

# Inserting Resource Records into DNS

- Example: just created startup “FooBar”
- Get a block of address space from ISP
  - Say 212.44.9.128/25
- Register foobar.com at Network Solutions (say)
  - Provide registrar with names and IP addresses of your authoritative name server (primary and secondary)
  - Registrar inserts RR pairs into the com TLD server:
    - (foobar.com, dns1.foobar.com, NS)
    - (dns1.foobar.com, 212.44.9.129, A)
- Put in your (authoritative) server dns1.foobar.com:
  - Type A record for [www.foobar.com](http://www.foobar.com)
  - Type MX record for foobar.com

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- In addition, need to provide reverse PTR bindings
  - E.g., 212.44.9.129 " dns1.foobar.com
- Normally, these would go in 129.9.44.212.in-addr.arpa
- Problem: you can't run the name server for that domain. Why not?
  - Because your block is 212.44.9.128/25, not 212.44.9.0/24
  - And whoever has 212.44.9.0/25 won't be happy with you owning their PTR records
- Solution: ISP runs it for you
  - Now it's more of a headache to keep it up-to-date :-)

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- In addition, need to provide reverse PTR bindings
  - E.g., 212.44.9.128 → 128.9.44.212.in-addr.arpa
- Normally, these are managed by the ISP
- Problem: you can't manage your own PTR records
  - Because your ISP owns the in-addr.arpa domain. Why not?
  - And whoever manages the PTR records
- Solution: ISP runs it for you
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Why do you think we use PTR records?

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Why do you think we use PTR records?

Anti-spam  
Logging

r.arpa

domain. Why not?

4

u owning their PTR

# DNS Measurements (old study from 2000)

- What is being looked up?
  - ~60% requests for A records
  - ~25% for PTR records
  - ~5% for MX records
  - ~6% for ANY records
- How long does it take?
  - Median ~100msec (but 90th percentile ~500msec)
  - 80% have no referrals (I don't know the answer but you should check this other server next); 99.9% have fewer than four
- Query packets per lookup: ~2.4

# DNS Measurements (old study from 2000)

- Top 10% of names accounted for ~70% of lookups
  - Caching seems like an excellent idea
- 9% of lookups are unique
  - Cache hit rate can never exceed 91%
- Cache hit rates ~ 75%
  - But caching for more than 10 hosts doesn't add much

# DNS Measurements (old study from 2000)

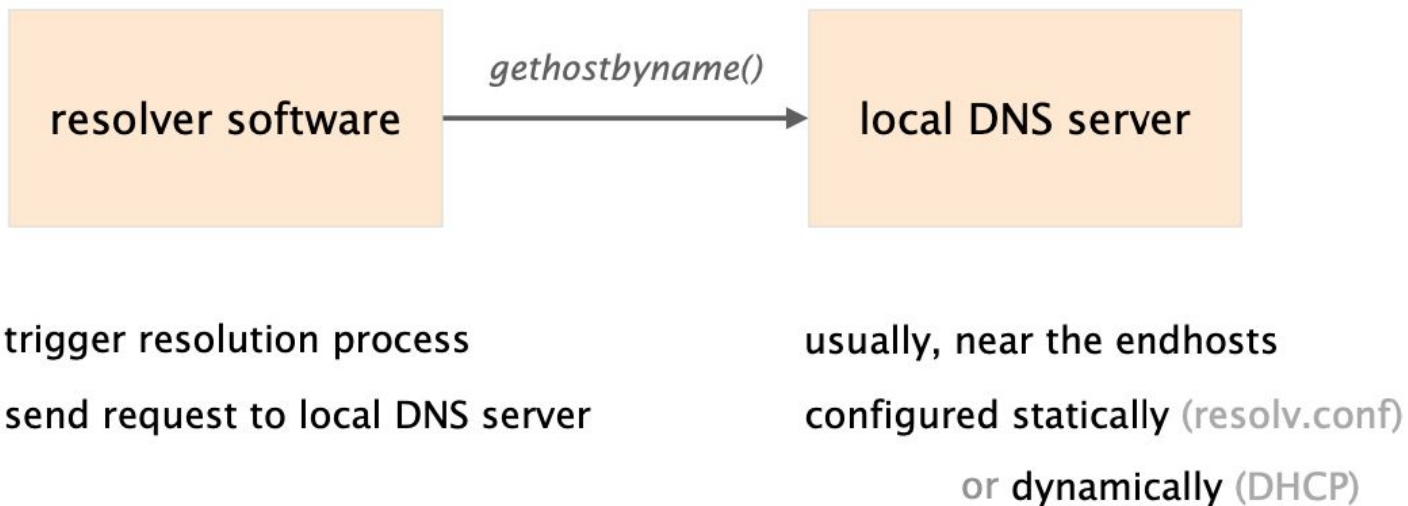
- Does DNS give answers?
  - ~23% of lookups fail to elicit an answer!
  - ~13% of lookups result in NXDOMAIN (or similar)
    - Mostly reverse lookups
  - Only ~64% of queries are successful!
    - How come the web seems to work so well?
- ~63% of DNS packets in unanswered queries!
  - Failing queries are frequently retransmitted
  - 99.9% successful queries have  $\leq 2$  retransmissions

## Moral of the story

- If you design a highly resilient system, many things can be going wrong without you noticing it



