

DOMAIN NAME SYSTEM (DNS) DELEGATION

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How do you delegate a subdomain?

- In principle straightforward: just insert NS records for the sub-domain, pointing at someone else's servers.
- If you are being careful, you should first check that those servers are authoritative for the sub-domain.
 - by using "dig +norec" on all the servers.
- If the sub-domain is managed badly, it reflects badly on you!
- and you don't want to be filing problem reports when the problem is somewhere else.

Zone file for "example.com"

```
$TTL 1d
@ 1h IN SOA ns1.example.net. brian.nsrc.org. (
    2008052700 ; Serial
    8h         ; Refresh
    1h         ; Retry
    4w         ; Expire
    1h )       ; Negative

    IN NS ns1.example.net.
    IN NS ns2.example.net.
    IN NS ns1.othernetwork.com.

; My own zone data
    IN MX 10 mailhost.example.net.
www  IN A  212.74.112.80

; A delegated subdomain
subdom IN NS ns1.othernet.net.
      IN NS ns2.othernet.net.
```

There is one problem here:

- NS records point to names, not Ips.
- What if zone "example.com" is delegated to "ns.example.com"?
- Someone who is in the process of resolving (say) www.example.com first has to resolve ns.example.com.
- But in order to resolve ns.example.com they must first resolve ns.example.com !!

In this case you need "glue"

- A "glue record" is an A record for the nameserver, held higher in the tree.
- Example: consider the .com nameservers, and a delegation for example.com.

```
; this is the com. zone

example                NS  ns.example.com.
                       NS  ns.othernet.net.

ns.example.com.  A      192.0.2.1      ; GLUE RECORD
```

Don't put in glue records except where necessary

- In the previous example, "ns.othernet.net" is not a subdomain of "example.com". Therefore no glue is needed.
- Out-of-date glue records are a big source of problems.
 - e.g. after renumbering a nameserver.
 - Results in intermittent problems, difficult to debug.

Example where a glue record IS needed

```
; My own zone data
                IN  MX  10  mailhost.example.net.
www             IN  A   212.74.112.80

; A delegated subdomain
subdom          IN  NS  ns1.subdom          ; needs glue
                IN  NS  ns2.othernet.net.   ; doesn't
ns1.subdom      IN  A   192.0.2.4
```


Checking for glue records

- `dig +norec ...` and repeat several times.
- Look for A records in the "Additional" section whose TTL does not count down.

```
$ dig +norec @a.gtld-servers.net. www.as9105.net. a
...
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 1
;; QUERY SECTION:
;;      www.as9105.net, type = A, class = IN

;; AUTHORITY SECTION:
as9105.net.      172800  IN      NS      ns0.as9105.com.
as9105.net.      172800  IN      NS      ns0.tiscali.co.uk.

;; ADDITIONAL SECTION:
ns0.as9105.com.  172800  IN      A        212.139.129.130
```



DOMAIN NAME SYSTEM (DNS) REVERSE DNS

How to manage reverse DNS

- If you have at least a /24 of address space then your provider will arrange delegation to your nameservers.
 - e.g. your netblock is 196.222.0.0/24.
 - Set up zone 0.222.196.in-addr.arpa.
- If you have more than a /24, then each /24 will be a separate zone.
- If you are lucky enough to have a /16 then it will be a single zone.
 - 196.222.0.0/16 is 222.196.in-addr.arpa.

Example: 196.222.0/24

/etc/namedb/named.conf

```
zone "0.222.196.in-addr.arpa" {  
    type master;  
    file "master/196.222.0";  
    allow-transfer { ... };  
};
```

/etc/namedb/master/196.222.0

```
@    IN    SOA    ....  
      IN    NS    ns0.example.com.  
      IN    NS    ns0.othernetwork.com.  
  
1    IN    PTR    router-e0.example.com.  
2    IN    PTR    ns0.example.com.  
3    IN    PTR    mailhost.example.com.  
4    IN    PTR    www.example.com.  
; etc
```

How it works

- e.g. for 196.222.0.4, the remote host will lookup 4.0.222.196.in-addr.arpa. (PTR).
- The query follows the delegation tree as normal. If all is correct, it will reach your nameservers and you will reply.
- Now you can see why the octets are reversed.
 - The owner of a large netblock (e.g. 192/8) can delegate reverse DNS in chunks of /16. The owner of a /16 can delegate chunks of /24.

There is nothing special about reverse DNS

- You still need master and slave(s).
- It won't work unless you get delegation from above.
- However, DO make sure that if you have a PTR record for an IP address, that the hostname resolves back to the same IP address.
- Otherwise, many sites on the Internet will think you are spoofing reverse DNS and will refuse to let you connect.

What if you have less than /24?

