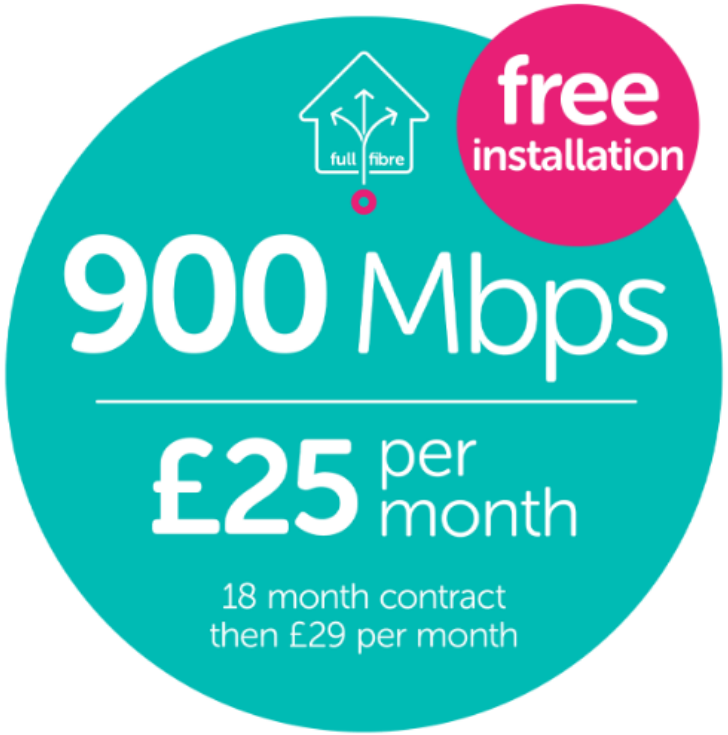
toob IPv6 Deployment

UK IPv6 Council

Charlie Huggan – Nov 2023

Who are toob?

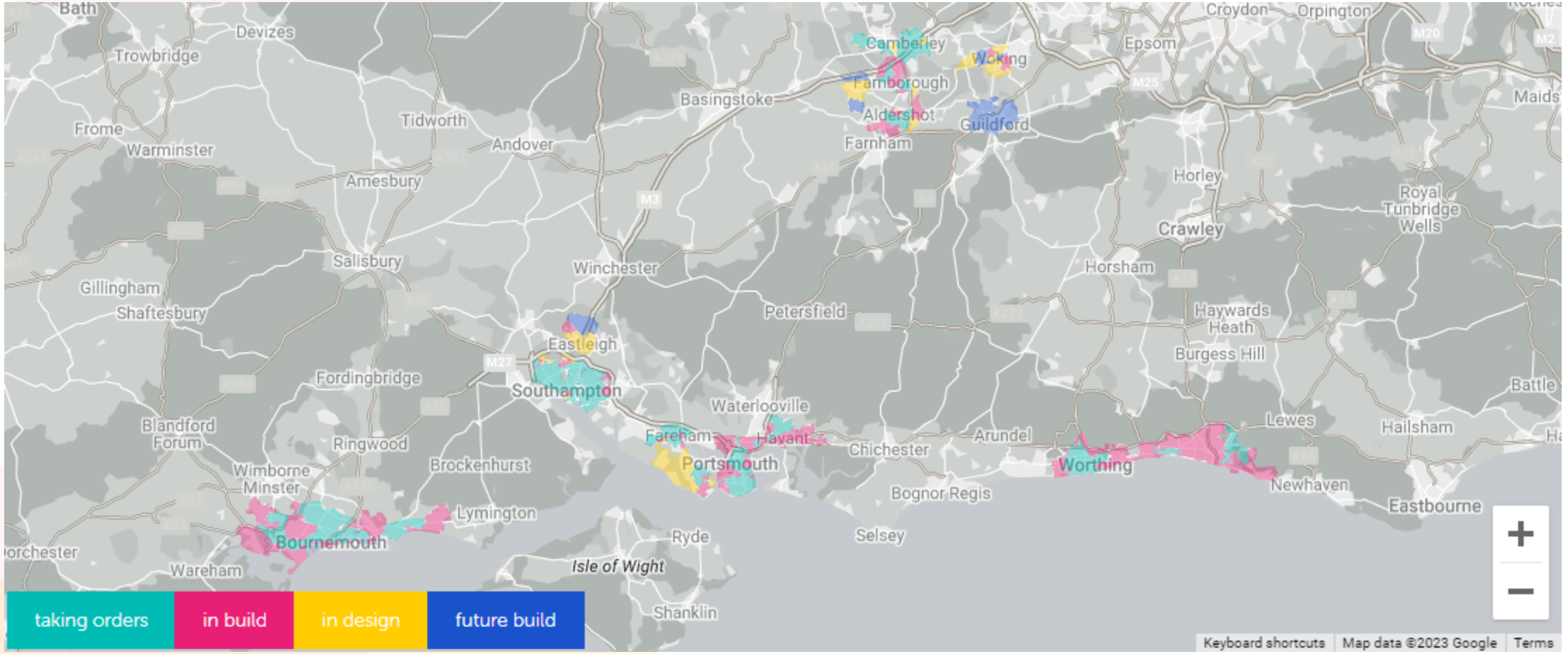
- We’re a full fibre ISP deploying our own fibre network to homes across the south of England
- We deploy on CityFibre’s network to extend our reach across the region
- One of the fastest growing Altnets in the UK
- What does “toob” mean? An easy to remember four letter word that correlates to the fibre “tubes” we utilize.



