IPv4 Address Markets

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Today was not meant to happen

- The experiment was never meant to escape from the lab in the late 1980s
- And even if it did, the name and address distribution arrangements were not meant to be part of the package
- Because they would not scale

2 out of 3 is not enough

- Scaling the DNS system has worked so far, but only with the determined effort to resist flattening the name hierarchy
  - *Recent efforts by the ICANN community to re-open this topic will inevitably engender a completely flattened name infrastructure and destroy the utility, performance and intrinsic value of a single DNS name infrastructure – but that's not today's topic!*
- Scaling the routing system has worked so far, and we've managed to contain the growth of the routing system and its dynamic properties to sit within improving silicon efficiency, so routing has been largely contained by Moore's Law – so far!
- IPv4 was the problem!

IPv6 was the answer

- The approach behind IPv6 was to simply increase the address fields of IPv4 from 32 to 128 bits
- If everyone was using IPv6 then the issue of address crunch was deferred indefinitely
- But how to get from an IPv4 here to an IPv6 there was a huge issue

But how to get from here to there

- Lets avoid giving away the “Last IPv4 address”
- So in the early 90’s we built an administrative regime to apply pressure on address usage to slow down the rate of address consumption and improve the efficiency of address use.
- Let’s use the RIRs to impose a ‘ongoing cost of address ownership’ (aka lease) to complement the notion of “demonstrated need” to dampen current consumption demands
- All to give us enough time to get IPv6 deployed before IPv4 ran out completely!

Obviously this did not work (in time)

- IPv4 address exhaustion happened
- Aftermarkets formed, as need was still present
  - Secondary redistribution was required to meet new needs through transfer market operations
  - Scarcity is now addressed as a market pricing function

How long will the market last?

- The IPv4 market will endure for as long as there are IPv4 services and IPv4 clients out there
- How long are we talking?
  - We had thought that it would be a small number of years – 3 years? 5 years?
  - Its now 11 years after the initial free pool exhaustion events and we have no idea how long this hiatus will persist

Why?

- Because NATs

Leasing vs Buying Addresses

It’s all about scenario planning:

- If you think that this situation will last for a long time, and the increasing scarcity function will act to increase market pricing then buying the asset tends to make financial sense
- Even if you think that NATs and similar will continue to relieve scarcity tensions so a constant perception of scarcity pressure will not drive the market price up, then buying the asset to reduce uncertainty risk is still worthwhile, but it’s a risk evaluation
- If you think this is a short term proposition and the demand for IPv4 will vaporise to zero then leasing makes sense as the lease holder is not left with a stranded asset

So this is really about time

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- Sure – lets talk about how long it will take for IPv6 to completely supplant IPv4
- But are you sure that's the only conversation to have?
- What else could supplant the need for globally unique IPv4 addresses?

The Death of Transit

- Unique addressing IP packets is a way of sharing a common communications resource
- But we don’t share any more
  - Each major CDN operator now builds and operates dedicated transmission services
  - Each access network uses dedicated channels for users, either time multiplexed (mobile) or frequency multiplexed (PON Fibre Broadband)
- So why do we need unique packet addresses?

Transforming NATS

- NATs were originally seen as edge devices for home networks
- IPv4 scarcity pressure has pushed NATS to the external edge of the access networks
- And cost and performance pressures has brought CDN points of presence to the edge of access networks
- What happens if/when the NAT is pushed out of the access network and into the CDN? Or the CDN is pushed into the access network?
  - Is the NAT even necessary?
  - Can’t we reuse client addresses across discrete service cones for each CDN point of presence?
  - Yes! Of course we can!

So its really about time and direction

The current situation is unstable

- It might resolve to a reversion to the original shared transmission infrastructure model using packet multiplexing and a global address mechanisms using IPv6 only
  - a revision to a 1980's architecture using a 1970's technology platform
- Or we might head down a model of abundant provisioning and rely on a continuation of the client/server model and replicate services in all points of presence
  - In which case we need names to perform service selection
  - But globally unique addresses are unnecessary

Supply Stability

- The folk who argued against a market in IPv4 addresses were not arguing arguing against economic rationalism
- They wanted IP addresses to be a stable commodity that was a platform for investments in digital goods and services – addresses were meant to be an enabler, not a choke point and a subject of speculative activities in their own right. Such a development would deter further investment in digital services by increasing the investment risk
- But that desire to have a stable address supply only works in environments of limitless abundance
- In environments of finite resources and unlimited demand then speculative pressures inevitably arise as a response to choke points and perceived scarcity

What does this mean?

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until they don’t