

IPv6 in criminal investigations at an MNO

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3 Sweden



Agenda

- ① All IP
- ② Mobile devices on the internet
- ③ Some IP statistics from 3 Sweden
- ④ CGNAT
- ⑤ Identify mobile users on the Internet
- ⑥ IP in criminal investigations



Palle Kongerslev

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MScEE Telecommunications
Technical University of Denmark
1996

Ericsson 1996-2007
3Scandinavia 2007-2025

I enjoy skiing, hiking,
padel, good food in the
company of friends
and family

Participated in the
introduction of
IPv6 and
dualstack in
3SE's mobile
network

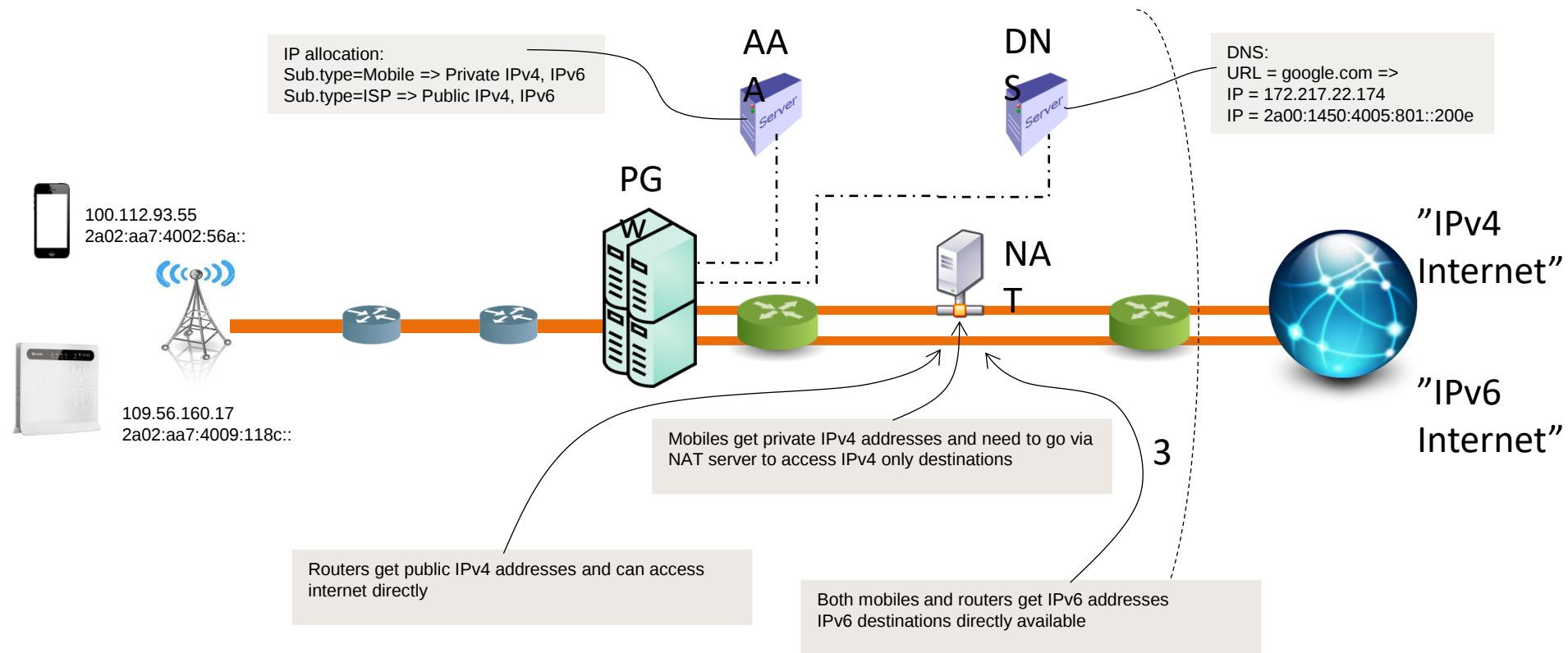


All IP

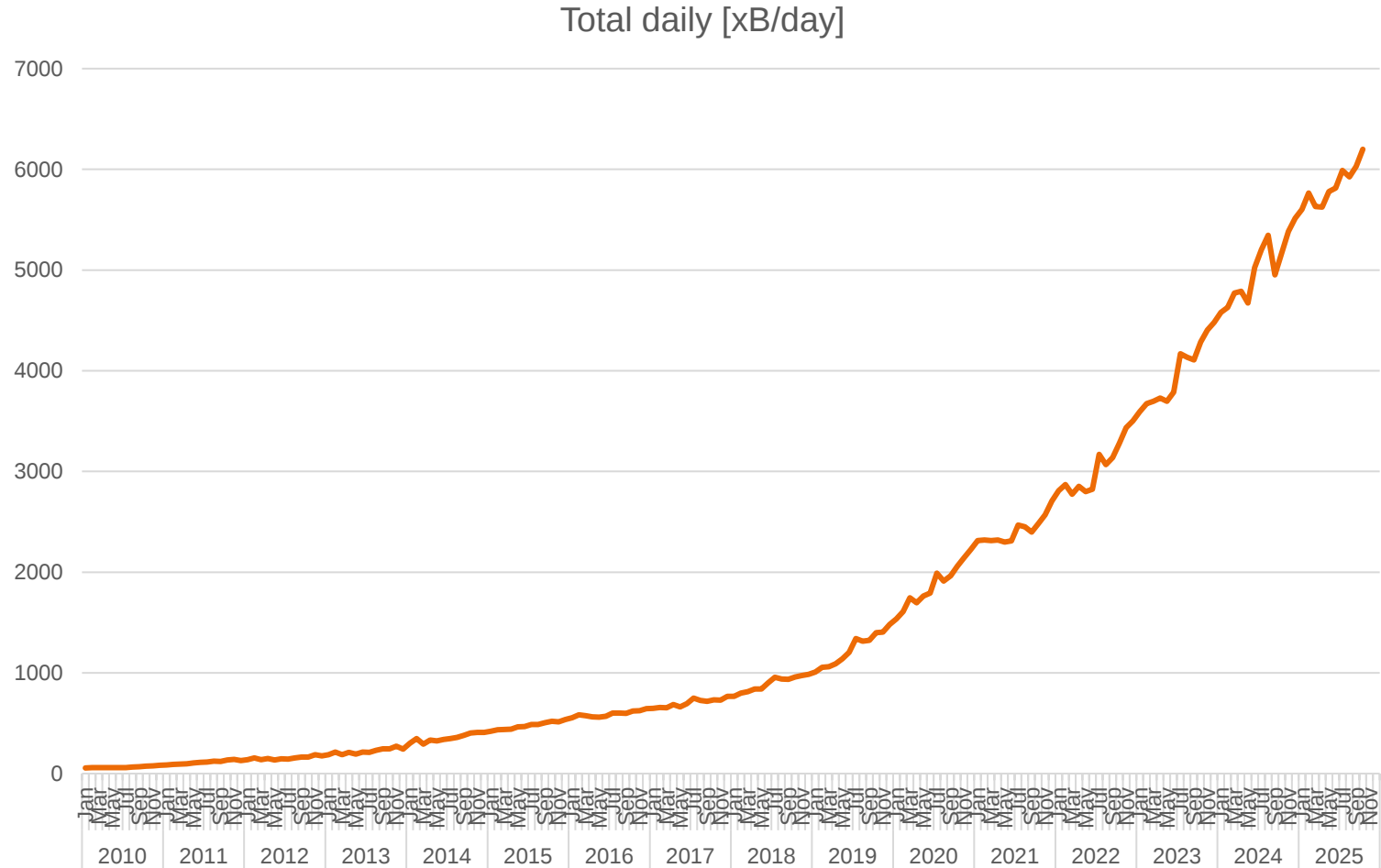
- From a Mobile Network Operator (MNO) perspective, "All-IP" was formulated in 3GPP release 4 to allow the Circuit Switched domain to run on IP in an "IP based Core" – this was in 2001
- With the standardization of IMS in 3GPP release 5 voice, video and messaging became truly IP based – this was in 2002
- LTE standardization was finalized around 2008 in 3GPP release 8 – now even 3GPP access (Radio Access Network) was "All IP", and everything runs on IP
- In parallel Apple launched the Iphone in 2007 and started the smart-phone era of users being online continuously and orchestrating their lives via apps and webpages most of the time adapted for the handheld screen. The mobile networks over time became equivalent to IP broadband networks.
- Two aspects of the mobile users' activities with their mobile devices leave footprints especially interesting in criminal investigations: location (not related to IP), and the IP connection information
- IP Connection: source IP, source port, destination IP, destination port and protocol



