

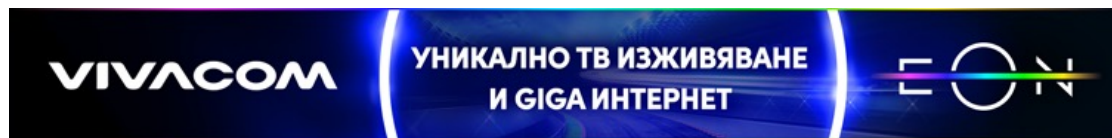
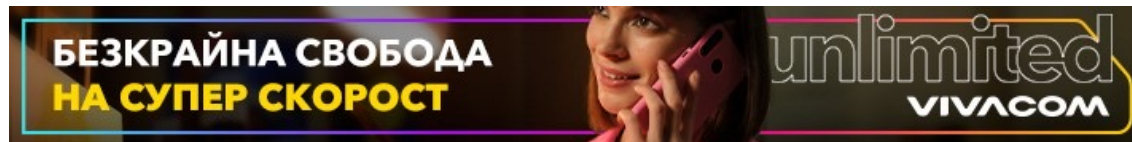


IPv6 and CGNAT: An Inevitable Team-Up in Vivacom's Network

June 2023

About Vivacom Bulgaria EAD

- Former incumbent operator, the largest in Bulgaria – Bulgarian Telecommunication Company (BTC)
- In 2004 a privatization procedure was started, and the Bulgarian government sold 65% of BTC
- Since Mid-2020 become part of United group - a leading telecommunications and media operator in Southeast Europe
- Currently the largest telecom in Bulgaria providing Unlimited 5G Mobile plans, EON TV service, 10G fiber access speeds for Internet, DTH TV and IPVPN business services
- VIVACOM has received the award for the fastest mobile network in Europe for the Q1-Q2 2020 period according to results from tests taken with Speedtest® by Ookla®
- VIVACOM Plana Teleport is a member of the World Teleport Association and in 2017 achieved full Tier 4 certification



CGNAT timeline

- 2004 - ADSL services - no CGNAT (Broadband Verification stats)
- 2007 - Mobile operator - CGNAT from the start
- 2011 - Fixed Broadband services AON/GPON - no CGNAT (Broadband Verification stats)
- Dec.2021 - CGNAT introduced for AON/GPON
- All new BB subs in CGNAT
- Existing BB subs migrated to CGNAT after contract renewal



Why ?

- Millions of mobile subscribers
- Hundreds of thousands of fixed BB subs
- Severe IPv4 shortage
- Increasing cost for buying and renting IPv4s



CGNAT – The reality

- Still requires Public IPv4s for NAT Outside pools
- Licensing
- HW - Limited Capacity, Rack space/Routers slot space/EOL/EOS/Backup/Spares
- DynNAT logging -> FlowExport/Radius Acct or Use Deterministic NAT
- Logging servers need maintenance
- Complicates the network configs – CGNAT bypass
- Blacklists



IPv6 timeline

- Nov.2007 2a01:5a8::/32 allocation
- Aug.2009 First business customer on Dual Stack
- 2009 IPv6 available to Business customers only (on BRs or IPv6 only in VPRN)
- 2011 IPv6 enabled on Vivacom's DNS caches
- Jan.2020 - Start of early tests of IPv6 for BB services on BNGs
- Apr.2020 - Full IPv6 routing table available on each BNG (moved IPv6 Cust to the Edge)
- Dec.2021 - IPv6 enabled for Mobile subs (CGNAT HW Offload)
- Feb.2022 - Started working on IPv6 for fixed BB subs (AAA/ACS/OLTs/ONTs/CPEs/LLD)
- Feb.2023 - Start of gradually enabling IPv6 for GPON subs
- Jun.2023 - IPv6 enabled for all GPON subs



Cache farms on IPv4/IPv6 from day one - FB,GGC,NetFlix,Akamai,Cloudflare ...

