

IPV6 FOR INTERNET SERVICE PROVIDERS STATE/LESSONS/STILL TO COME

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RIPE70

PERCEPTION OF IPV6 IMPLEMENTATIONS

- Network People
 - “We dual stacked the network years ago and we’re done”
- Sales People
 - “Yes, we have that”
- DevOps
 - “We don’t really need to do anything” – “Do I need to be doing anything?”
- Systems Support staff
 - “All we have to do is turn it on and HUP the process”
- Cloud Providers
 - “We can get you an IPv6 address”..

EXPLORING REALITIES

- After conducting interviews with various type of providers in the Service Provider space, I've found that reality does not match perceptions.
- While we in the operator and policy forums are focused heavily on dual stacking backbones, eyeballs and eyeball facing content, the reality of percentage of implementation is different than perception.
- The globally acceptable metric in these forums seems to be percentage of IPv6 traffic on the global internet measured by, typically, Google.
- While measuring actual implementation with ISPs may be challenging, this is an attempt to give the state of some ISPs, where they are today, difficulties, and general experiences.
- If this is useful, it may be useful to have regular polls in an anonymous format for Service Providers (and perhaps Enterprises) to provide to this audience.

A SMALL CANADIAN ISP

- Our IPv6 plan was phased over time
- We started with our BGP core adding transit and peers over time
- As part of server refreshes, we enabled IPv6 functionality over time.
- A byproduct of the migration has been the cleanup of a number of outlier systems and network components.
- We didn't have a large lab to test everything so we would change a small part each time and watch for issues.
- To date a couple minor bugs but no customer facing concerns.

A SMALL CANADIAN ISP CONT.

- Routers
- Switches
- BACKEND Monitoring
- DNS (recursive)
- DNS (authoritative)
- MAIL
- Control Panel Web Servers
- Radius
- Backup Servers
- VPN
- Corporate Firewall

A SMALL CANADIAN ISP CONT.

Things we learned along the way:

1) The Big Unknown. Older Servers and Routers need to be updated or refreshed.

- Stateful Firewall for IPv6 not supported in Redhat 5 (No Connection Tracking).
- Feature parity in older JunOS versions weren't there.
- FreeRadius 1.x doesn't support sending IPv6 packets.

2) It's the small things

- fail2ban a firewall script for blocking doesn't have IPv6 support (experimental only)
- Custom scripts written years ago were making IPv4 assumptions.
- We use greylisting and utilize whitelisting, very limited IPv6 support.

A SMALL CANADIAN ISP CONT.

3) Reverse DNS is a bind ☺

- We migrated to PowerDNS to simplify IPv6 reverse delegation.

4) Have a plan for your netblock

- A /32 is a lot of space for a small ISP, unless you divide it badly. We split ours into a /36 per POP. Each business customer is sparse allocated a /48.

5) The final step is the enabling of IPv6 for our DSL and Fibre customers, as this has the most devices outside of our control.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- Dual stacking the backbone was easy.
 - We started with peers early on (HE was a huge help since they provided full tables)
 - Transit was harder to get and took time to get them to execute (6 months for all transit providers to get completed)
- Subnet size challenges for PTP (/127 v /126 v /64)
 - Initially used /64s, switched to /126s after hearing about TTL bouncing attacks. Chose 126 over 127 to keep operation staff comfortable with ::1 ::2 (discarded the rest of the 64) (Didn't like the idea about :: (or ::0) as a valid address.
 - Over time converted back to 64s on all interfaces and 48s to customers via static.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- After dual stack was completed, added a few SLAAC subnets in lab environments and quickly added public facing services (NS, MAIL, WEB)
- Writing IPAM was a painful process e.g. get next approach different from IPv4
- Internal tools took some time to update and training sales and SEs to add fields in Salesforce for IPv6 allocation (\$0 line item) was challenging to explain.
- Selling the story internally to all staff was like talking about the Y2K issue. People simply didn't believe we were really in need of making serious changes.
- Customer "demand" trickled in slowly over time and implementation staff received real world experience with turn-ups including customer BGP inet6, etc.
- Took an additional year to get supporting internal services dual stacked.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- Supporting systems were difficult
 - Training ops on PTRs for ip6.arpa. / Delegation not easy.
 - Were using IRRPT for customer filters, no support for v6
 - Many hard coded references in code, logging analysis, abuse reporting, etc
 - No monitoring tools available to properly externally monitor dual stack.
 - Added additional probes per host with hard coded stack
 - Still a work in progress with external monitoring orgs.
 - Debating service.ipv4.domain.com & service.ipv6.domain.com
 - Name Based virtual hosts with application testing extremely difficult.
 - Internal monitoring was less of an issue, but still no decent discovery of v6 subnets and hosts within. Displaying stacks on visuals is still a challenge.
 - Debugging which stack is being used not being relayed clearly to support.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- IPv6 not engrained in decision making
 - Getting entire company to require proper support from vendors (not make the problem worse) is very hard to instill
 - Not willing to put the relationship on the line for IPv6 support.
 - Constant reminders to provisioning staff that dual stack must be the default assignment is getting better, but still not part of normal behavior
 - Convincing sales to charge more money for IPv4 statics and give IPv6 without cost is difficult. They don't want to confront the "why" we are charging more with the customer(s).
 - Eating your own dog food is not enough to get people to understand the underlying differences.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