- Most compelling proposition on the market
- One simple product at £25/mo
- Static IP can be added for an additional £8/mo
- Use whatever CPE you want

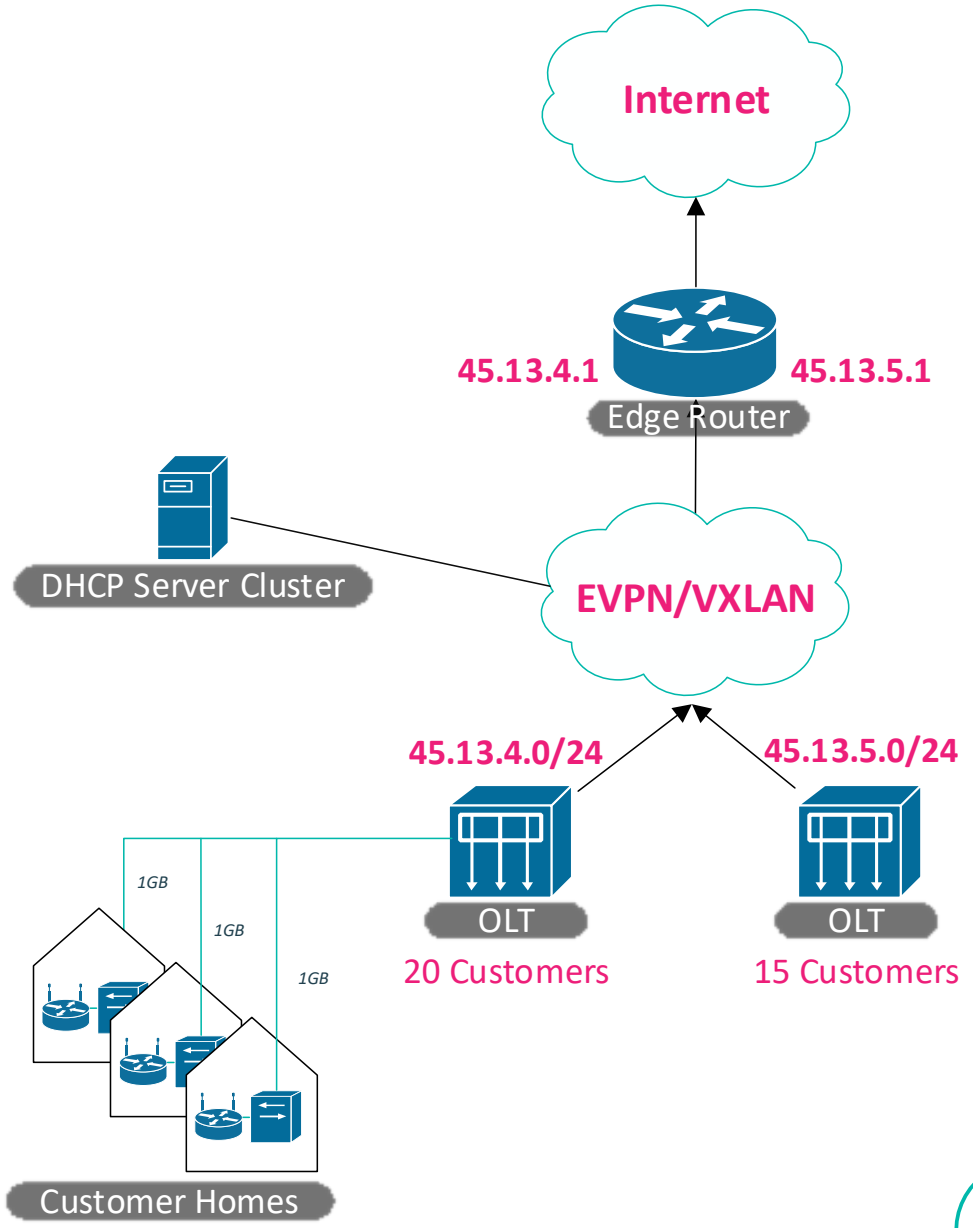
Our coverage

- Deployment is regionally focused across the south and in urban to sub-urban environments
- Well over 20,000 connected customers and 150k homes passed.



toob Network Initial Deployment …. 2019

- We started out with a v4 only network in December 2019 – a shoestring deployment to get to market within a couple months – minimal redundancy, all customers directly talked to a DHCP server – with v4 gateways on our edge router, we didn't have BNG at the time.
- Very easy to get us started, but a highly inefficient use of v4 address space… we were quickly going to run out



