Services:
DNS – domain name system

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Buying numbers and names

- numbers are IP addresses
  - you buy them from an ISP
  - the ISP makes sure those addresses go to your place
- the names are domain names
  - you buy them from a name registrar
  - if you can connect the names to the addresses, those names will go to your place

Grouping numbers and names

- grouping IP addresses is called subnetting
  - you buy 164.67.*.* from an ISP
  - you define subgroups 164.67.78.* 164.67.79.* etc
- grouping names is called creating zones
  - you buy mycompany.com from a name registrar
  - you define machine names like vp.mycompany.com
  - you define subgroups like sales.mycompany.com
    - you define machine names like manny.sales.mycompany.com, moe.sales.mycompany.com, jack.sales.mycompany.com

DNS job 1:

Assigning your numbers to your names by a cross-correlation of your choosing, and making the assignments accessible to the world by dynamic software lookup. Then, the world can use your names and forget about your numbers.

A poor-man's, non-DNS alternative: /etc/hosts

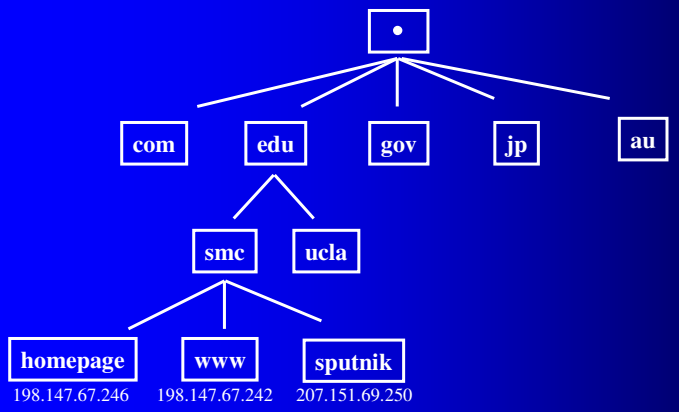
```
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1       hostz hostz.linnet.edu localhost.localdomain localhost


164.67.79.150    hostz.linnet.edu
164.67.79.151    hosta.linnet.edu
164.67.79.152    hostb.linnet.edu
164.67.79.153    hostc.linnet.edu
164.67.79.154    hostd.linnet.edu
164.67.79.155    hoste.linnet.edu
164.67.79.156    hostf.linnet.edu
164.67.79.157    hostg.linnet.edu
164.67.79.158    hosth.linnet.edu
164.67.79.159    hosti.linnet.edu
164.67.79.160    hostj.linnet.edu
164.67.79.161    hostk.linnet.edu
164.67.79.162    hostl.linnet.edu
164.67.79.163    hostm.linnet.edu
164.67.79.164    hostn.linnet.edu
164.67.79.165    hosto.linnet.edu
164.67.79.166    hostp.linnet.edu
164.67.79.167    hostq.linnet.edu
164.67.79.168    hostr.linnet.edu
```


Resolvers

- Clients that query name-number databases
- Functions
  - issue query
  - interpret response
  - return response to program that requested it
- Resolvers can query local /etc/hosts file

The domain name space



root

top-level domains

1st-level domains

hosts (computers)

Name-address correlation table

Name	Address
homepage.smc.edu	198.147.67.246
www.smc.edu	198.147.67.242
sputnik.smc.edu	207.151.69.250

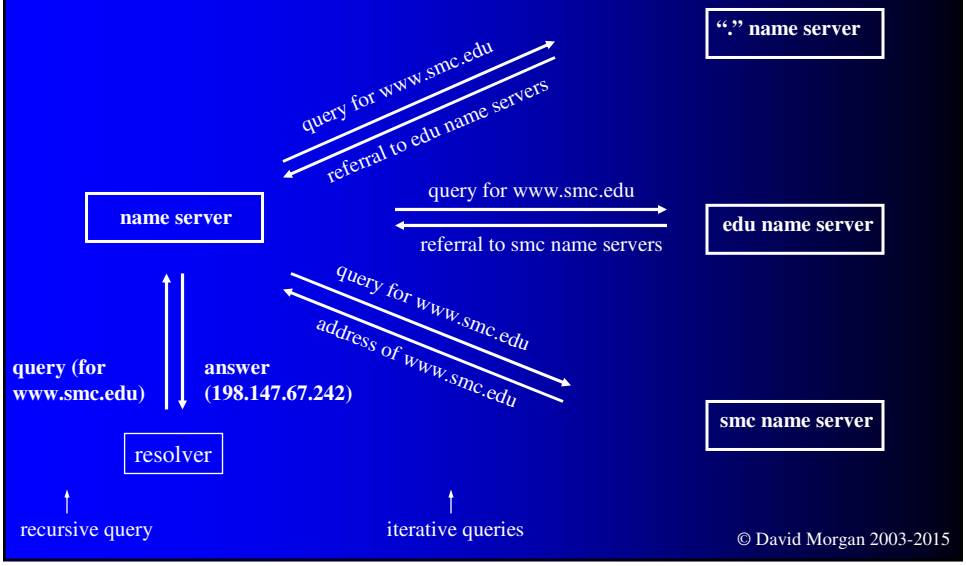
Addresses in a nameserver's database

- Always (permanent, file-based)
  - for the nameserver's own domain
    - the hosts in it
  - for a subdomain of the nameserver's domain
    - the hosts in it, or
    - the nameserver(s) for it
  - hosts in the root zone
- Maybe (transient, cache-based)
  - for other, unrelated domains
    - some of the hosts in those

