

IETF

IPv6 Forum

IPv6 Deployment Status: An IETF Operational View

draft-ietf-v6ops-ipv6-deployment

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Agenda

1. Background of the analysis
2. Main findings and remaining challenges
3. New areas of research
4. Conclusions

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Background of the analysis

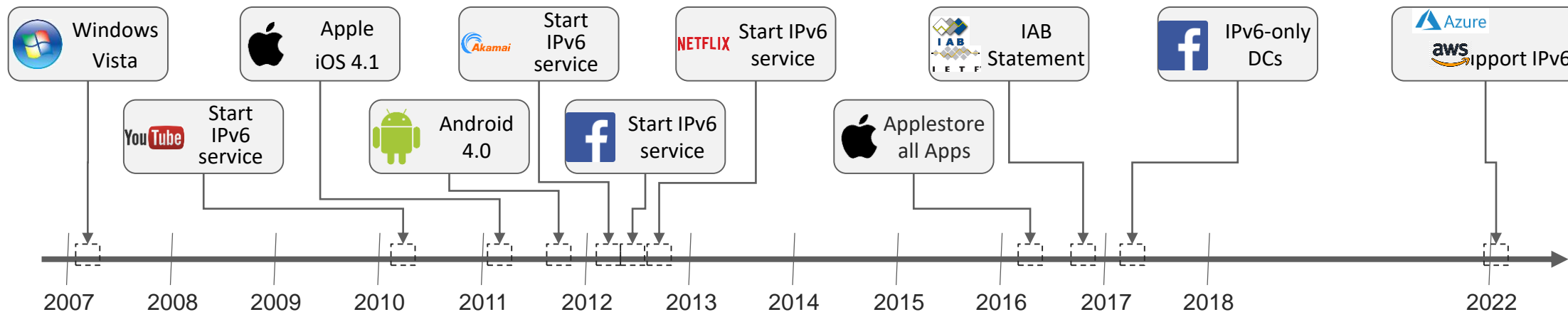
- The analysis done by the soon-to-become RFC is twofold.
- First, it provides **the status of IPv6 deployment worldwide**.
 - Show the progression of IPv6 in the last ten years, since the publication of RFC 6036.
 - Provide the Industry a one-stop place to get relevant information for their plans and activities.
- Second, it discusses **the remaining challenges** for IPv6 adoption.
 - Highlight both the technical and non-technical areas hindering the transition to IPv6.
 - Propose further investigations to foster new researches to support the transition to IPv6.

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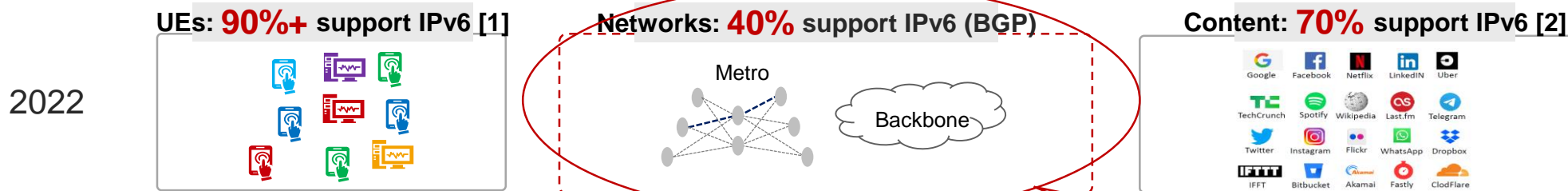
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IPv6 Value Chain and Open Questions

IETF transition solutions ready by 2010; UEs & big applications ready by 2017; public clouds getting ready in 2022 to move SMEs to IPv6



