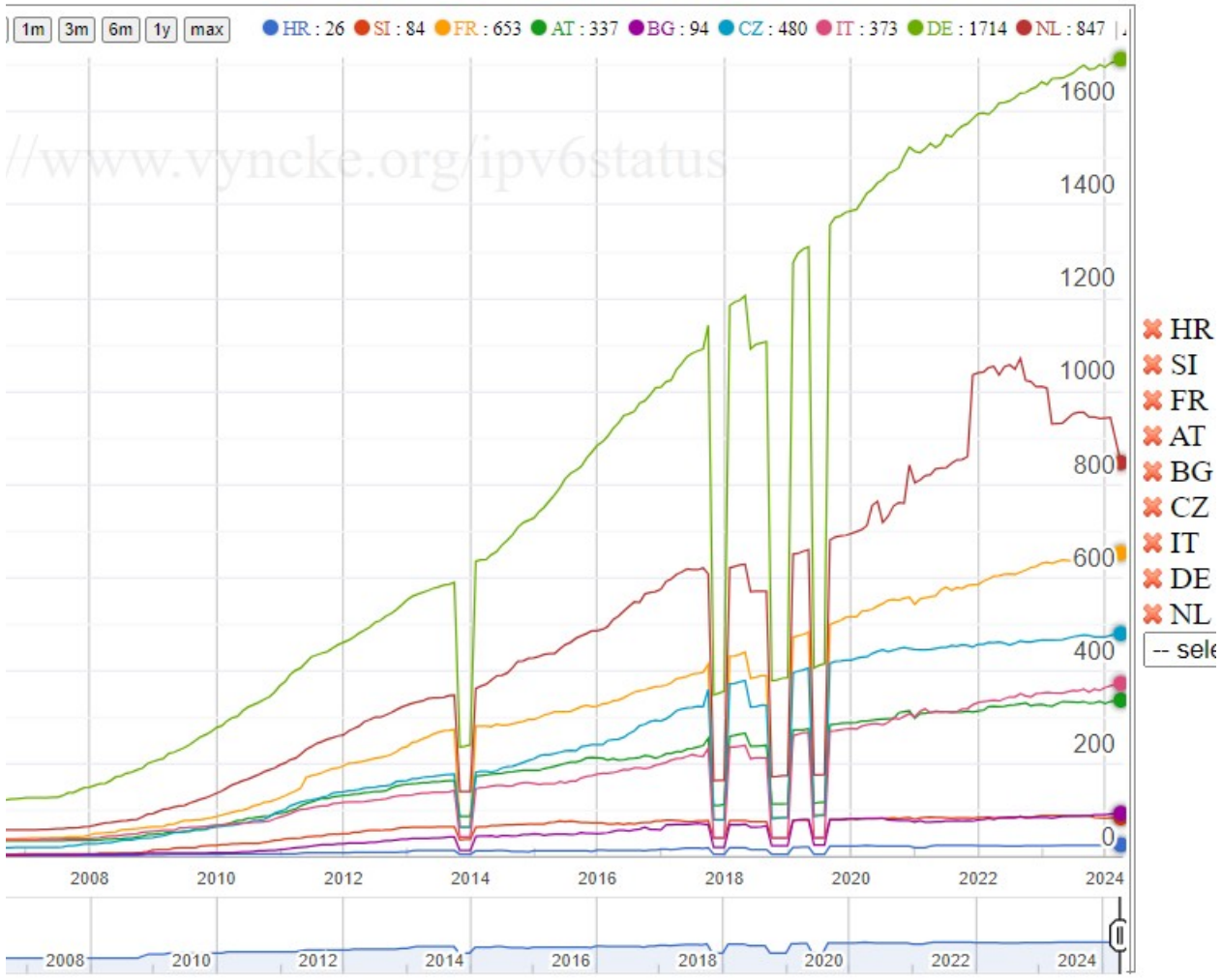
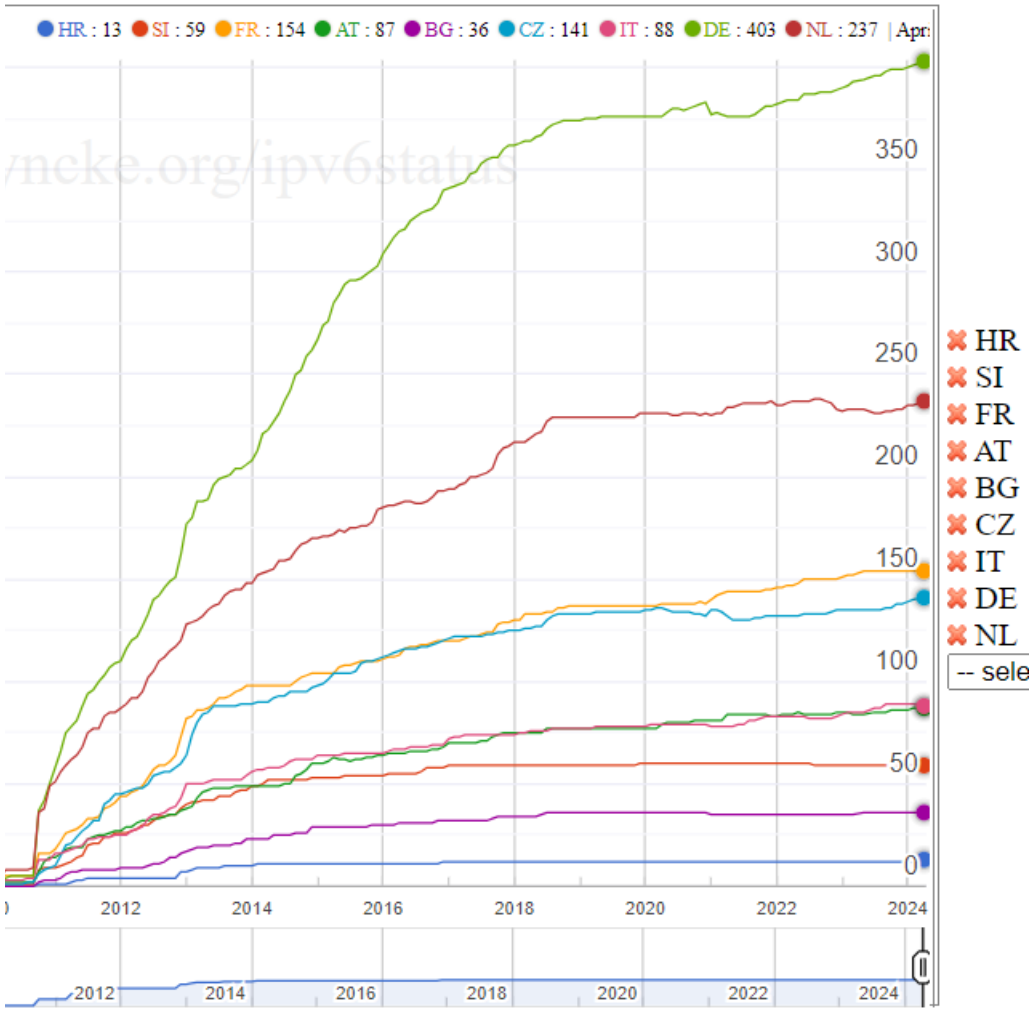
Comparison of IPv6 Announced Prefixes in Different Countries