# User perspective: DNS relies on two components



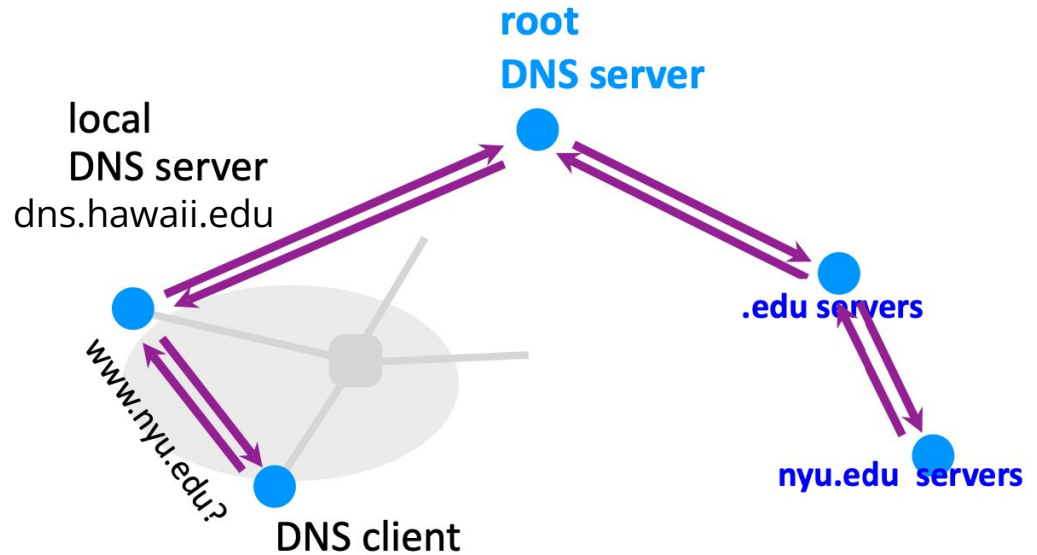
# How does it work? Recursive vs Iterative Queries

## Recursive query

- Ask each server to get answer for you (most common)

## Iterative query

- Ask server who to ask next



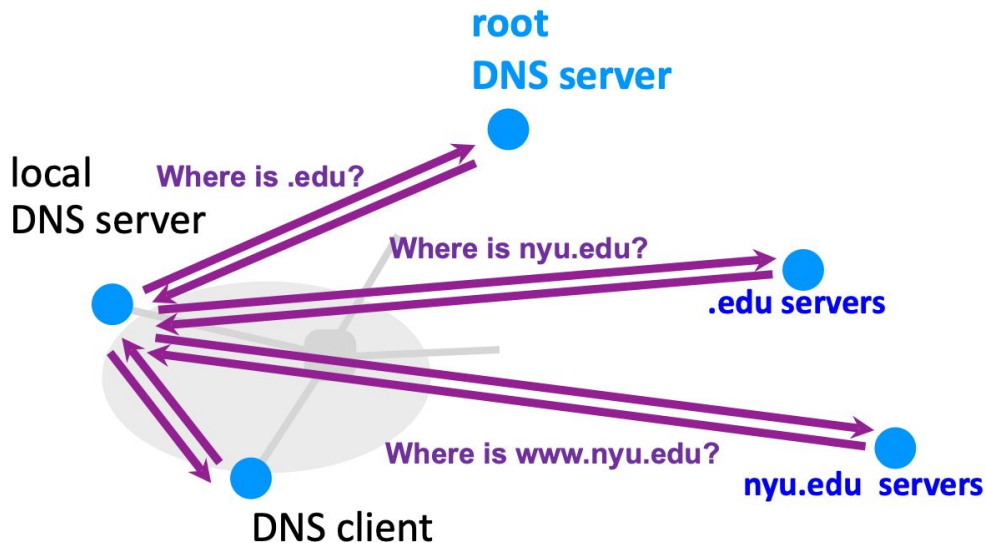
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# Exercise

On Linux and Mac computers you can use the command line tool `dig` to perform DNS lookups. The corresponding tool for Windows is `nslookup`. First, perform a lookup for `nyu.edu` using your default DNS server by running the command `dig nyu.edu` or `nslookup nyu.edu`.

What is the IP address of the server behind `nyu.edu`?

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What is the IP address of the server behind `nyu.edu`?

Solution: Note that the actual IP address can depend on the local DNS server you use. We got the following answer with `dig`:

```
;; ANSWER SECTION:  
nyu.edu. 60 IN A 216.165.47.10
```

Note that the format is slightly different for `nslookup`:

```
Non-authoritative answer:  
Name: nyu.edu  
Address: 216.165.47.10
```

## Exercise

Now, perform the same lookup, but use one of the DNS root servers (e.g., a.root-servers.net) by running

```
dig @a.root-servers.net nyu.edu
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nslookup nyu.edu a.root-servers.net
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Why does the answer differ compared to the one from your local DNS server?

**Solution:** The request is not sent to an open DNS resolver, but to a DNS server that only provides answers about its own zone. Therefore, the root DNS server only points you to the name servers responsible for the next zone in the hierarchy, the edu zone.



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**Solution:** Now that we know which servers are responsible for the edu zone, we can continue step-by-step just like your local DNS server would. Next, we would send a request to one of the edu name servers:

```
dig @a.edu-servers.net nyu.edu
```

The reply points us to the name servers in charge of the zone of NYU. By sending a request to them, we finally get the IP address behind the URL nyu.edu.