

Tie Downs, TE and TCAM tuning.
IPv6 from an ISPs perspective.



Aaron Hughes, President & CTO
6connect

IPv6 and ISPs

- ❖ What's so special about ISPs?
- ❖ Transport and Transit
- ❖ Effectively a pipe
- ❖ Good candidates for early adopters

Why ISPs are early adopters?

- ❖ Security is less of an issue (directly)
 - ❖ Already have a security policy
- ❖ Enough pull to get vendors to help
- ❖ Generally have budgets (every 5 years)
- ❖ Community support
- ❖ Competitive in nature.. Customer moves if.....

Sense of the room

❖ ISPs vs. Non-ISPs?

Non-ISPs

- ❖ It's your lucky day!
- ❖ (Not really but we'll get to that later)
- ❖ Part of the reason you are here is because you know you need to get educated about IPv6.
- ❖ There is operational experience in this room
- ❖ There will be best practices developed
- ❖ ISPs will make a lot of the mistakes for you.

Why this talk is about ISPs?

- ❖ 1) No one else was speaking about them when I picked my topic.. :)

ISPs are the guinea pigs

- ❖ Guess who gets to make most of the mistakes?
- ❖ There are few documented best practices
 - ❖ ISPs are writing them for everyone
- ❖ Resources are extremely limited (SME -> books)
- ❖ Vendor management starts here
- ❖ Benefits outside of survivability
- ❖ No significant cost to dual stacking the network

ISP motivation

- ❖ Survivability (loss of revenue)
- ❖ RIR max IPv4 resource allocations at 3 mon
 - ❖ Impact on Tie downs and guestimates
- ❖ Eventually v4 will be very expensive
- ❖ IANA out of IPv4
- ❖ Global exchange market about to open
- ❖ Alternatives suck! (NAT444/CGN/etc)

ISP Motivation cont.

- ❖ Customers do not care how they reach other numbered objects on the Global Internet, they just want it to work and will blame you for its failure PERIOD
- ❖ IPv4, IPv6, X.25, ATM, LTE, String and Paper cup.. They don't care as long as it works and at the speed they know as the norm or better.

Moving forward.

❖ We've decided to stay in business..

Step 1

- ❖ Network is the transport for all other services as an ISP so network must go first.

Implementation

- ❖ TAKE YOUR IPv4 HAT OFF NOW
- ❖ Write an IPv6 10 year implementation plan
- ❖ Write an IPv6 10 year numbering plan
- ❖ Write an IPv4 3 mo - 10 year survivability plan
 - ❖ This can be done second, but must be done

ISP Implementation Approach

- ❖ Departments are isolated (to some extent)
- ❖ Simple hierarchal approach to IPv6
 - ❖ Network
 - ❖ Lab / Sometimes ops
 - ❖ Edges (we'll worry about that later)

Why Network?

- ❖ Super easy!
- ❖ Start at an edge (Peering, Transit, anything v6)
- ❖ Work your way in to the core and around the network testing each step
- ❖ address some pieces of security (maybe)
- ❖ Pat yourself on the back, you're done!

A little deeper

- ❖ Dual stacking is fairly easy on the network
- ❖ Walking /32s & /30s and adding /128s and /126s is not that hard
- ❖ OSPFv2 + OSPFv3
- ❖ BGP unicast IPv4 + BGP unicast IPv6
- ❖ Never touching a host means less work

Challenges

- ❖ Ok.. So it's not quite that easy, but it's a good start.

Challenges across depts.

- ❖ Marketing and PR (website, campaigns)
- ❖ Sales
- ❖ Planning and design
- ❖ Sales Engineers
- ❖ Provisioning / Implementation
- ❖ Operations
- ❖ Customer awareness / Account Management

Operations Challenges

- ❖ Monitoring is now double (or more)
- ❖ Debugging which path
- ❖ Managing resources TCAMS, memory, processor, IGP and EGP sessions
- ❖ Training staff (Sales -> Provisioning -> Ops)
- ❖ Tools no longer cover needs

Marketing

- ❖ Yes people Google for \$City + ISP + IPv6 (lead gen)
- ❖ Compliance / we're telling them to look for it.
- ❖ All website material for IPv4 needs to be updated to include IPv6 (communities, DNS, BGP, resource requests, blah blah)

Sales

- ❖ What's IPv6?
- ❖ We currently charge per IPv4 address. How do we charge for IPv6? 18 Quintillion dollars?
- ❖ Promotion vs. Profit
- ❖ Did you say we can make money off of IPv4?!

Sales

- ❖ Your sales people do not want to learn anything new unless it means more money in their pocket.
- ❖ Figure out a cost model (if you charge for v4)
- ❖ Think of outreach as an upsell opportunity. Customer contact is a good thing.
- ❖ This also makes the customer stickier

Operational Policy

- ❖ Do we allow customers to announce IPv6 to us?
- ❖ What size is the minimum/maximum
 - ❖ Follow RIR-> LIR policy or not?
 - ❖ How do we deal with multihoming?
- ❖ What do we recommend to our customers
- ❖ How do we update IRR, filters, SWIP?