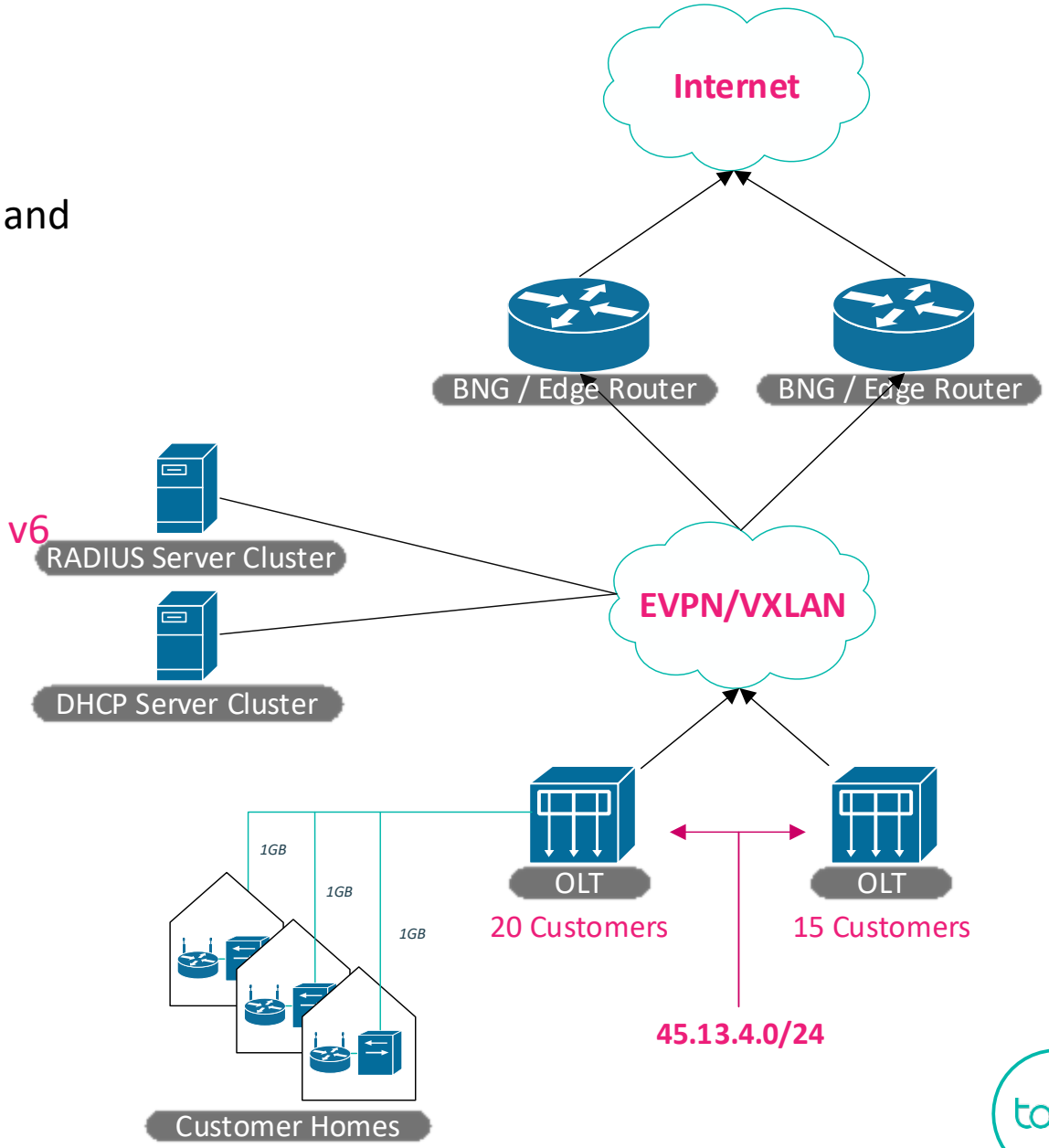
Let's deploy CGNAT? … toob network 2020

→ "Let's make more efficient use of public v4 by deploying BNG and implementing CGNAT…"

→ "OK, but CGNAT sucks. How can we make the deployment a smooth experience?"

- Deploy IPv6 for all customers – ensuring they can access v6 internet without NAT.
- Allow v4 static addressing for "power" users

- Acquired a /18 (16,384 addresses) to give time for implementation and future flexibility