Comparison of IPv6 Alive Prefixes in Different Countries



Source: https://vyncke.org/ipv6status/

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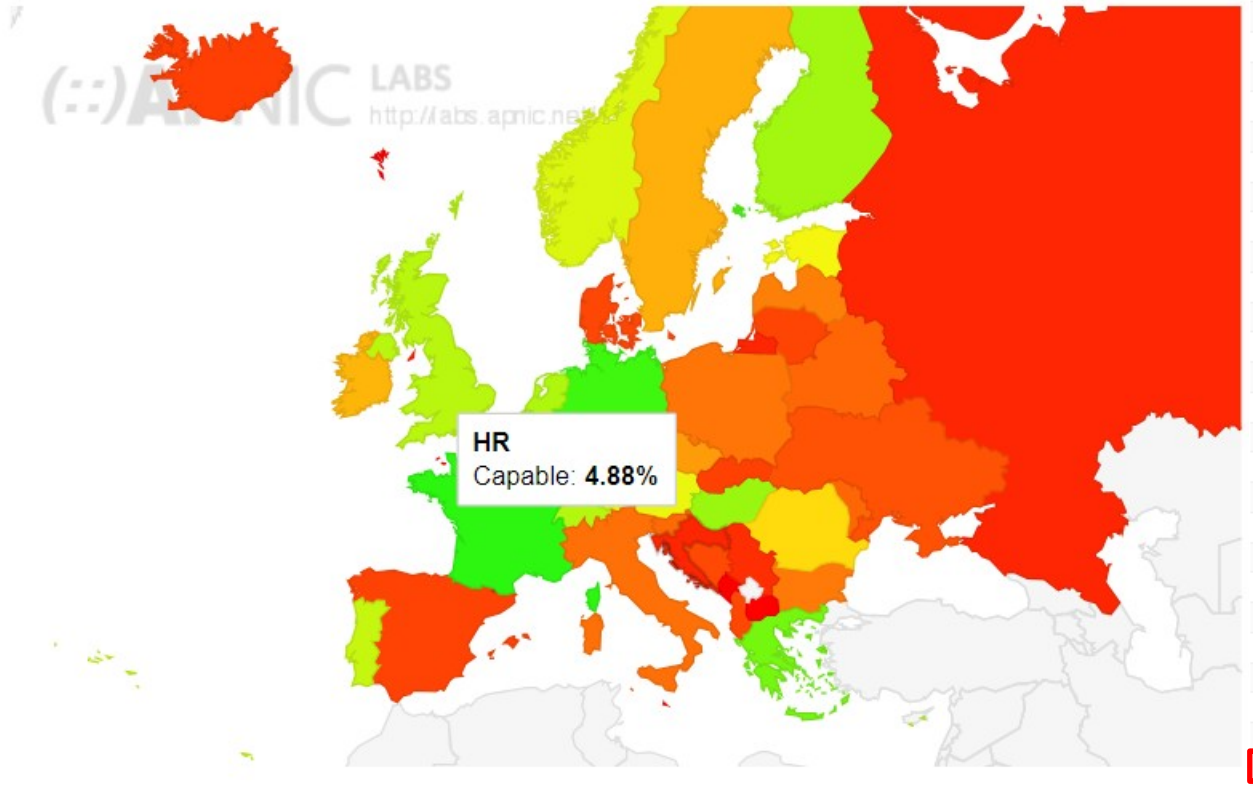
Region Map for Europe (150)



CC	Country	IPv6 Capable	IPv6 Preferred	Samples	Weight	Weighted Samples
FR	France, Western Europe, Europe	69.54%	69.06%	7,474,417	0.97	7,244,582
BE	Belgium, Western Europe, Europe	67.55%	67.14%	1,900,159	0.74	1,399,156
DE	Germany, Western Europe, Europe	66.64%	66.20%	7,437,754	1.27	9,481,621
AX	Aland Islands, Northern Europe, Europe	64.29%	64.11%	7,404	0.29	2,139
GR	Greece, Southern Europe, Europe	57.88%	57.69%	1,846,115	0.55	1,010,410
HU	Hungary, Eastern Europe, Europe	51.69%	51.47%	1,614,100	0.62	1,006,740
FI	Finland, Northern Europe, Europe	50.63%	50.15%	925,679	0.71	654,174
NL	Netherlands, Western Europe, Europe	48.39%	47.82%	2,389,807	0.92	2,202,028
LU	Luxembourg, Western Europe, Europe	47.79%	47.42%	152,673	0.54	82,810
CH	Switzerland, Western Europe, Europe	47.58%	47.32%	586,206	1.99	1,164,390
GB	United Kingdom of Great Britain and Northern Ireland, Northern Europe, Europe	46.65%	46.38%	12,483,927	0.7	8,756,458
LI	Liechtenstein, Western Europe, Europe	46.55%	46.45%	3,242	1.56	5,062
PT	Portugal, Southern Europe, Europe	44.50%	44.21%	2,220,616	0.49	1,081,299
NO	Norway, Northern Europe, Europe	41.06%	35.46%	1,817,410	0.38	696,548
AT	Austria, Western Europe, Europe	38.30%	37.95%	1,032,857	1.08	1,117,920
EE	Estonia, Northern Europe, Europe	36.71%	36.57%	281,741	0.56	158,670
RO	Romania, Eastern Europe, Europe	30.93%	30.83%	2,342,676	0.78	1,835,009
IE	Ireland, Northern Europe, Europe	25.31%	25.14%	1,135,190	0.5	563,529
SE	Sweden, Northern Europe, Europe	24.42%	23.97%	2,498,975	0.56	1,409,468
CZ	Czech Republic, Eastern Europe, Europe	21.52%	21.42%	2,030,632	0.58	1,175,967
LV	Latvia, Northern Europe, Europe	17.34%	17.12%	358,070	0.59	211,213
BG	Bulgaria, Eastern Europe, Europe	16.44%	16.34%	1,315,093	0.49	649,681
PL	Poland, Eastern Europe, Europe	15.83%	15.70%	4,300,486	0.97	4,190,548
IT	Italy, Southern Europe, Europe	15.11%	14.88%	5,763,426	0.89	5,129,086
SI	Slovenia, Southern Europe, Europe	14.19%	14.12%	438,879	0.54	235,702
BY	Belarus, Eastern Europe, Europe	13.73%	13.63%	1,597,579	0.64	1,023,660
MD	Republic of Moldova, Eastern Europe, Europe	13.70%	13.67%	316,830	1.43	452,187
UA	Ukraine, Eastern Europe, Europe	10.79%	10.71%	4,747,090	0.8	3,791,775
BA	Bosnia and Herzegovina, Southern Europe, Europe	9.50%	9.46%	624,235	0.6	376,320
DK	Denmark, Northern Europe, Europe	9.44%	9.29%	1,890,260	0.4	758,422
AL	Albania, Southern Europe, Europe	9.39%	7.52%	1,343,481	0.23	310,026
LT	Lithuania, Northern Europe, Europe	9.03%	8.94%	786,137	0.39	304,346
ES	Spain, Southern Europe, Europe	8.72%	8.62%	4,979,929	1.14	5,685,201
SK	Slovakia, Eastern Europe, Europe	8.57%	8.52%	759,732	0.82	620,311
IS	Iceland, Northern Europe, Europe	8.14%	7.70%	149,491	0.3	45,033
RS	Serbia, Southern Europe, Europe	6.03%	5.99%	2,555,499	0.35	882,656
HR	Croatia, Southern Europe, Europe	4.88%	4.84%	514,154	0.66	341,268
RU	Russian Federation, Eastern Europe, Europe	4.86%	3.96%	85,295	186.76	15,929,979
IM	Isle of Man, Northern Europe, Europe	4.18%	4.17%	28,507	0.22	6,270
MC	Monaco, Western Europe, Europe	0.65%	0.27%	2,928	1.81	5,290
GG	Guernsey, Northern Europe, Europe	0.45%	0.45%	11,357	0.41	4,647
JE	Jersey, Northern Europe, Europe	0.32%	0.32%	34,889	0.37	12,821
FO	Faeroe Islands, Northern Europe, Europe	0.17%	0.17%	19,529	0.34	6,632
AD	Andorra, Southern Europe, Europe	0.14%	0.14%	16,017	0.65	10,437
MK	North Macedonia, Southern Europe, Europe	0.12%	0.12%	825,718	0.28	230,316

