# IPv4 / IPv6 Coexistence Mechanisms

## Los Angeles / 2008.10.13

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<http://archive.psg.com/081013.nanog-6trans-A+P.pdf>

# Montrèal IETF Mtg

- IETF Interim two weeks ago

- Divided the Space into
  - Translators, i.e. NAT-PT replacement
  - Tunnels, aka the Large Consumer ISP Problem

# Translators

- SIIT – IPv6 host to IPv4 host
- DNS fabrication to give the v6-only host a v6 address for the v4 host (the totd hack you are using right now)
- NAT6, IVI, … muddle still in discussion

# Tunneling

- Dual-Stack Lite

- Carrier Grade NATs

- Port Borrowing

- ...

# A+P Address Hack
## The Revenge of the Stupid Core

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# Problem Statement

Large broadband providers will not have enough IPv4 space to give one IPv4 address to each consumer CPE so that every consumer has usable IPv4 connectivity.

# Carrier Grade NAT

- NAT in the core of the provider's network to allow 4/6/4 or similar translations

- Customer has 4to6 NAT and the core re-NATs 6to4 for v4 destinations

# CGN Breaks the Net

- Not only does this cause problems for the carrier, but also for the whole net, as these captive customers can not try or use new disruptive technology

- NAT in middle of net has the problems of a smart core

- Walled gardens here we go!

# I Googled "Walled Garden"
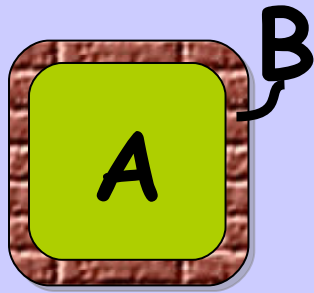


Walled Gardens Explained:
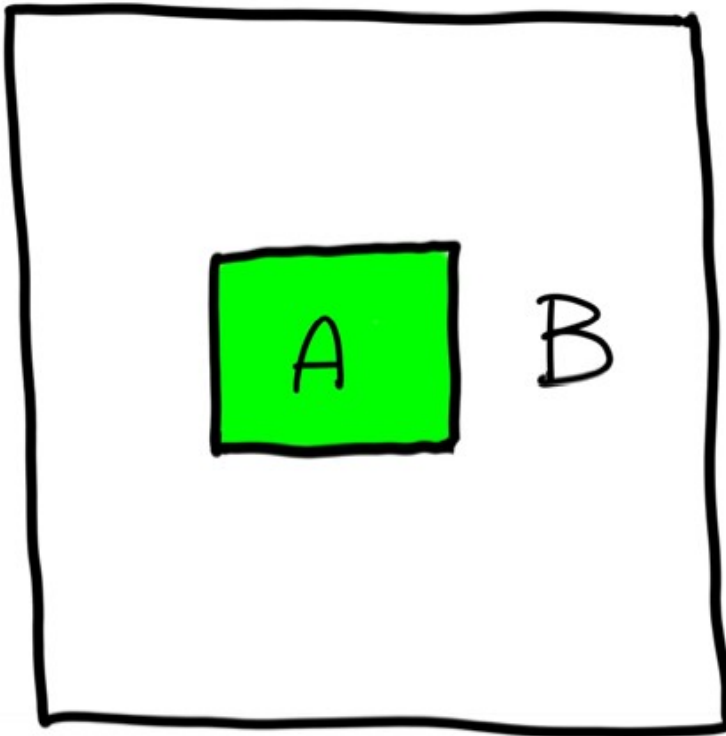
A: Everyone here makes money.

B: Everyone here can go f~~ook~~ themselves.

@hugh

# Walled Garden Re-Explained

**B**

**A**

**C =** The Global Internet
E.g. My Customers

A:  Isolated, exploited, & restricted

B:  Everyone here makes money

C:  Everyone here can go fsck themselves

# This Need Not Be Inevitable

# Move the NAT to the CPE

# As Alain Says

"It is expected that the home gateway is either software upgradable, replaceable or provided by the service provider as part of a new contract."

# If You Can't Roll CPE

- If you can not roll CPE immediately

- Then run a dual stack core

- The legacy CPE has a legacy IPv4 address now, let it keep it

- No need to break the Internet

# A+P in One Slide

- Do the work at the CPE so that the **customer may control their fate**

- 'Steal' bits from the port number to extend the IPv4 Address

- Encapsulate in IPv6 in the ISP core and use normal routing to the edge

- Border Routers also en/decapsulate

# "But This is Like X"

# Nothing New Under Sun

- Late ARPANET ran out of address space with NCP circa 1981

- Needed to add more institutions

- Thus a *long leader* address extension

- No one wanted to rewrite kernels

- Greg Noel 'stole' unused short leader numbers and translated

# A+P CPE is Modified

- Configured to use a restricted range of ports

- Configuration can be as simple or complex as you want it to be :)

- Some port bits dedicated to address extension, A+P

- NATs internal IPv4 to external A+P and encapsulates in IPv6

# IPv6 Encap from CPE

- WKP = well known prefix, 4666::0/64

- Source of v6 packet is WKP+A+P

- Dest address of v6 packet

  - WKP+v4dest

- Border (BR) makes global v4 packet

  - source = A+P

  - dest    = v4dest

# Note That

- Normal IPv6 backbone routing is used

- Routing out from CPE is based on real destination, not pre-configured tunnel

- Only CPE and Border Routers are hacked

- No new equipment is introduced

- BRs do not have state or scaling issues

# IPv6 Encap Toward CPE

- BR receives IPv4 packet w/ src/dest
- Encapsulates in IPv6 packet
  - src   = WKP+src
  - dest = WKP+dest
- But note that dest is A+P
- It routes normally within ISP core

# What Changes

- CPE - NATs and handles IPv4 A+P de/encapsulation in IPv6

- Border Router - de/encapsulates

- If you want to get into the kink of variable and/or dynamic length(P) games, life gets complex

- No extra hardware required

# Transporting IPv6

- If the backbone is IPv6 capable, then IPv6 packets just move end to end

- If the backbone is not IPv6 capable, then the host or the site CPE must encapsulate to a 6to4 gateway or some other kink

- Deploy IPv6, it's forward not sideways

# In an IPv4-only Core

- CPE sends packet with

  - Source of A+P

  - Dest of global IPv4 destination

- Outbound routes perfectly normally

- Replies need to be tunneled as they need to route A+P for the last mile

- Let's not go here

# Nomenclature

It might be helpful to differentiate

- *Tunnel* goes from A, through some cloud, to B, i.e. has a predetermined end point, often pre-configured

- *Encapsulation* has no fixed end point, but goes from A, through the cloud, using normal IPv4/IPv6 routing, to an end point which is not predetermined

# Thanks To

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