- Deployed BNG (and added resilience!) to efficiently allocate address space – no more subnets on the edge.



toob IPv6 Deployment

Goals:

- Dual-stack all customers with IPv4 & IPv6
- Give customers a static WAN and /56 prefix allocation from day one
- Simplify network – have the BNG become DHCP servers

Stretch Goal:

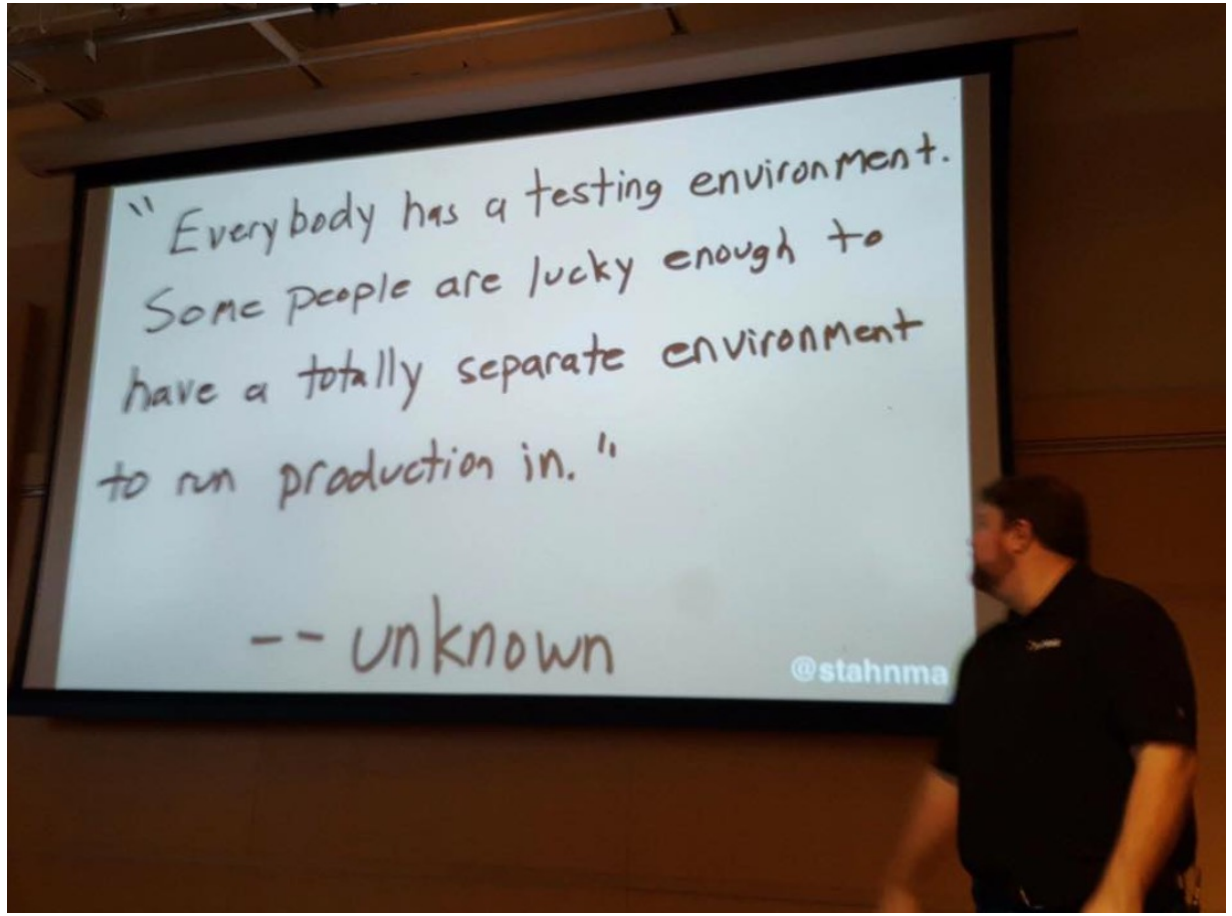
- Ensure “700b” is inserted into everyone’s WAN prefix