Source: https://stats.labs.apnic.net/ipv6/XE?o=cXEw30x1r1

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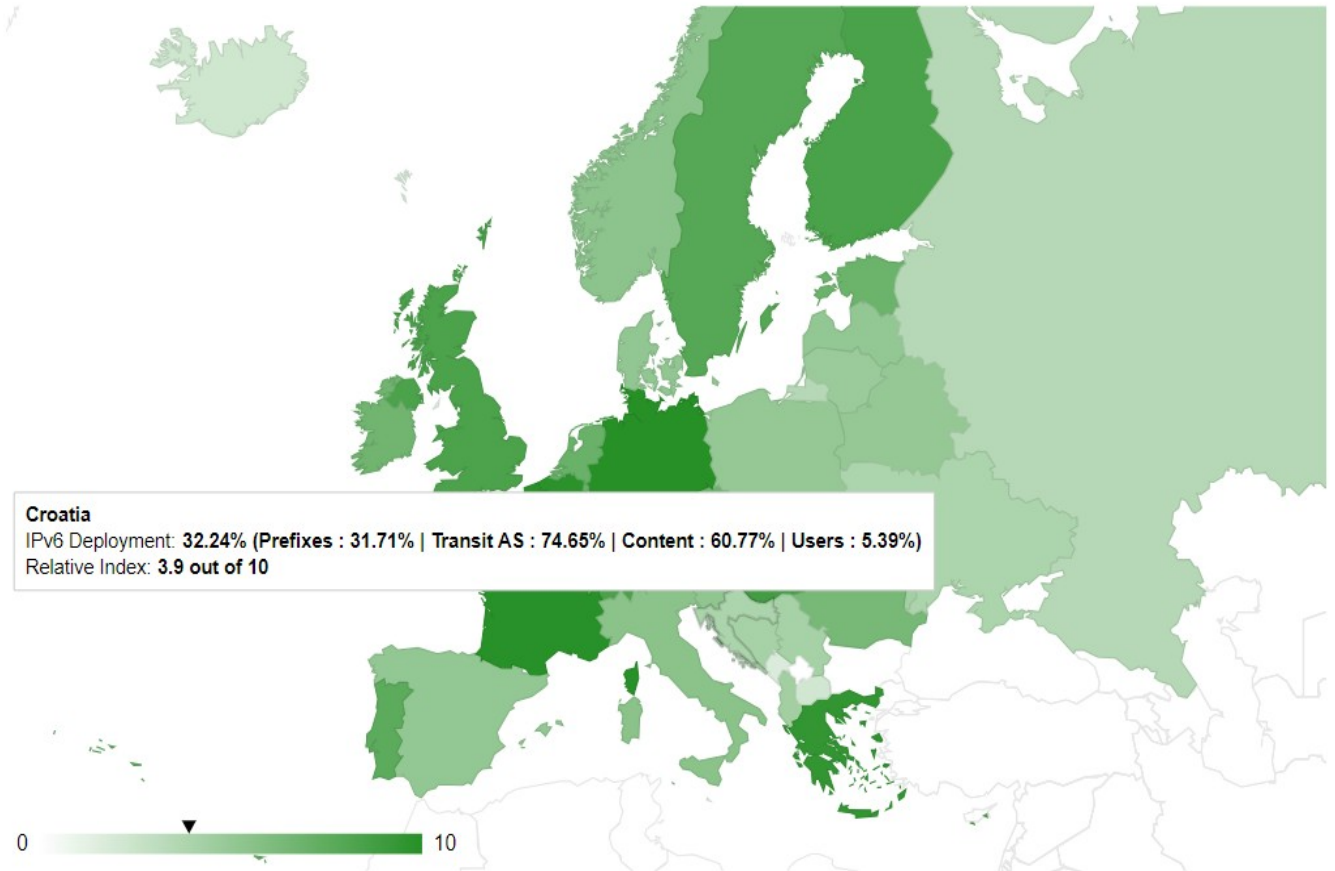
IPv6 adoption statistic

Updated on 2024-4-5

Display global data

World | Africa | Asia | America | Europe | Oceania

Northern Europe | Western Europe | Eastern Europe | Southern Europe



Source: https://6lab.cisco.com/

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Findings from an BEREC internal questionnaire

The Body of European Regulators for Electronic Communications (BEREC) - contributes to the development and better functioning of the internal market for electronic communications networks and services in order to bring benefits to consumers and businesses. Assists the European Commission and the National Regulatory Authorities in implementing the EU regulatory framework.