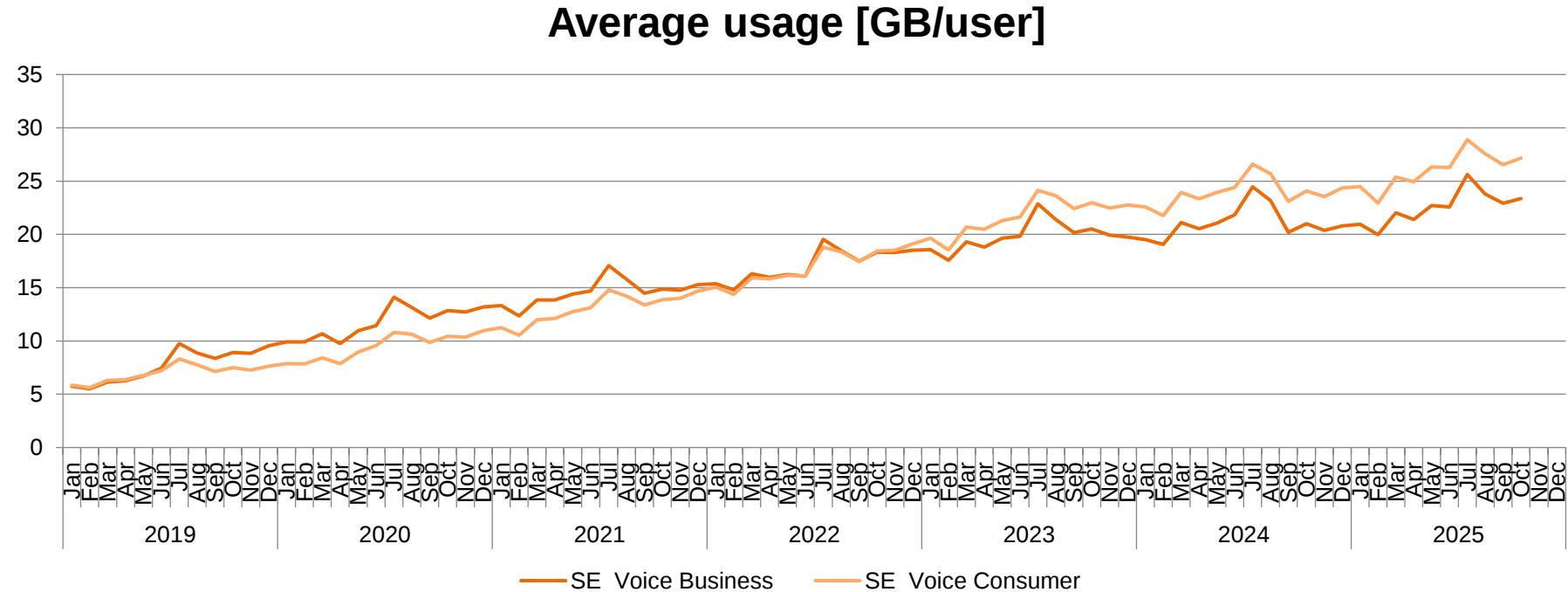
Mobile devices on the internet



Average network data usage

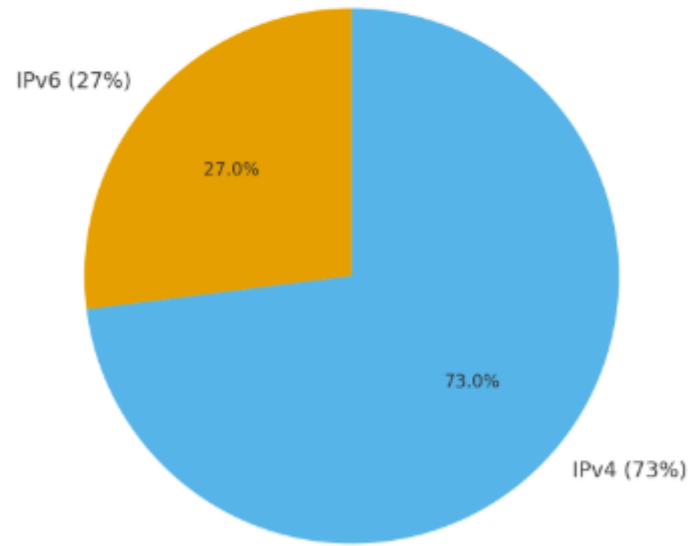


Average data usage per user

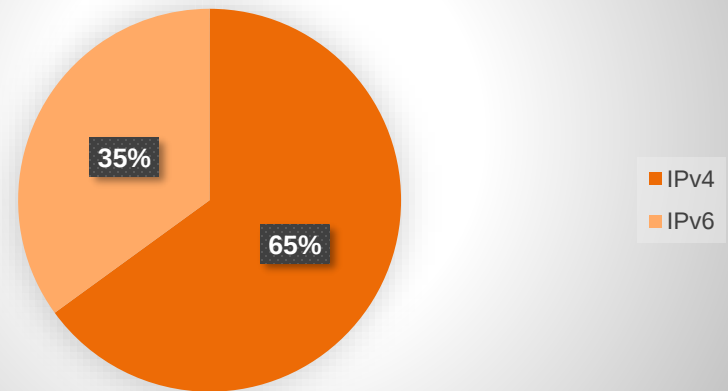


IPv6 in Sweden

IPv6 vs IPv4 Usage in Sweden (Approx., 2023–2024)