It’ll be easy… IPv6 has been around for 20 years. There’s no way there will be any issues at all 🙂

Initial Testing… early 2021

We started testing during H1 2021 – there were unexpected issues…

- → Our CPE stopped sending DHCPv6 packets if the WAN cable was disconnected and reconnected – the lease would get stuck and would not renew. V4 was OK though ☺… A bug fix was needed.
- → Our OLT (customer access nodes) sent any received router advertisements to all downstream devices rather than to a single *specific* customer. Therefore, customers were getting router-advertisements from BOTH BNG and randomly dropping packets…. Oh no. A bug fix was needed again.
- → There were more – vendors certainly don't give v6 the same treatment as v4, hopefully that's changing.

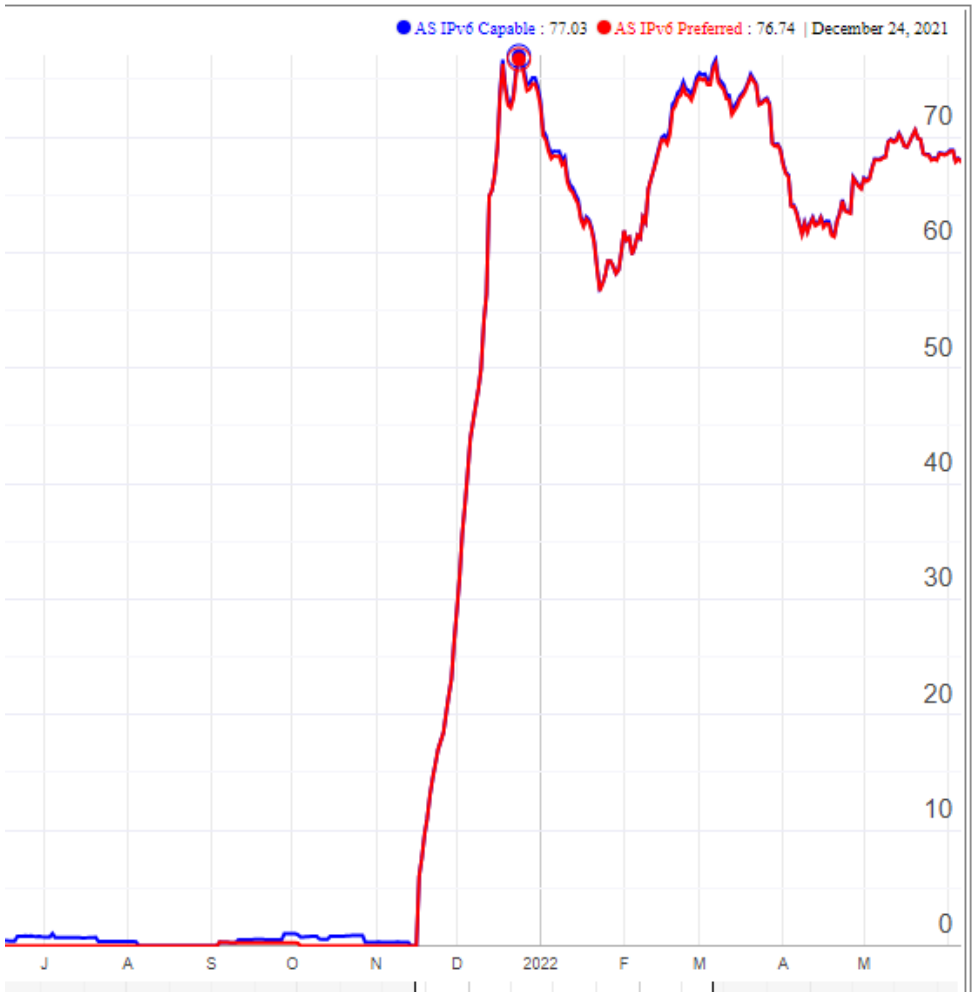


Deployment – November 2021

We launched in November ‘21 successfully after about a year of planning and testing -

1. We peaked at 77% IPv6 capability across our customer base.
2. Our subscribers were all assigned static **/128** IA_NA and **/56** IA_PD addresses.
3. Prefixes are all assigned from a large **/33** regional pool – 8M total /56 assignments possible.
4. Subscriber address pools are managed by our OSS platform which is integrated with RADIUS
5. DHCP is served from our Juniper BNG directly, without needing separate DHCP servers. The BNG are N+1 resilient.