- IPv6 deployment is still rather fragmented across Europe
  - No harmonised approach at European level
  - Progress in some countries, no progress in other
- Differences with regard to competencies in the transition to IPv6
  - No NRA has a specific mandate for IPv6
  - In some countries the responsibility in this matter still lies within a public authority, while in others it is up to the industry or it is subject to self-regulation
- Public IP addresses are needed so that
  - end-users can use and provide services of their choice and
  - internet continues to function as an engine for innovation
- Various actions taken at national level

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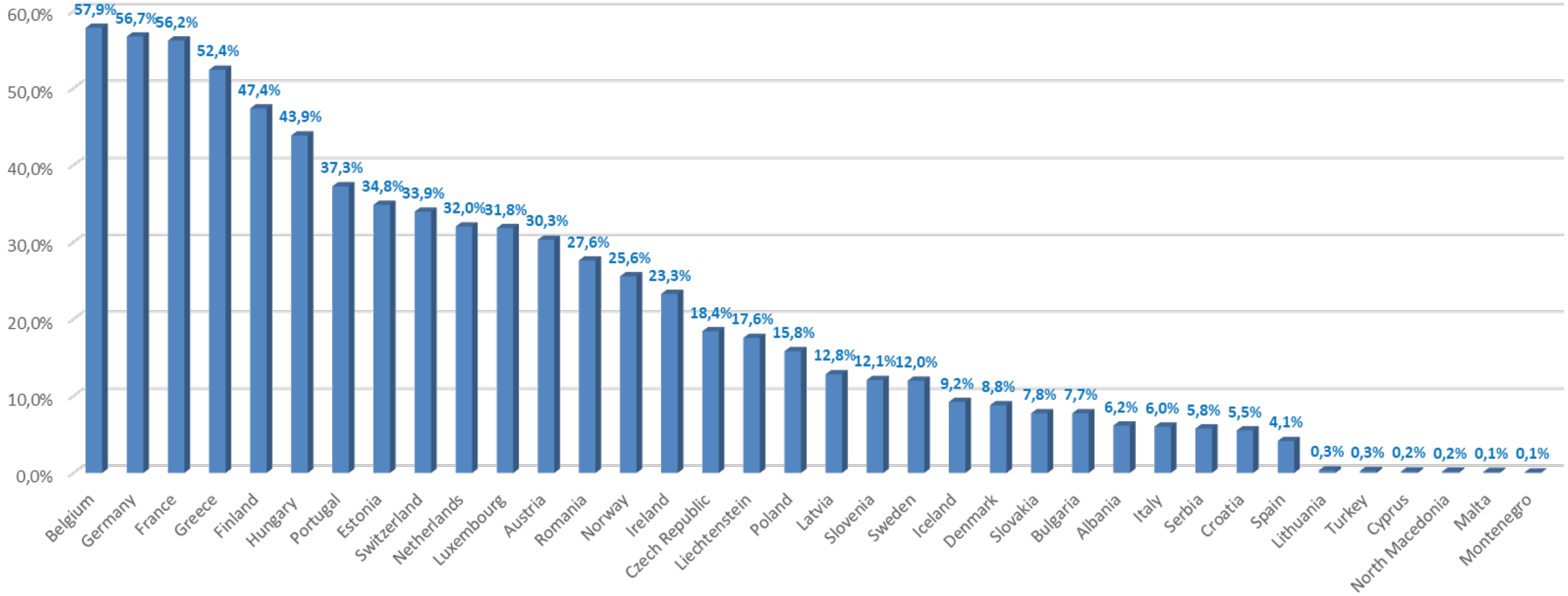
IPv6 deployment across BEREC members and participants



Source : "Google IPv6 adoption", "Facebook IPv6 adoption", "Akamai IPv6 adoption" and " Apnic IPv6 preferred" median value as of 30 September 2022.

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Internal report on a preliminary assessment of the transition to IPv6 in Europe

- Examples of some actions already put in place by NRAs or the public authority in charge of the transition to IPv6 in Member States include:
  - Obligation for state bodies to have e-gov services and website also on IPv6, applicable since 2009 (CZ);
  - Obligation for the national ccTLD29 (.dk) to be able to handle IPv6 and as of 1 July 2020 to promote nationally the IPv6 adoption (DK);
  - Launch of the transition to IPv6 for the NRA's public address (IT);
  - Constant discussions with communications sector players to speed up introduction of IPv6 and to promote introduction of IPv6 in public administration (LV);
  - Promotion of the transition to IPv6 facilitated by a specific platform and launch of a financial incentive-arrangement to stimulate local registrars on transition to IPv6 (NL);
  - Organisation of a workshop to promote the debate towards IPv6 and initiative of the NRA to adopt IPv6 internally (PT).

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Assessment of IPv6 readiness of ISPs in Croatia - questionnaire results -

- The purpose of the questionnaire was to obtain information about the respondents' knowledge of IPv6 technology, as well as status of and plans for IPv6 deployment.

- The main aspects covered by the questionnaire are:
  - technology (knowledge and equipment),
  - cost,
  - motivation,
  - security concerns and
  - transition strategy

- The questionnaire consists of six sections:
  - general (administrative) information,
  - knowledge and understanding of IPv6 technology,
  - reasons for not planning or postponing the transition to IPv6,
  - IPv6 deployment planning, needs, and current status,
  - IPv6 deployment in network infrastructure and services, and
  - general feedback/comments.