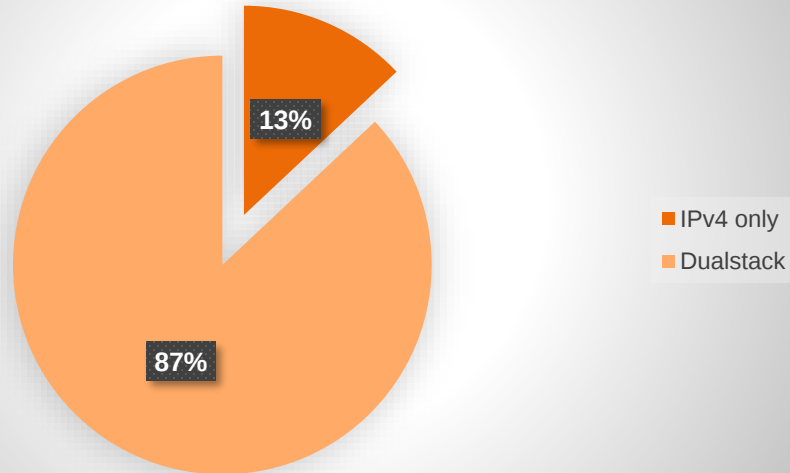


3SE: IPv4 vs IPv6 data volume 10-2025

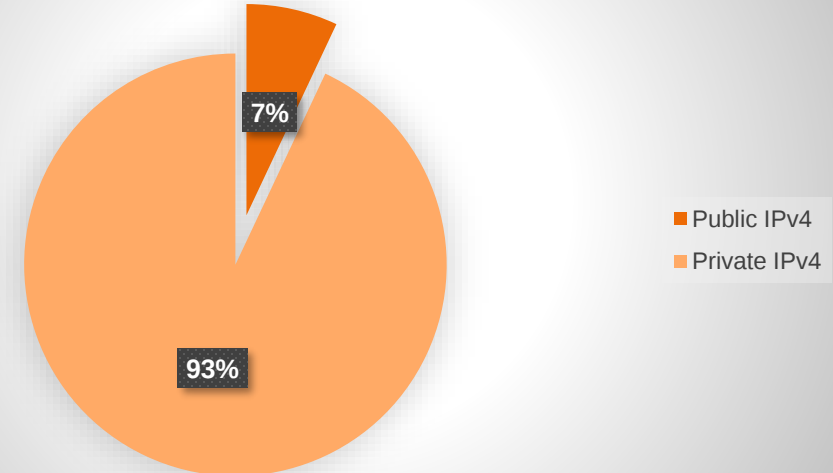


IP versions at 3 Sweden

PDN Types in 3SE 11-2025

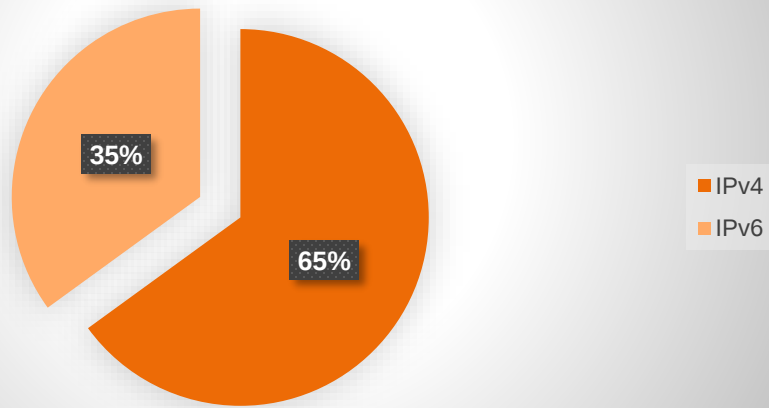


IPv4 type distribution 3SE 11-2025

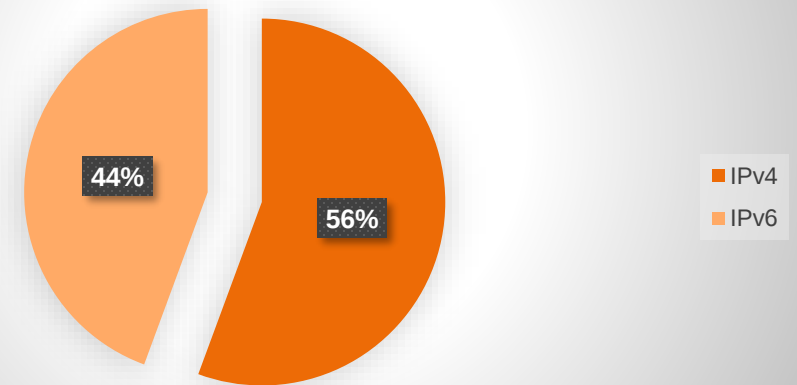


IPv6 at 3 Sweden

3SE: Volume per IP version
10-2025



3SE: Connections per IP Version
10-2025



Dualstack introduced end 2017

[Nyhetsarkiv](#) [Mediearkiv](#) [Event](#) [Kontakt](#)



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Tre framtidssäkrar nätet med nästa generations internetprotokoll IPv6

Mobiloperatören Tre har implementerat och aktiverat nästa generations internetprotokoll IPv6, vilket innebär en rejäl ökning av tillgängliga publika IP-adresser - en viktig faktor inför lanseringen av 5G och utvecklingen av IoT (Internet of Things).