IPv6 Capable/Preferred (APNIC stats) – Toob AS60377

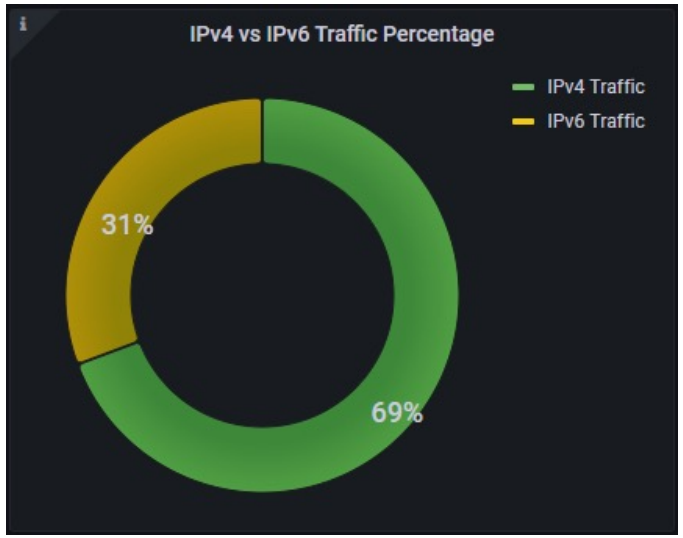


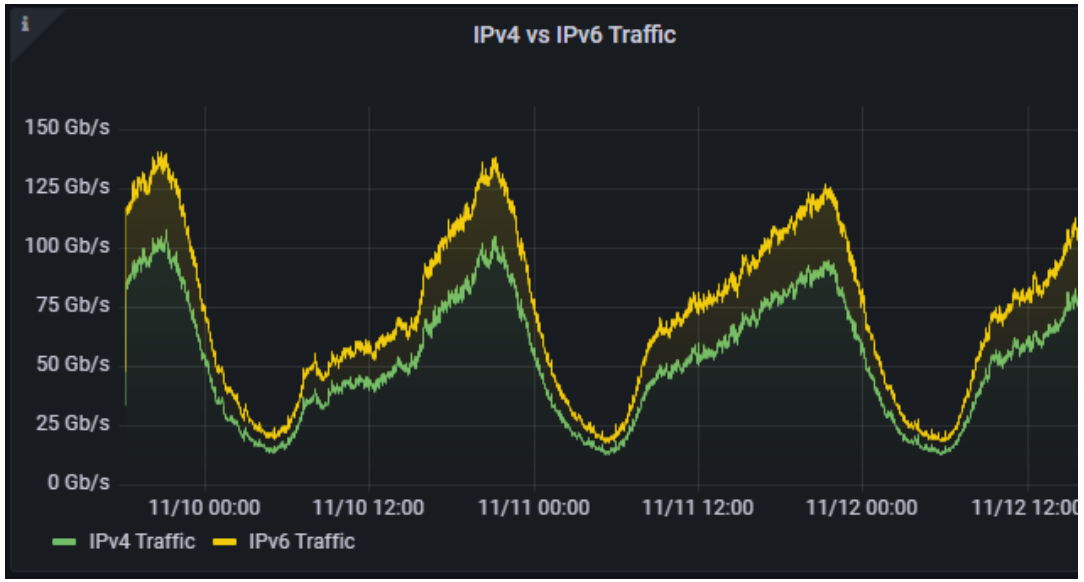
Wait… why hasn't this gone higher than 77%?

There are several factors –

- 7.5% of connected customers are not using toob CPE – it seems most 3rd party routers seem to have IPv6 disabled by default or perhaps aren't configured for toob IPv6 settings.
    - **If you're a customer using a 3rd party router, please enable IPv6 ☺**
- Due to a bug on our legacy CPE hardware, a percentage of customers do not have v6 leases, or may have a lease but are not operating as expected. The bug has been patched, but in most cases the CPE needs to be factory reset to revert to a fully operational state.

  We stopped deploying this CPE a few months ago and expect our IPv6 capability will improve significantly over time.