Dual Stack overview

Mobile

- Dual-Stack – Public or Private IPv4, /64 IPv6 Dynamic or Static
- /64 for all - Smartphones/Tablets/FWA CPEs

(Really straightforward implementation)

Fixed

- Dual-Stack for GPON Subs - Public or Private IPv4, /128 WAN and /64 PD (IPv6 only dynamic)
- DHCPv6 only access
- IPoE sessions on BNGs (Single Auth for IPv4/IPv6)
- Authentication based on Opt82-Circ-Id/Interface-Id Opt-18
- Dynamic allocation of /128 on WAN + /64 PD for ONT/CPE LAN.
- SLAAC behind the ONT/CPE
- Radius-Accounting for IPv6

What had to be done?

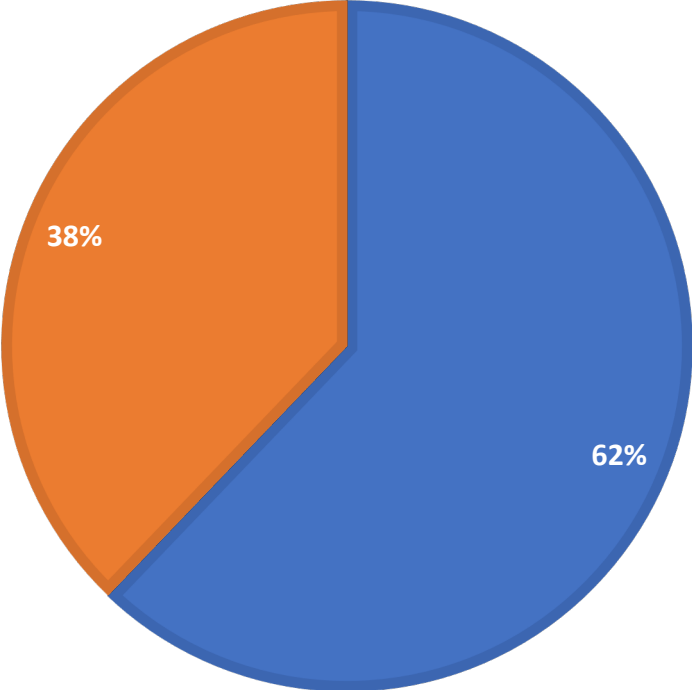
- Low Level design for Dual Stack on BNGs
- IP Core BNGs configuration
- AAA/ACS development
- DHCPv6 Security features in the access infrastructure
- ONTs/CPEs tests and software upgrade / TR-69 for IPv6
- OLTs configuration (DHCPv6 snooping)
- IPv6 activation on ONTs
- Training