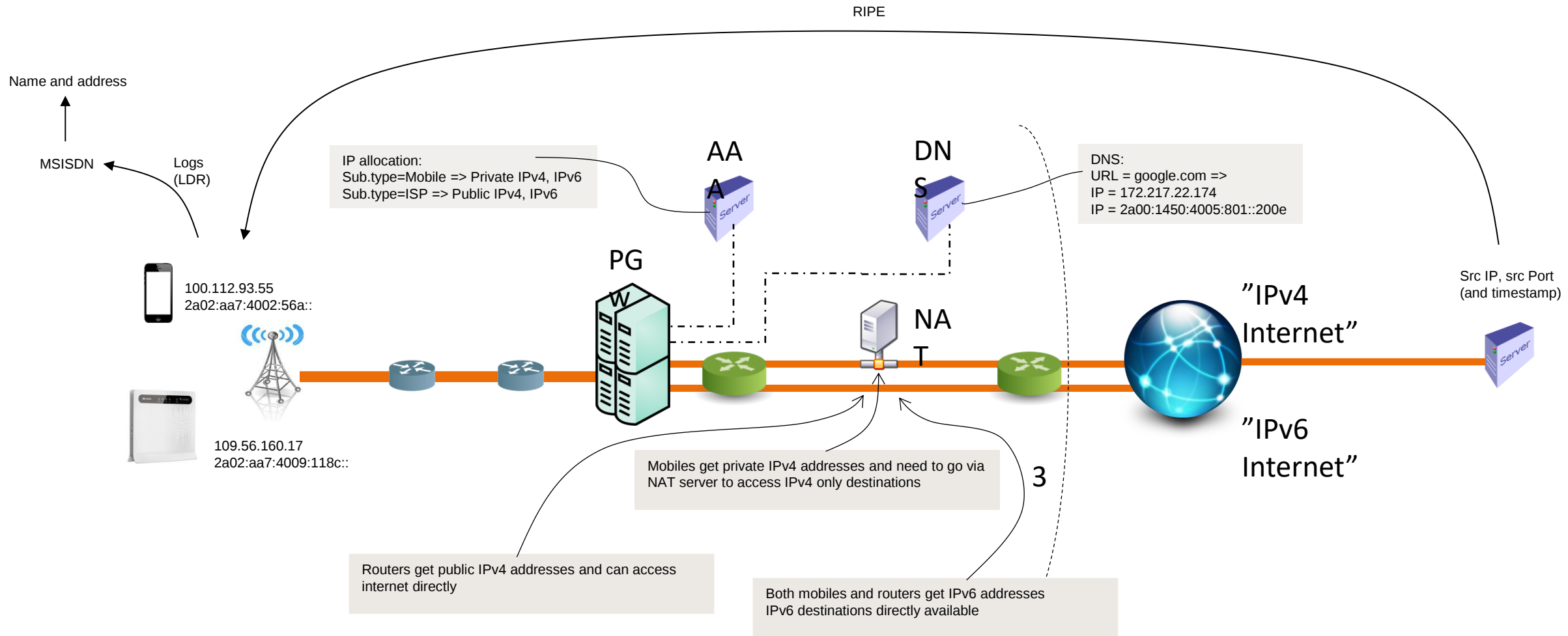


CGNAT

- 3 Sweden came late into the ISP market, launching mobile broadband in 2007
 - 3 Sweden has never had excessive amounts of public IPv4 addresses
- Hence subscriber growth meant need for more public IPs than was / is available
- The solution is to use CGNAT:
 - 65536 ports per IP
 - Portblock size = 64
 - Potentially 1000 users per public IPv4 address
- The introduction of dualstack meant that we could have a controlled increase in CGNAT capacity
 - All major Over The Top providers (OTTs e.g. Google, Meta, Amazon, Microsoft, Apple, Netflix) support IPv6



Identify users on the internet



IP in criminal investigations

- With an IPv6 source address a user (SIM) can be uniquely identified
- With an IPv4 source address a user (SIM) can be uniquely identified only if:
 - The user has a unique public IPv4 address
 - or the user has a CGNAT:ed IPv4 address and the source port has also been provided
 - or the user has a CGNAT:ed IPv4 address and the user is the only user with a port-block for that IP
- The challenge is that the source port is rarely provided in the request
 - In that case upto 1000 MSISDNs match the source IP and the timestamp
- CONCLUSION: with an IPv6 address the user generating the traffic can ALWAYS be uniquely identified
- Experiences as of 11-2025: approximately 2/3 of requests for user-id based on IP address is IPv4 (without port), and approx. 1/3 is IPv6



Questions?



