

DNS Enterprise Anycast: From Exotic to Necessary

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So, Who Am I and Why Do I Care About DNS?

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- DNS anycast services for lots of ccTLDs: most of Western Europe, customers all over Africa, South America and Asia (we're possibly the largest DNS operator on the Internet for ccTLDs)
- premium and standard enterprise DNS anycast designed for large numbers of zones
- ... from a grand total of roughly 70 locations around the Internet (including Copenhagen, Stockholm and every nordic country)

... to some extent this may be my fault

When DNS Anycast Was Exotic

DNS used to be easy, but those days are long gone.

- we reached the point where Anycast started being used, for a few high profile zones (starting with the root)

Now DNS is of ever growing importance, and that causes all sorts of changes.

- DDOS risks and complexity in DDOS prevention stuff (RRL)
- new software choices with more and more dynamic configs
- at the same time zones must be deployed rapidly (or at least the zone owner believes so)
- and the zone data in itself is becoming more and more dynamic

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- nor as boring. . .

Let's look at what is changing in slightly more detail.

Changes

During the last few years a number of changes, some technical, some not so technical, have been propagating through the DNS community.

- DNS Anycast has become a staple technology
 - root, TLDs and also Enterprises
- DDOS attacks have become a routine issue
- static configurations are disappearing
- more and more “behaviour modifying” features outside the DNS protocol are used to tweak responses in various ways
- system complexity is exploding, and this is a problem

The major reason that DNS is becoming a “problem” is that there **is not sufficient revenue to match the increasing cost of operation.**

Sidebar: DDOS, DDOS, DDOS

However, important as the DDOS threat is, I think that it is important not to make too much of it.

- i.e. we, as a community, should avoid falling into the trap of trying to make the argument that every DNS zone on the Internet is going to be attacked all the time.
- ... that is just not going to happen

There are also other forces at play in the market

- primarily economic drivers

... and this may turn out to actually be more important.

Emergence of “DNS APIs”

The DNS space consolidates. Fewer providers provide service for vast numbers of zones (authoritative service) or vast numbers of users (recursive service), but always with vast numbers of servers. In practice, the configuration file is disappearing

- the days of manual hacking `named.conf` are over
- today a requirement on DNS service is “API access”

What is that? Well, there are

- provisioning APIs (adding and removing zones, modifying content of zones, etc)
- stats APIs (returning statistics and sometimes pretty graphics)
- management APIs (managing servers, modifying policies, etc)

With the APIs follow new needs for authentication, etc

The Requirement For an SLA

Furthermore, slowly but surely, the number of customers that

- have requirements on time-to-resolution of problems,
- have requirements on capacity and overprovisioning levels,
- have requirements on service levels,
- etc,

are increasing.

SLA requirements are difficult to deal with in a professional way when running a best effort service in a corner

- dependent on staff that often has a gazillion other responsibilities in addition to DNS

DNS very rarely is a profit center, which makes it hard to staff up.

Outsource Some Zones!

The solution is of course to outsource the zones that have SLA requirements (or they will go elsewhere for DNS service on their own).

- the problem with this is that in a zero margin business it is not easy to justify the time required to segment the customer base into:
 - "**premium**" customers (that require quality service, SLAs, etc, and are prepared to pay for it)
 - "**standard**" customers (who will always go for the cheapest, preferably zero-cost, alternative)

So the problem is usually deferred.

Price Erosion To The Rescue!

Because of the massive rollout of anycast services we're seeing price erosion among the commercial services.

- while the cost of "running your own infrastructure" is increasing

There are always new threats. Apart from DDOS threats the software vulnerability threats are a major concern.

- software vulnerabilities: the gift that keeps on giving :-)

And, again, DNS is not a profit center in most cases.

Price Erosion, cont'd: **Outsource All Zones**

The price erosion is reaching a price point where it is more cost effective to just outsource the entire portfolio of customer zones, regardless of whether they are

- **premium** zones (that would be willing to pay)
- or **standard** zones (that would not)

to an external provider (able to run on a thinner margin due to higher volume).