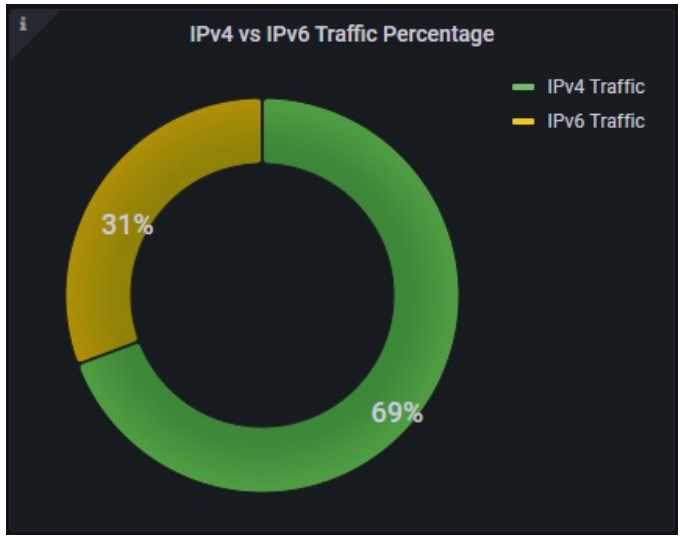


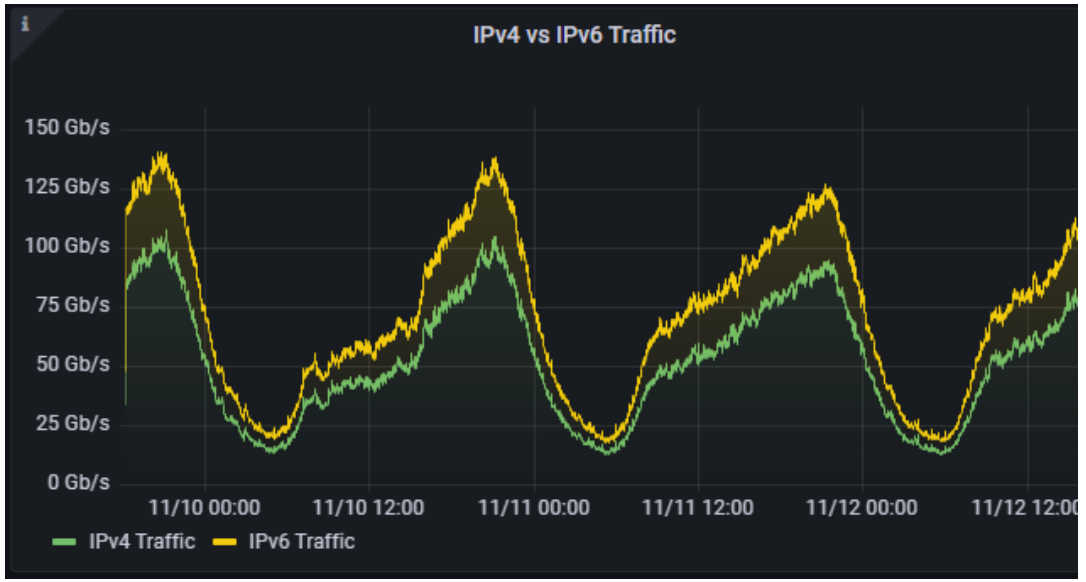


toob v6 vs v4 Traffic Graphs (Nov '23)

What's next?

- Launch of our new CPE should increase v6 utilization significantly over time
- Possibly more education for customers around enabling IPv6 as we have a significant percentage of users with it disabled
- We want to increase our v6 utilization and ultimately reduce our reliance on CGNAT.