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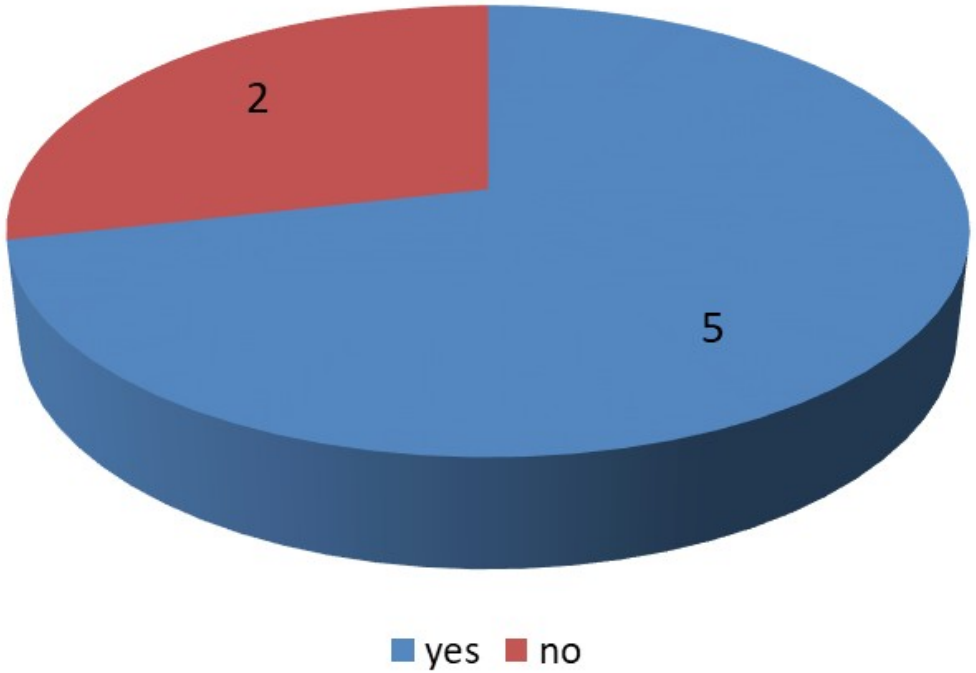
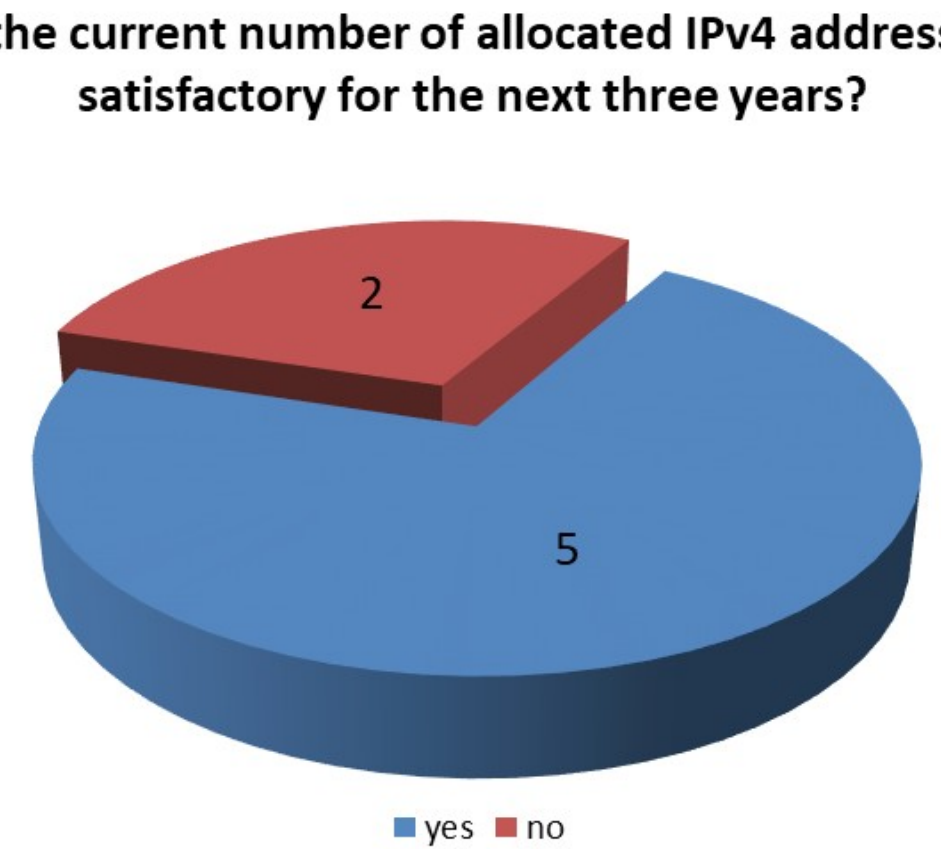
Findings from an HAKOMs questionnaire





