Rock Solid Internet Exchange

Deploying IPv6

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What we wanted to do

- Deploy IPv6
  - I.e make it work like IPv4 - just with IPv6
  - Seemed like such a straight-forward idea :-)
- The important thing
  - It is meant to be production, so it had to be production quality
  - All monitoring and statistics had to work too...

Problem split

- We have different categories of services that needed to be ported
  - The IX LANs
  - The services at the IX(es)
  - i.root-servers.net / TDLs / Anycast

IX LANs

- Very straightforward
- Apply for your IPv6 allocation from RIPE
  - Will be a /64 for a single LAN IX
  - Or /48
- We then assigned /64 per VLAN (there are two VLANs per site, MTU1500 and MTU4470)

IX LANs

- We are running IPv6 on the same infrastructure as IPv4
- Each ISP will get a static IPv6 address from each /64
  - For example 2001:7f8:d:ff::73/64
  - The last "octet" matches that of IPv4

Netnod services

- Netnod as LIR applied for an initial allocation of a /32 from RIPE under the current policy
- Then we made an address plan
  - Somewhat interesting starting from scratch
  - We split out one /48 per city using binary-chop
  - And left space for (services-) customer allocations

The steps...

- 1. Enabled IPv6 on the infrastructure
  - Loopback interfaces
  - P2P Links
  - LANs
  - Established iBGP sessions and set up OSPFv3

The steps

- 2. Enabled IPv6 on office LANs, and some servers
  - Services where given static addresses. I.e 2a01:3f0:1:3::101.
  - Office LAN is given addresses via RA
  - DNS resolving is done over IPv4 (we are looking at DHCPv6 - now we just need a client...)
  - Added AAAA for public names, i.e www, mail, etc

The steps

- 3. Monitoring
  - Nagios is used for monitoring using 2.10
  - Initially ran into problems with perl libraries (Net::DNS) needed to support IPv6 addresses
  - Doubles the number of alarms
- 4. Then the problems started...

Problems

- Routing
  - Native or not - it's a jungle. We are still seeing really weird routing issues. And we have spent significant efforts on debugging routing all around the world
- Customers reporting faults
  - Related to above, but it turns out to be really hard to be (seemingly) alone in trying to offer a production quality service. I.e first of all to find someone at a provider that knows they are running IPv6 followed by convincing them to fix problems is hard

The problems

- Vendors
  - Needs to be able to check the "IPv6 ready" box for US DoD contracts
  - Only assures the box actually forwards packets with IPv6 packet headers
  - Seems like vendor regression testing consists of "it compiles"
  - We still lack those 20 years of usage that made RFCs into software that you can operate
    - A lot of relearning needs to be done
  - I am ignoring all software bugs we found

Lessons learnt

- The IX side is very straight forward
- But some better debugging for example NDP snooping would have been nice
- Discussion on same vs. dedicated VLAN
  - Again, we see this as production and want our customers to do the same
  - 18 members have IPv6 IX addresses

Lessons learnt

- EUI64 addresses are meaningless except perhaps on workstations
  - Impossible to debug, maintain reverse DNS for and changes when you replace hardware
- Routerinterfaces, loopbacks, and servers all have static interfaces.
- P2P links set to /64. No real reason...

Lessons learnt

- Make sure you don't fall into known traps as you start adding AAAA records
- We found it easier to threat IPv6 just as IPv4. Same processes, same set-up etc.
- Seems to be great interest in the topic among members
  - We organised a workshop on IPv6 with 75 attendees - for multicast we had 20

Left to do

- Upgrade standard kernels on machines running Quagga
- Install / Activate IPv6 in production for i.root-servers.net (already running for Unicast DNS zones)
- Pick a set of IPv6 capable anycast hosts and start anycasting

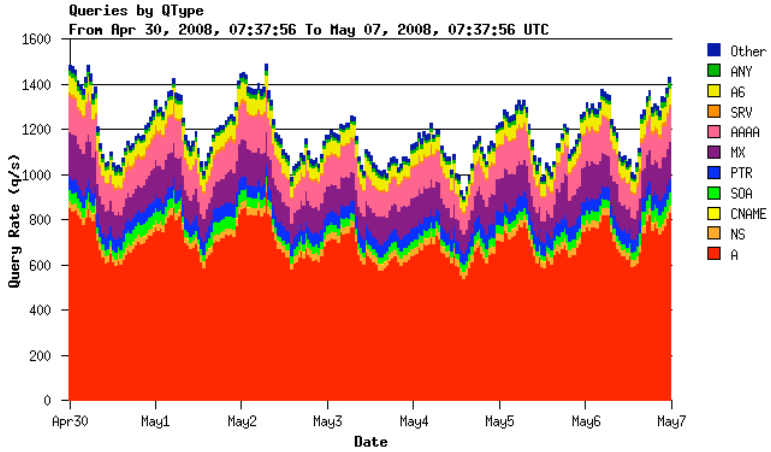
Left to do

- The other cities will be interesting
  - Either announce more specifics, i.e /48s and hope they get propagated (likely)
  - Or build tunnels back to Stockholm where we announce the /32
  - Or most likely - both
- Training, documentation, debugging, and training
  - http://www.6diss.org/e-learning/