- Beyond IPv6…
  - For our CGN solution we're going to keep using NAT444 – MAP-T is great in theory, but to deploy requires support at CPE & core.
  - We've deployed 400GZR+ in the core and will soon deploy in the metro

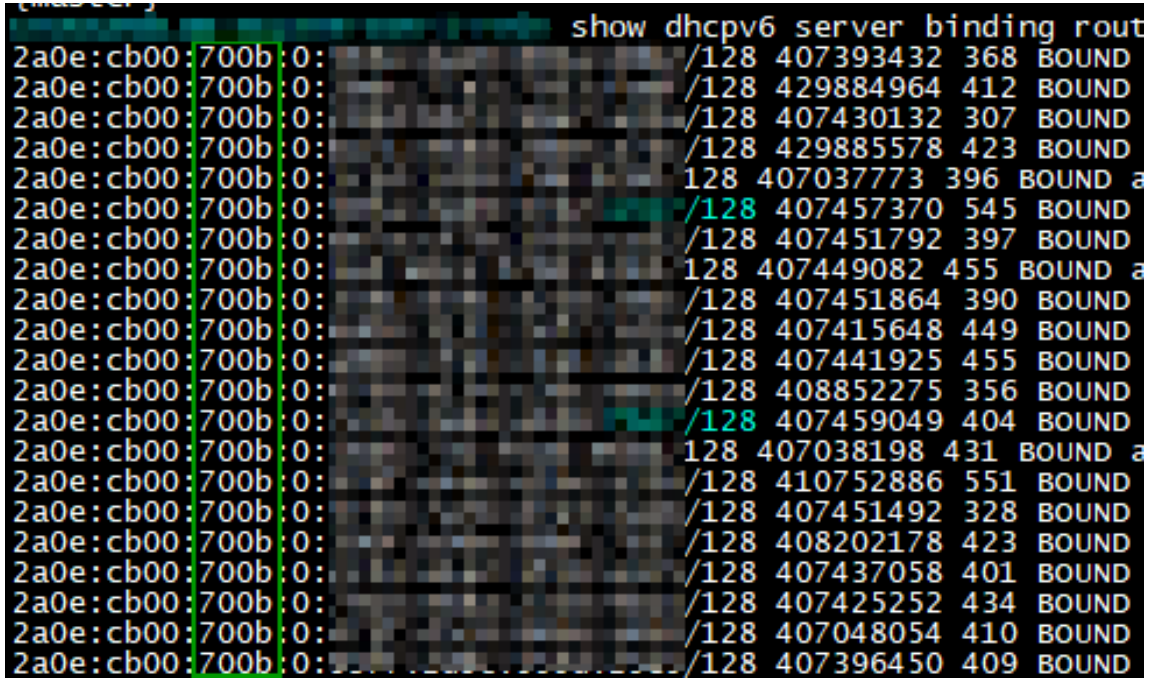




toob v6 vs v4 Traffic Graphs (Nov '23)

Stretch goal…

I did manage to get “700b” added to all our router WAN v6 assignments ☺



V6 IA_NA Assignments