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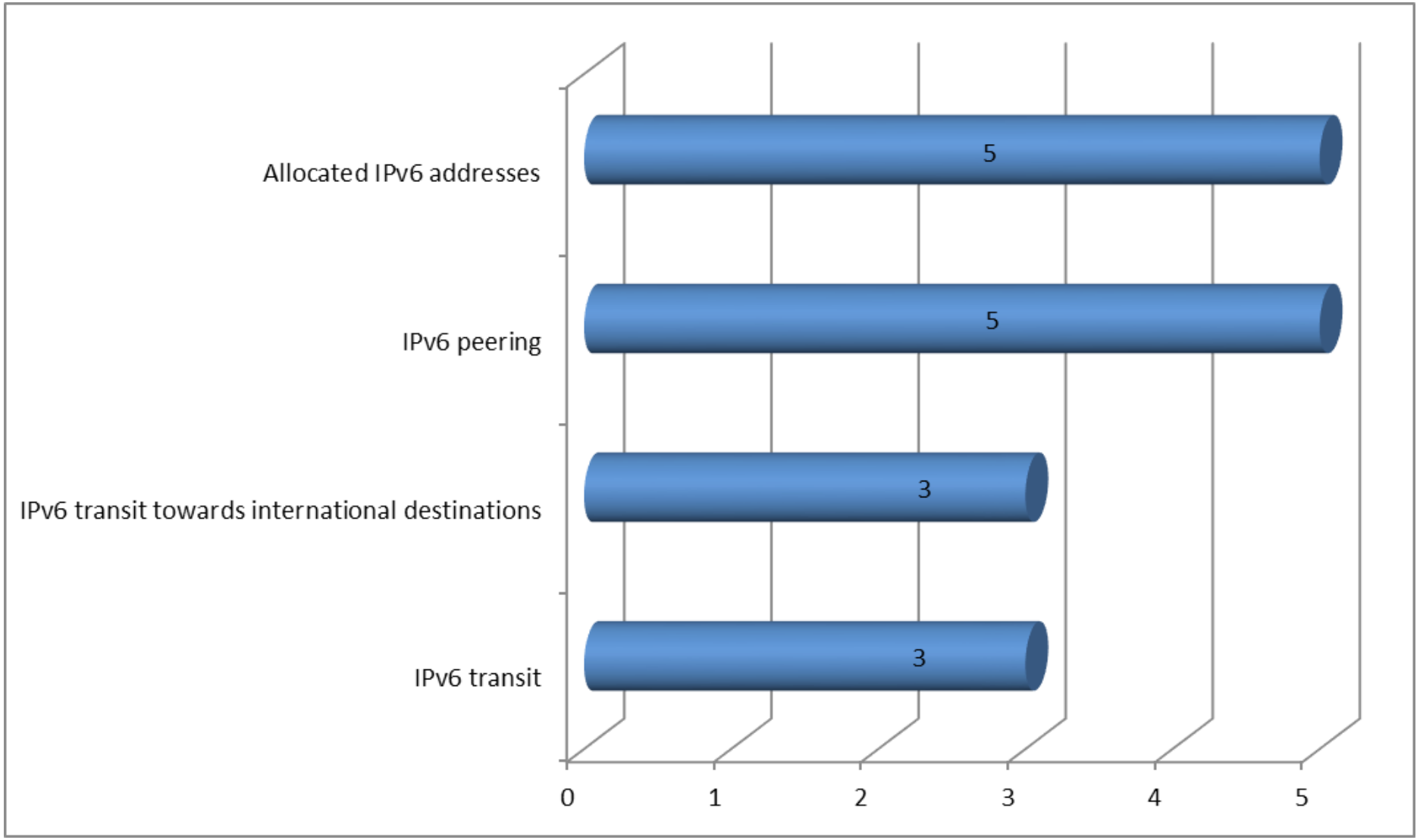
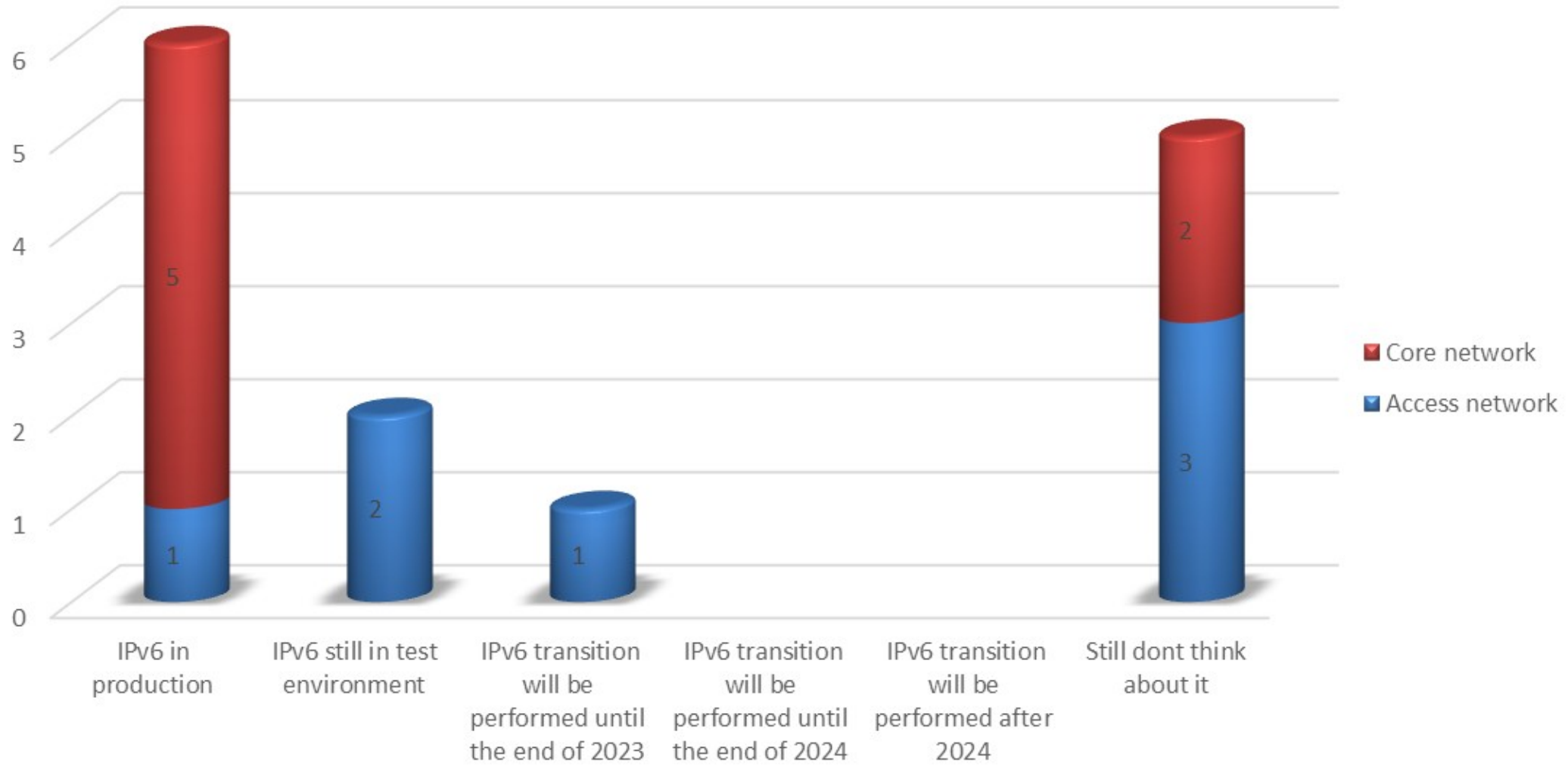
Status of IPv6 deployment