Provisioning

- ❖ Serious considerations here, possibly the most challenging department.
- ❖ Eval existing systems and accommodate
- ❖ SFA/CRM
- ❖ IPAM/DNS/Asset management
- ❖ Implementation tools/Config Templates
- ❖ E-mail templates to customers

Provisioning cont.

- ❖ Simple Assignments / Detailed Assignments
- ❖ Logging
- ❖ Post log processing +d\.+d\.+d\.+d
- ❖ NAT444 (dealing with 100.64/10)
 - ❖ Dealing with duplicates
- ❖ Addressing runout in general

Compliance

- ❖ SAS70/SSAE16/AT101/SOX/Govt.
- ❖ Repeatable process has changed and therefore docs will need to be updated
- ❖ What steps do you need to go through to change your process
- ❖ Access controls (ACLs)/log processing/accounting
- ❖ How do translation technologies impact compliance? (port+address+timestamp)

Abuse

- ❖ What's that funky ::number in the header?
- ❖ RBLs
- ❖ Reporting
- ❖ AUP update/rewrite
- ❖ Again with tools

Security

- ❖ How do we protect our infrastructure?
- ❖ i/e ingress filtering
- ❖ To route or not route internal infrastructure
- ❖ Protecting internal systems
- ❖ Statefull firewalls v. NAT (New \$'s)
- ❖ Automated prefix list distribution (IRRpt)
- ❖ Anti-Spoof

Downstream Customers

- ❖ Communication - How do we inform our customers?
- ❖ What's our default allocation size?
- ❖ Routed vs. Bridged
 - ❖ Why is this different than IPv4 (assumes NAT)
- ❖ Dealing with lack of DDNS (-> CPE)

Colo customers

- ❖ What happens if I just assign an /64 to each interface by default as my policy?
- ❖ IPv6 one direction -> out
- ❖ IPv4 in (No AAAA's)

Borrow from Peter to pay Paul

- ❖ TCAMs are finite
 - ❖ Bucket for IPv4 unicast
 - ❖ Bucket for IPv6 unicast
 - ❖ Bucket for IPv4 multicast
 - ❖ Bucket for IPv6 multicast

TCAMs cont

- ❖ Roughly 1M IPv4 unicast
- ❖ Roughly 8K IPv4 unicast
- ❖ Reload required!
- ❖ 500K v4 60K v6 (BTW: IPv4 multicast is growing too)
- ❖ Balance is tough and we can only guess

TCAMs cont.

- ❖ What happens when there is no more Peter?
- ❖ Time to start trimming?
- ❖ Split tables into multi-routers and punt in circles?
- ❖ \$'s for routes?
- ❖ New un-budgeted hardware?

Tie down policy

- ❖ No longer running to 80% utilization
- ❖ How do I write an IPv6 plan good for 10 years?
- ❖ Do I follow nibbles or conserve?
- ❖ What size? /44s? /40s? /36s? /32s? /28s?
- ❖ How do I deal with subsequent allocations?
- ❖ Single announcement policy?

Sizing up a region

- ❖ Think BIG, REALLY BIG!
- ❖ Round up and multiply..
- ❖ Round that number to next nibble

Network sum up

- ❖ Once the network dual stack is done, TCAMs are tuned, TE planned, 10 year plan in place, the network is done. The IPv6 box is checked!
- ❖ But what about the rest of the services?

That's your problem..

- ❖ The network would be perfect if it weren't for the pesky users.
- ❖ This is not untypical...
- ❖ Cable, DSL, Video, Voice, Wireless, Residential Services
- ❖ Far slower adoption in ISP services using the network

Ethernet like connectivity

- ❖ Less common but..
- ❖ These are the easiest customers to dual stack and hardest to communicate with

Cable and DSL

- ❖ Majority have started to look at or have completed DSLAM and CMTS upgrades (or have plans to) but still have issues with vendor support for CPE.
- ❖ SLAAC supported DHCPD some, PD not supported on any that I am aware as of this writing.
- ❖ Customer gear still unknown..

Fears

- ❖ Old systems will be used forever (think pulse)
- ❖ Transition technologies will be used forever
- ❖ Plans will be incorrect
- ❖ No real development on the other side of the demarc
- ❖ DNS never gets fixed
- ❖ Security becomes a nightmare

What happens if I do nothing?

- ❖ How are my customers affected by CGN?
- ❖ Who takes the support call?
- ❖ Do my customers go to my competitor?
- ❖ Do devices start to exist with IPv6 only?

What's missing?

- ❖ Everything beyond the pipe/CPE/demarc still in development / no real standards
- ❖ No idea what will happen to the IPv4 unicast table
- ❖ No idea what will happen when global transfer opens / speed up runout?
- ❖ Awareness could be triggered suddenly

Sum up

- ❖ ISPs networks are well dual-stacked and challenges are possible to overcome but fluid.
- ❖ Services over the network are moving along but slowly.
- ❖ A good deal of mysteries still exist BCOPs still in progress
- ❖ This, like all presentations about IPv6 will be out of date by the time we get to the questions slide..

Questions?

❖ Aaron Hughes <aaron@6connect.com>