- will there be a waterfall effect?
- not unlikely that most zones in the public DNS are migrated to the large DNS service providers in relatively short time

Market Penetration Thresholds Are Interesting Things

History is full of examples where “change” started gradually. . . but when it reached a certain threshold there was a cascade effect

- at first only a few, wealthy, families had phones. . . but when a threshold was reached everyone had to get one
- at first only geeks and university students had email. . . but when the threshold was reached everyone had to get email
- . . . cars, credit cards, Internet access, etc, etc

At some point we will reach a threshold where basically everyone

- zone owners, registrars, web and email hosting providers, etc switch to DNS service from a dedicated DNS provider rather than fiddling with a bunch of servers on their own

- I believe that we are **getting close to that point.**

And then DNS Anycast Becomes Necessary

When this happens, it will be anycast service for every DNS zone, including the one only used for my dog's fan mail.

- no business case for unicast as a commercial service

At this point:

- the market will inevitably become more “professional”
- the general quality of the DNS name space will increase and the number of outages and issues will decrease
- general DDOS resilience will increase (although no one with a sane mind will be willing to guarantee ability to withstand a large attack)
- outages due to “the nameserver is broken” will mostly disappear as a source of problems

Disadvantages of DNS Anycast Becoming Necessary

Yes, there are disadvantages:

- smaller providers will be edged out of the market
 - there is a real **risk of increased fate sharing** as more and more zones are served by a shrinking number of massive providers
- the cost (to remaining providers) of moving all the data for millions of zones of minor importance to anycast servers at the edge of the Internet will be impossible to recover

In the end there is no way around the problem that there is a real cost to providing a professional anycast service from servers installed in many remote locations.

- if all the customers go for the lowest cost alternative
- ... then the end game will not be pretty

Does DNS-As-A-Service Cause Risks Of Mono Culture? Closed Source?

DNS has a long tradition of relying on open source implementations. Most of the major implementations (BIND, NSD, etc) have always been open source.

- it is certainly a rich culture (despite the huge BIND user base)

Will a rapid migration towards professional DNS services provided by a limited number of providers change this?

- probably yes (as in some implementations will die), but not enough to make the risks of mono culture a real concern

My concern is instead the trend towards closed source implementations that implement various extensions to DNS as a means to distinguish themselves from the competition

The DNS Problem (for the registrar/hosting/etc company)

The "DNS problem" (or "DNS question") is about to shift from:

- choice of software platform to use on the nameservers,
- worrying about new vulnerabilities ("time to urgently upgrade BIND9 again. . .")
- configuration management, etc

and largely instead be about:

- different APIs provided by the DNS service providers ("does the the API from DNS provider X support feature Y?")
- the SLAs they're offering, and at what price point,
- lock-in effects of adapting systems to someone else's API, etc

The DNS Problem (for the DNS service provider)

More and more zones, more and more DDOS attacks and continued price erosion is not an ideal mix.

- aggressive automation of everything that can be automated is necessary,
- anycast services must evolve significantly to deal with a situation where they define the base-line

We will see a widening spectrum of services available via the provisioning APIs to allow the customers to pick and choose according to their needs and requirements.

- the old, static, anycast service that was just a **standard slave server cloned into many locations will no longer be sufficient**

Some Predictions for the Future (this is so last year!)

- ① The drivers for further DNS evolution remain
 - “DNS service” and “routing” is becoming more and more mixed up due to prevalent use of anycast
 - DNS will continue to become an ever more complex service
 - with increasing complexity more and more of the “regional level” DNS service will be edged out
- ② DNS is becoming a more professionalised service
 - with a smaller number of large scale providers
- ③ DNS consulting will remain a good field of work

Some Predictions for the Future

Updated

- ① The drivers for further DNS evolution remain
 - “DNS service” and “routing” is becoming more and more mixed up due to prevalent use of anycast, **but customers won't care, no longer their problem**
 - DNS will continue to become an ever more complex service
 - **the market forces will ensure that within a few years time very few of you will run public authoritative (or recursive) servers**
- ② DNS is becoming a more professionalised service
 - with a smaller number of large scale providers
 - **and an increasing dependence on closed source implementations**
- ③ DNS consulting will **increasingly consist of API integration work**

DNS Anycast Services For The Enterprise Market

- After many years of providing DNS Anycast Services for the **root zone** and a large number of **major ccTLDs**, Netnod is now also providing the same set of services to the **Enterprise market**
 - ... but with a completely new provisioning infrastructure to be able to cater to very large numbers of small zones
 - ... rather than just a single (large) zone (the typical case for a ccTLD customer)
- In the Northern European region we believe that we are already able to provide a significantly better DNS service at a lower cost than other DNS providers
 - as we continue our rollout the same will be true for an increasing number of markets