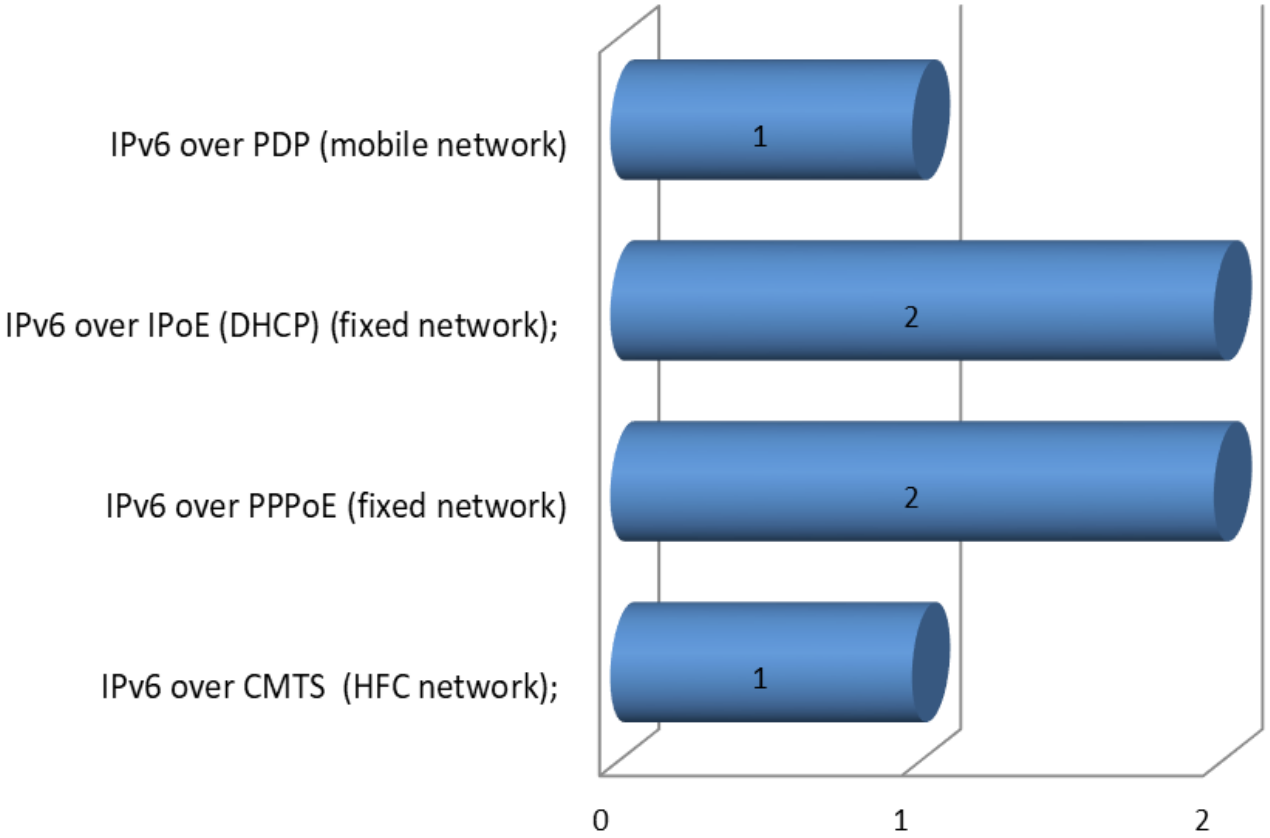


IPv6 connectivity

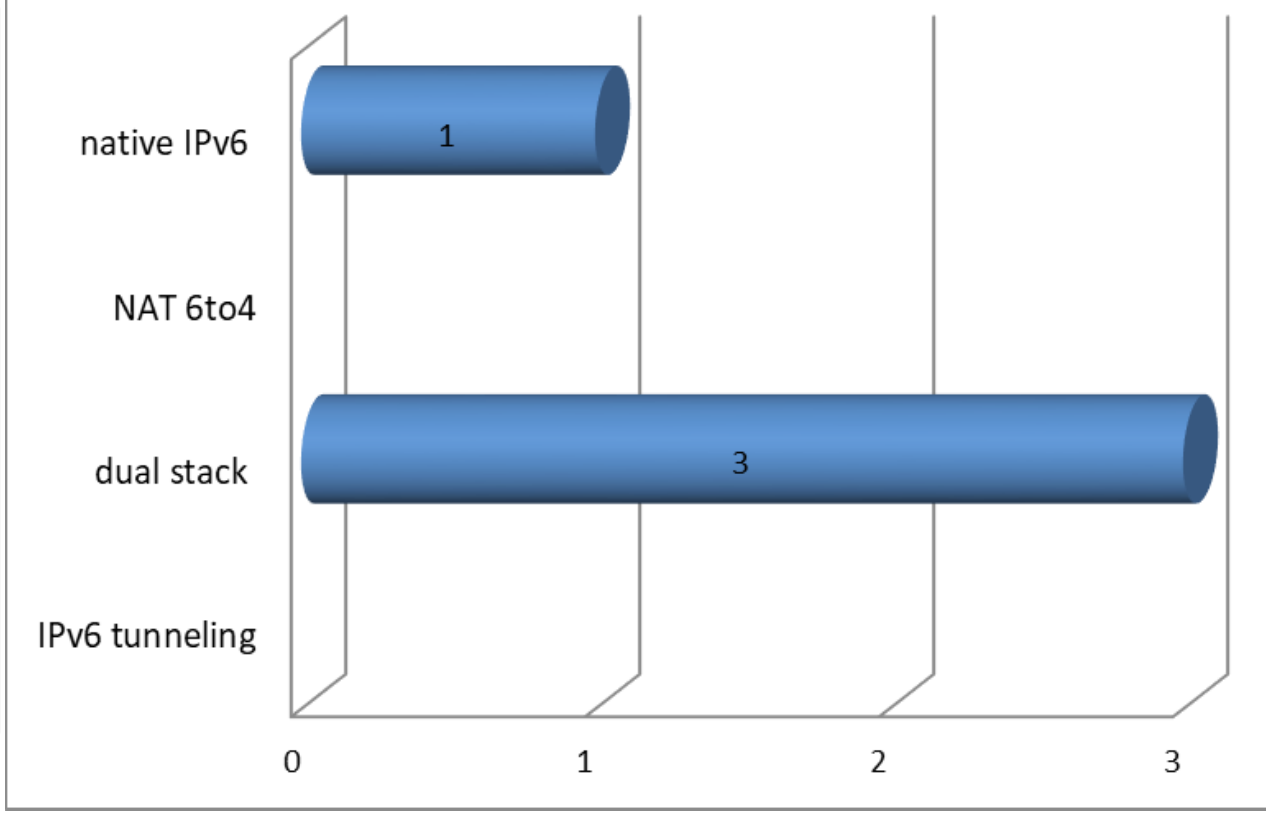


IPv6 network infrastructure

Access network



Core network



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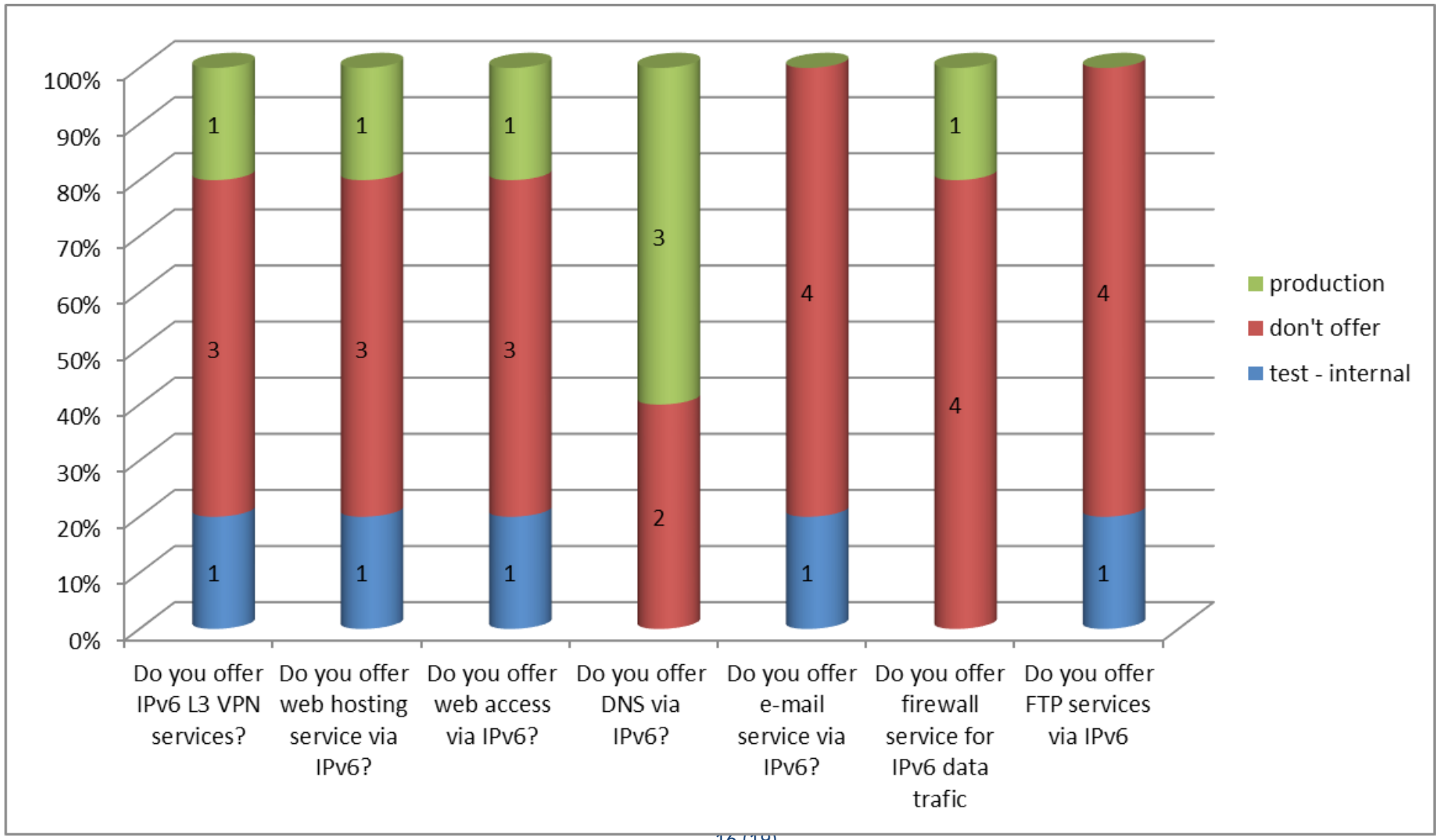
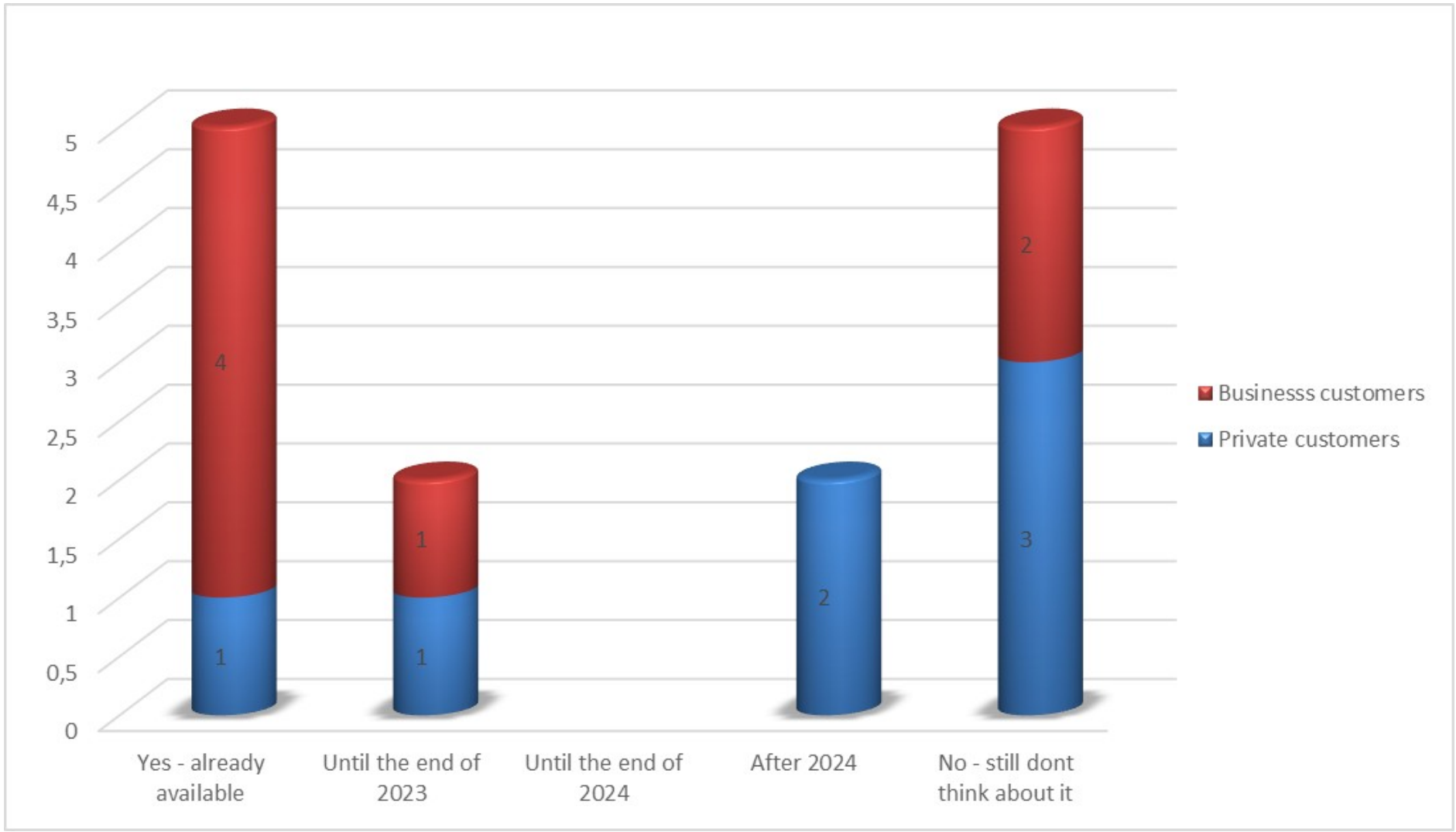
Service provisioning over IPv6



Number of ISPs that offer IPv6 connectivity for customers



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Conclusion

- The IPv6 adoption in Croatia is way below the European and global average.
  - lack of incentive for operators/providers to supply and offer IPv6
  - decisions and funding for the deployment of IPv6 is not prioritised in organisations
- HAKOM can act within its authority to promote and to raise awareness of IPv6 in Croatia and ensure competition.
- Successful IPv6 deployment should be led by the private sector, provided that the private sector recognizes that adopting IPv6 is an investment for the future.
- Need for establishing a forum for stakeholders in the IPv6 value chain?
  - facilitating information and best practices sharing between different stakeholders;
  - working on concrete deliverables to help different actors in their transition.

Thank you!

Panel rasprava - Iskustva operatora i preporuke za nacionalni pristup u RH za promociju IPv6

Panelisti: Dejan Jakšić (Cisco), Mario Ravnjak (Hrvatski Telekom d.d.), Nenad Tomašević (A1 Hrvatska d.o.o.), Vanja Papug (SDURDD)

Moderator: Vesna Gašpar (HAKOM)