- Reverse DNS for the /24 has been delegated to your upstream provider.
- Option 1: ask your provider to insert PTR records into their DNS servers.
 - Problem: you have to ask them every time you want to make a change
- Option 2: follow the procedure in RFC 2317.
 - Uses a trick with CNAME to redirect PTR requests for your IPs to your nameservers.

e.g. you own 192.0.2.64/29

In the provider's 2.0.192.in-addr.arpa zone file

```
64      IN      CNAME    64.64/29.2.0.192.in-addr.arpa.
65      IN      CNAME    65.64/29.2.0.192.in-addr.arpa.
66      IN      CNAME    66.64/29.2.0.192.in-addr.arpa.
67      IN      CNAME    67.64/29.2.0.192.in-addr.arpa.
68      IN      CNAME    68.64/29.2.0.192.in-addr.arpa.
69      IN      CNAME    69.64/29.2.0.192.in-addr.arpa.
70      IN      CNAME    70.64/29.2.0.192.in-addr.arpa.
71      IN      CNAME    71.64/29.2.0.192.in-addr.arpa.
64/29   IN      NS       ns0.customer.com.
64/29   IN      NS       ns1.customer.com.
```

Set up zone "64/29.2.0.192.in-addr.arpa" on your nameservers

```
65      IN      PTR      www.customer.com.
66      IN      PTR      mailhost.customer.com.
; etc
```

DOMAIN NAME SYSTEM (DNS) LANDMARKS

DNS Landmarks

- A quick survey of organisations and personalities involved in the DNS.
 - The Root Zone.
 - Top-Level Domains.
 - Registries, Registrars, Registrants.
 - Nameserver Vendors.
 - Conferences, Industry Groups.
 - Mailing Lists.

The Root Zone

- The root zone contains delegations for top-level domains.
 - Hosted by root server operators.
 - 13 root servers, 12 root server operators.
 - Named [A-M].ROOT-SERVERS.NET
 - See www.root-servers.org (note! org, not net).

Top-Level Domains

- Generic Top-Level Domains (gTLDs).
 - Created either years ago by early Internet pioneers (e.g. COM, ORG, NET), or created recently by giant international policy processes (e.g. INFO, BIZ, MUSEUM).
- Country-Code Top-Level Domains (ccTLDs) derived from ISO 3166.
 - Database of TLDs maintained by the IANA, see www.iana.org.

Registries, Registrars, Registrants

- Registry – a database of domain registrations which is used to generate a zone file (or the organisation that maintains that database).
- Registrar – an organisation that maintains the data within the registry.
- Registrant – an end user who registered a domain.

Nameserver Vendors

- Free Software.

- BIND from ISC, www.isc.org.
- NSD, unbound from NLNet Labs, www.nlnetlabs.nl.
- PowerDNS, see www.powerdns.com.

Commercial Software.

- ANS, CNS from Nominum, www.nominum.com.

Conferences, Industry Groups

DNS-OARC, www.dns-oarc.net

- RIPE dns-wg, www.ripe.net/ripe/wg/dns/
- IETF.
 - dnsop, www.ietf.org/html.charters/dnsop-charter.html
 - dnsext, www.ietf.org/html.charters/dnsext-charter.html
- Various Policy Bodies.
 - Not listed here for fear of offending someone by including or excluding them, use Google

Mailing Lists

- AfNOG, afnog@afnog.org
- DNS-OARC, dns-operations@mail.dns-oarc.net
- CCNOG, operations@ccnog.org
- ISC, bind-users@lists.isc.org
- NLNetLabs, unbound-users@unbound.net
- RIPE, dns-wg@ripe.net
- IETF, dnsop@ietf.org (DNSOP),
- namedroppers@ops.ietf.org (DNSEXT)

DOMAIN NAME SYSTEM (DNS)

COURSE SUMMARY

Summary

- Distributed database of Resource Records.
 - e.g. A, MX, PTR, ...
- Three roles: resolver, cache, authoritative.
- Resolver statically configured with nearest caches
 - e.g. /etc/resolv.conf
- Caches are seeded with a list of root servers.
 - zone type "hint", /etc/namedb/named.root
- Authoritative servers contain RRs for certain zones (part of the DNS tree).
 - replicated for resilience and load-sharing.

Summary Cont'd

- Root nameservers contain delegations (NS records) to gTLD or country-level servers (com, ke etc).
- These contain further delegations to subdomains.
- Cache finally locates an authoritative server containing the RRs requested.
- Errors in delegation or in configuration of authoritative servers result in no answer or inconsistent answers.

Further reading

- "DNS and BIND" (O'Reilly).
- BIND 9 Administrator Reference Manual.
 - </usr/share/doc/bind9/arm/Bv9ARM.html>
- <http://www.isc.org/sw/bind/>
 - includes FAQ, security alerts.
- RFC 1912, RFC 2182.
 - <http://www.rfc-editor.org/>

Q&A.

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THANK YOU!