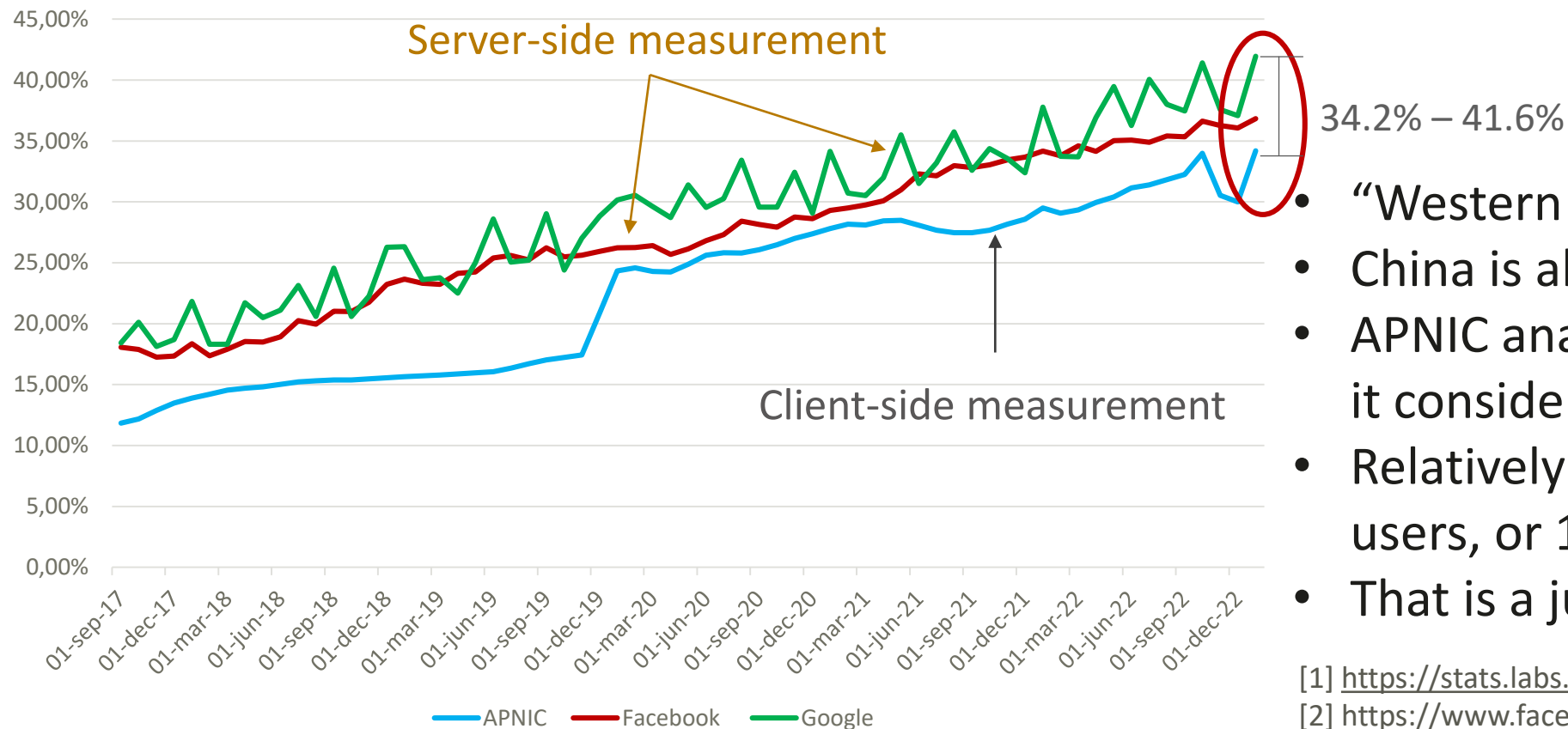
In IPv6 value chain, networks behind UEs and big applications/clouds



Question: why networks are still low?
Who is missing?

First finding: the IPv6 value chain is ready. Open aspects: IPv6 in Cloud and networks.

IPv6 Users' Sessions – World (January 1, 2023)



- “Western world” view.
- China is also active in IPv6 [4].
- APNIC analytics used because it considers the client side.
- Relatively to it, add ca. 480M users, or 11%.
- That is a jump to 45%.