Summary

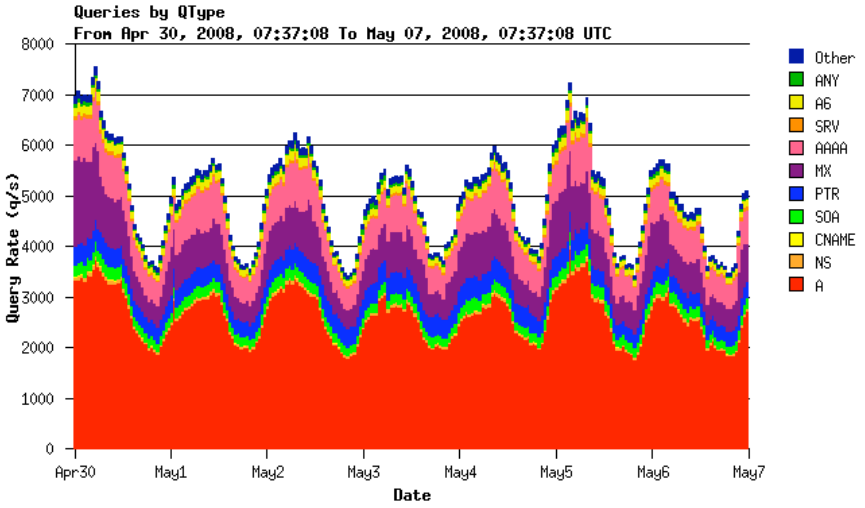
- It wasn't hard
- It does take planning
- It will take a lot more time than you think - due to details annoying differences and debugging
- It actually works...
- We will do a more detailed writeup and post to the Wiki at http://www.civile-tongue.org/6and4

Some stats



Tokyo

Stockholm



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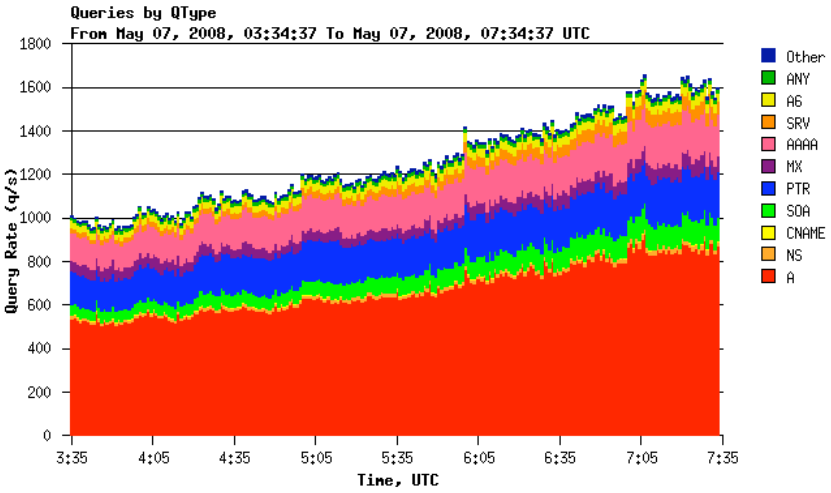
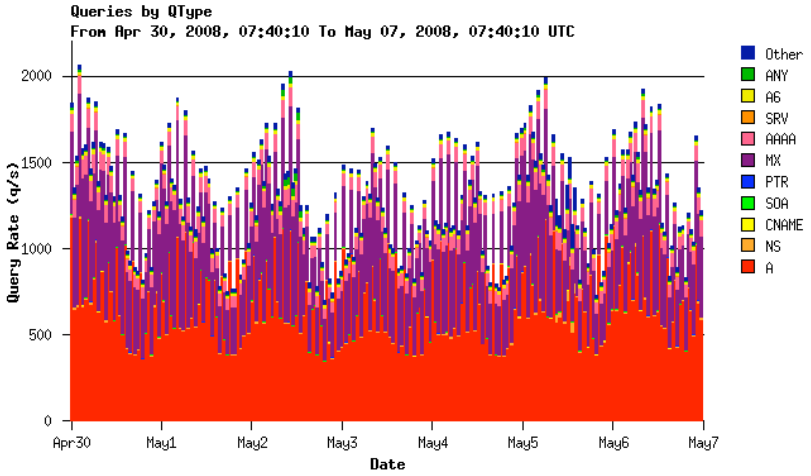
Some stats



London

Unicast Stockholm



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Questions?