Traffic charts

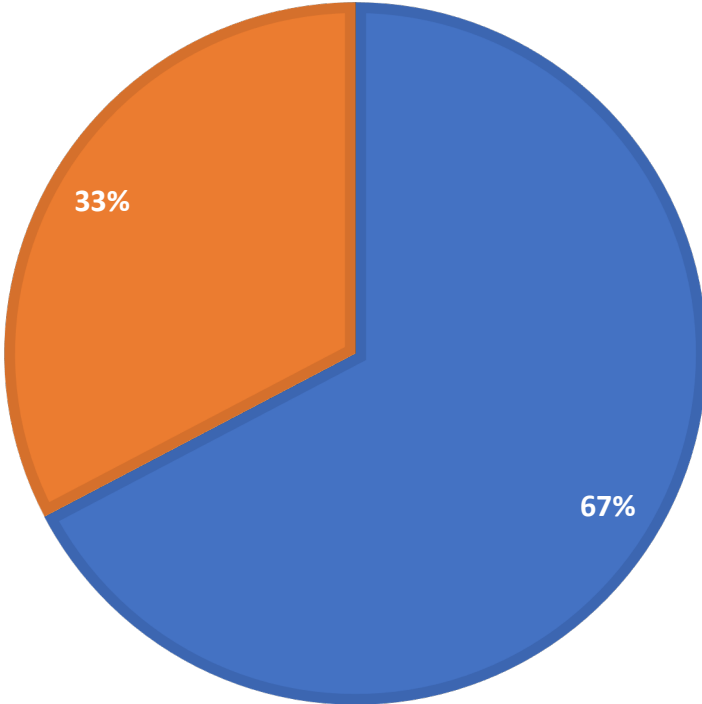
MOBILE

■ CGNAT ■ IPv6

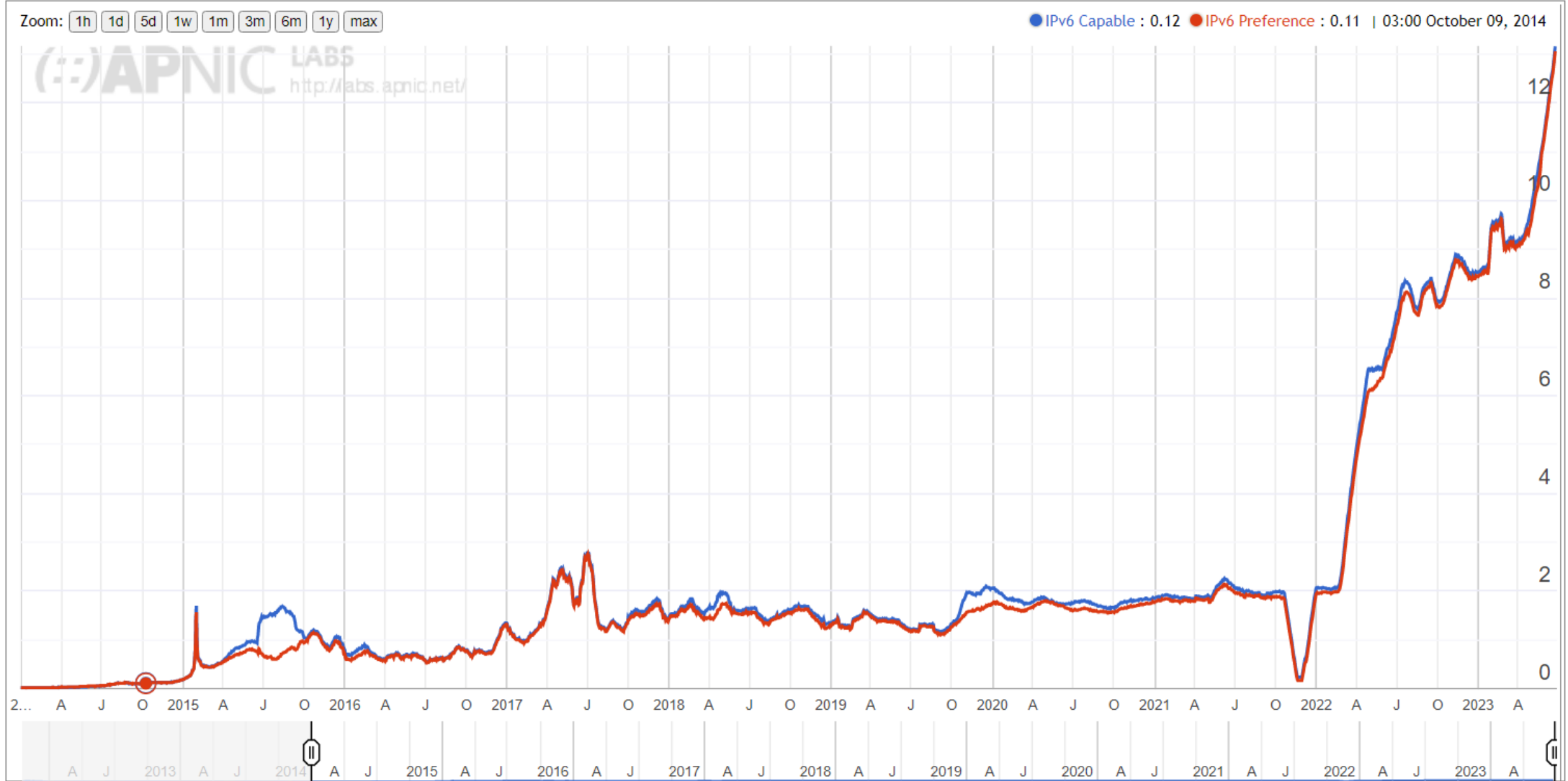


FIXED

■ CGNAT ■ IPv6



APNIC IPv6 stats for Bulgaria



IPv6 and NAT team-up

- Apparently inevitable for us
- Cost reduction and native access to IPv6 enabled resources
- Surprisingly smooth and problem free implementation
- Future proof and sustainable (340 undecillion IPv6 addresses and increasing IPv6 traffic, CGNAT Offload)

Future Plans

IPv6 as much as possible