[1] <https://stats.labs.apnic.net/>

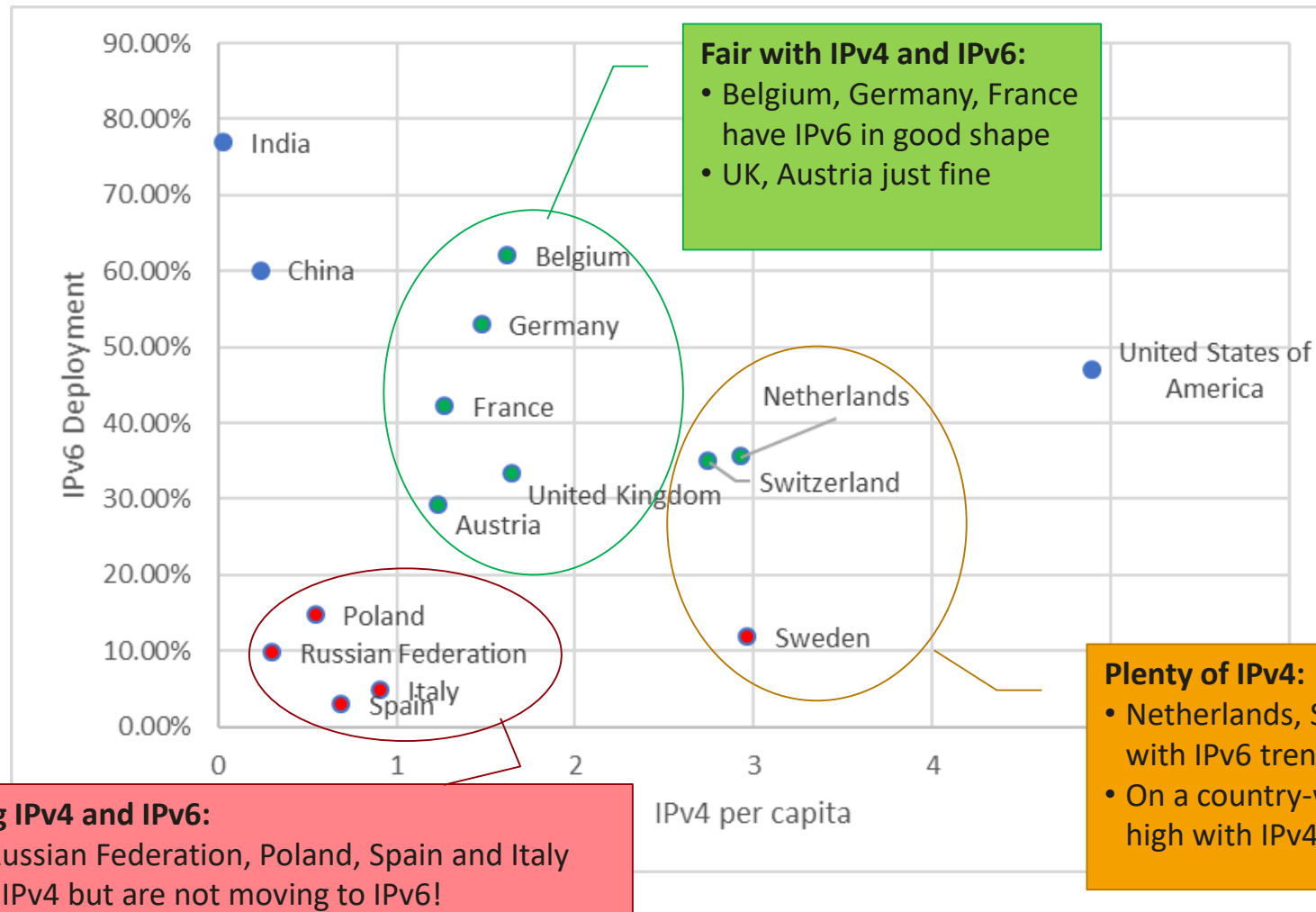
[2] https://www.facebook.com/ipv6/?tab=ipv6_country

[3] <https://www.google.com/intl/en/ipv6/statistics.html>

[4] <https://www.china-ipv6.cn/>

Second finding: the growth of IPv6 users is steady, pushed by need of addresses and government policies.

IPv4 per Capita versus IPv6 Adoption: No Direct Correlation (May 22). Company Ambition & Government Policies Matter More



- Is the lack of IPv4 addresses a reason for deploying IPv6?
- In Europe no direct correlation.
- **Red** Country: quite below the world IPv6 trends (lack of actions)
- **Green** Country: close or above the world trends.