Downstream Training:

- Educating prospects and existing customers is an uphill battle
 - Sales staff does not want to risk potential revenue by injecting IPv6 into RFP requirements.
 - The level of comfort with discussing downstream customers IPv6 plan is low. There is a fear that the dialogue can interfere with margin or cause them to feel unhappy
 - Additional fears / discomfort with potentially disclosing how much IPv4 space is in our own inventory (The customer may go somewhere with more inventory).

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- Feature Parity
 - Seemingly simple features in IPv4 are not supported with IPv6 on a great deal of hardware and software (or supporting software)
 - Cisco HSRP (standby version 2)
 - Stateful firewalls
 - Load balancers
 - IPS/IDS/Security analysis tools (and alerting)
 - FlowAnalysis
 - Log Parsing tools
 - Filtering tools
 - DNS management tools
 - DHCPd (and helper addresses)
 - Odd behaviors with v4 NAT + v6 Native (inconsistent security policies)

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- Internal supporting staff
 - Very limited number of operations and IT staff able to understand how to debug IPv6 and dual stack issues.
 - Even fewer able to train others
 - DevOps staff consider requests 'new features' vs. 'bug' and have long timelines.

A MEDIUM SIZED PROVIDER IN CALIFORNIA

- Security
 - Entirely different to secure
 - Duplication of policies does not always work
 - NAT is no longer the demarc and requires unique policy
 - Some applications only bind to IPv4 and avoid the security application entirely
 - Symantec Encryption Desktop / PGP issues
 - Duplicating security policy challenges

A CLOUD SERVICE PROVIDER

- Orchestration platforms missing IPv6 support entirely.
 - vCenter, vRemote, etc, zero support for IPv6
- Defining vCell IP schema difficult, matching to existing 1918 plan
- Could not add management network without public facing first
 - If a server has an IPv6 address, it will attempt to use the AAAA's of those returned.
- DNS policies utilizing split horizon need to change
- Mapping solutions for things such as OpenStack UUID (mgmt ssh broken)
- Most provisioning tools are home-grown dev-ops v4 only
- Missing ILMI support over v6 on a ton of gear

EYEBALL ACCESS

- All connected Ethernet type services were easy to dual stack (bridged)
- DSL and cable modems have mixed support and behavior
 - Feature parity missing with 100% of vendors based on received feedback
 - Missing firewall, mapping, MAC filtering, security features
- Allocation sizes to customers vary from a single /64 to a /48.
- Surprising majority only hand out a single /64
- Support for static v6 assignments missing from most eyeballs.
 - Long DHCP leases were the norm
 - Several waiting on CMTS support for IGP features.

BACKBONE TOPOLOGY

- Overwhelming majority:
 - OSPFv3 on loopbacks and connected links
 - iBGP injecting other connected interfaces and static routes
 - eBGP aggregation of aggregates
 - Most started with dual stacking the backbone, adding peers or transit and working their way in from edge to core
 - Most added test systems and then some public facing services
 - Most added operations staff for purposes of comfort
 - Most then considered this a stopping point for a long time while working on internal education and approaching all other services and equipment over long periods of time.

CONCLUSIONS

- ISPs have had no trouble dual stacking their backbones
- Major public facing services were mostly easy to deploy
- There is still a great deal of work to do with hardware and software vendors
- Many vendors claim support which simply does not work
- Completely missing in all evaluated cloud orchestration products
- Getting to the next steps (default v6 for all customers, services, educated staff same as v4) is going to take a lot of time.
- Continuous work with hardware and software vendors
- “IPv6 enabled / compatible” frequently means broken implementations or some portion of IPv6 support
- Everyone I spoken to was comfortable talking about their experiences and naming specific vendors with issues as long as they were anonymous.

QUESTIONS / COMMENTS ?