Third finding: if governments, industry, market take actions then IPv6 moves ahead, as in Belgium, France, Germany.

Remaining Challenges

- Knowledge
 - IPv6 perceived as more complex than IPv4 in ICT environments.
 - Lack of proper training, in particular in higher education.
- Motivation
 - Enterprises still lagging behind, often lacking the business motivation.
 - Cloud providers started to provide IPv6 services, IPv4 still dominant for businesses.
- Technical and Operational
 - Multiple choices in selecting the transition mechanisms.
 - Management and Operations impacts.
 - Performance not yet clearly in favor of IPv6.
 - Security and Privacy still not perceived at the same level of IPv4.

Fourth finding: areas still remain where the Public sector can do a lot to create conditions in favor of IPv6.

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From IPv6 Sessions to IPv6 Traffic

- The IPv6 analytics currently available measure adoption by **users** or **sessions**.
 - Provided by Regional Internet Registries (RIR) and Content Delivery Networks (CDN).
- A much more effective analytic is the measurement of **IPv6 traffic** (e.g., in Gbit/s).
 - The knowledge of traffic gives an immediate indication of IPv6 status in a network.
 - Not an easy task. Carriers seldom advertise their traffic analytics.
- A research on how to compute IPv6 traffic is proposed.
 - It takes the available analytics as an input, complemented by statistics.

The IPv6 traffic volume is the ultimate KPI to effectively understand its adoption.

IPv6 Traffic Volume Computation – The Model

A theoretical model to compute the traffic percentage:

$$IPv6_traffic\% = f(IPv6_user\%, IPv6_content\%, IPv6_connectivity_factor\%)$$

Where:

<i>IPv6_user%</i>	is the percentage of IPv6 users in country X or operator Y's network measured by APNIC.
<i>IPv6_content%</i>	is the content available by IPv6.
<i>IPv6_connectivity_factor%</i>	reflects the capability for IPv6-capable users to reach IPv6-available content.

This model is still under study. Collaboration is welcome.

Connectivity_factor as a Measure of the IPv6 Network Quality

- Connectivity_factor_% is key to measure/assess the “quality” of an IPv6 network.
 - If it is equal to 100%, then the probability to reach an IPv6 content is 1.
 - We expect it not to be 100% due to the technical issues still affecting the current networks.
- The reasons for the connectivity being less than 100% may be related to:

Higher latency	MTU issue
Worse peering	DNS
High packet loss	Configuration error

- Our expectation is that Connectivity_factor of a typical European network is between 85% and 95%.

We would be happy to get the carriers' view on their IPv6 traffic % and collaborate on the connectivity analysis

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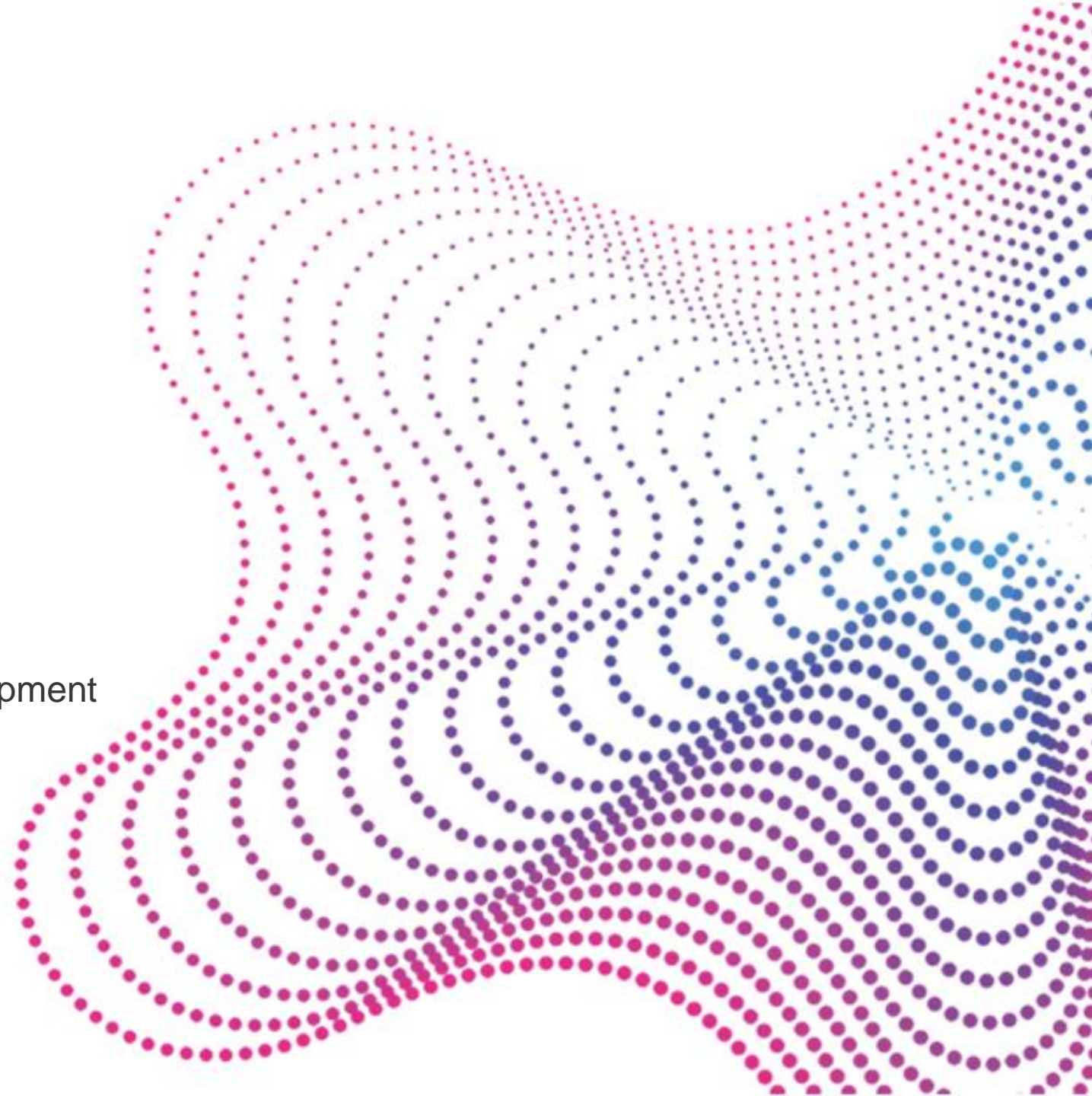
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Conclusions and Further Activities

- The good signs
 1. IPv6 is approaching the critical threshold of 50% users.
 2. Awareness in public and private sectors on the need to transition to IPv6 is also increasing.
- The still bad signs
 1. Enterprises and verticals are still relying mainly on IPv4.
 2. Governments and Authorities are, in some cases, doing little to stimulate IPv6 adoption.
- New areas of research
 1. Moving from measuring users/session to real traffic would be more effective to feel the pulse of IPv6 status.
 2. We are actively looking for more cooperation and collaborations in this domain.

Thank you

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Brief History of draft-ietf-v6ops-ipv6-deployment

- **Editors:** Giuseppe Fioccola (Huawei SID), Paolo Volpato (Huawei SID).
- **Co-Authors and Contributors:** Jordi Palet Martinez (The IPv6 Company), Gyan Mishra (Verizon Inc.), C. Xie (China Telecom), Nalini Elkins (Inside Products), Sébastien Lourdez (Post Luxembourg).
- The first bulk of analytics on IPv6 deployment collected and analyzed in 2019-2020.
 - Support ETSI White Paper “IPv6 Best Practices, Benefits, Transition Challenges and the Way Forward”.
- Topic proposed and discussed into IETF v6ops Work Group during 2020.
 - Individual draft presented at IETF 109 (virtual, November 2020) for the first time.
- Adopted as v6ops WG draft in March 2021.
 - WG last-call completed in September 2022.
 - Entered RFC-Editor queue in December 2022.
 - Expected to be published as an RFC in February-March 2023.