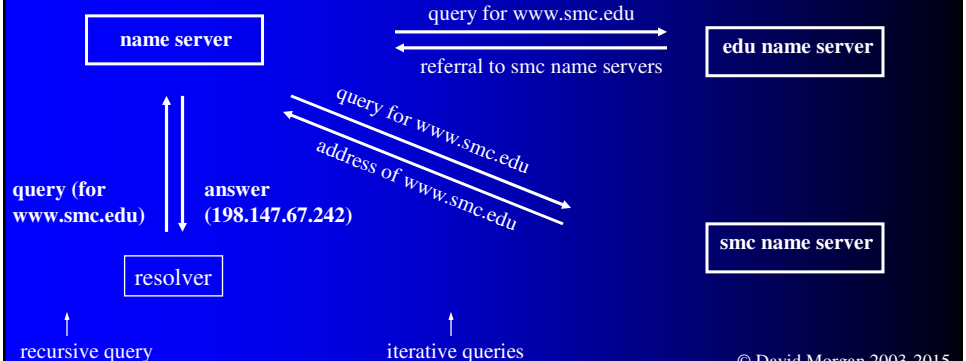
Name-resolution process

- Computers (including nameservers) query nameservers
- 2 query types
  - recursive
  - iterative
- Resolvers can query nameservers
  - configured with addresses of a few known namservers

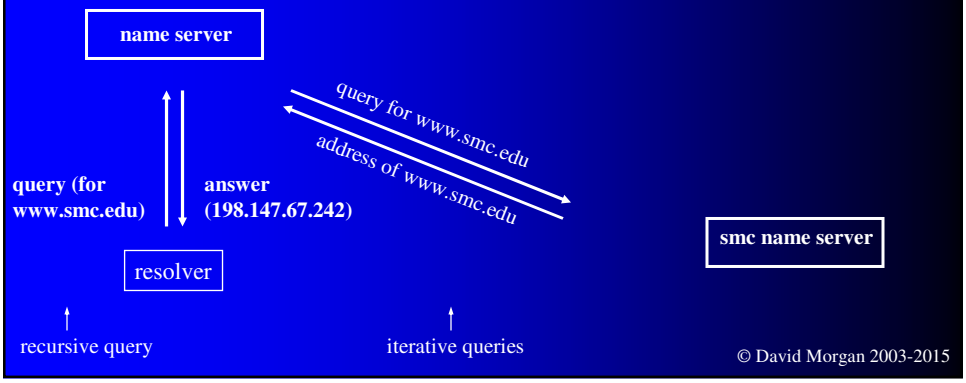
Name-resolution process



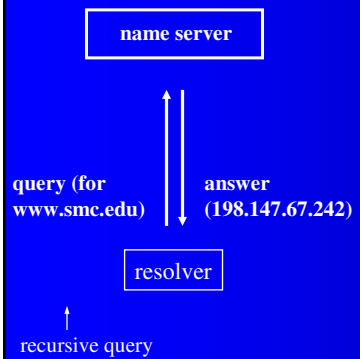
Or maybe just…



Or maybe just…



Or maybe just…



DNS mechanism

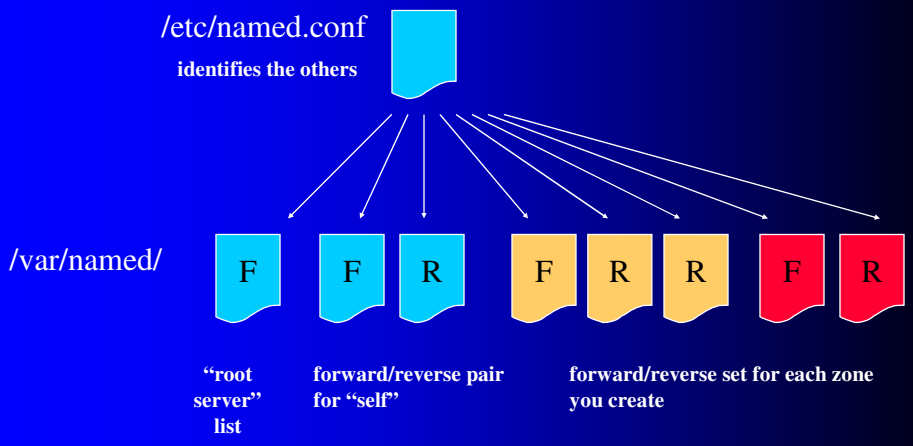
A decentralized, distributed database for the internet as a whole. You keep the part internal to your company on your own nameserver for others to access. They do the same for you.

Software on linux to integrate your name-number list into the global database is Berkeley Internet Name Daemon (BIND). You supply your name-number list to BIND and BIND makes it available to outsiders.

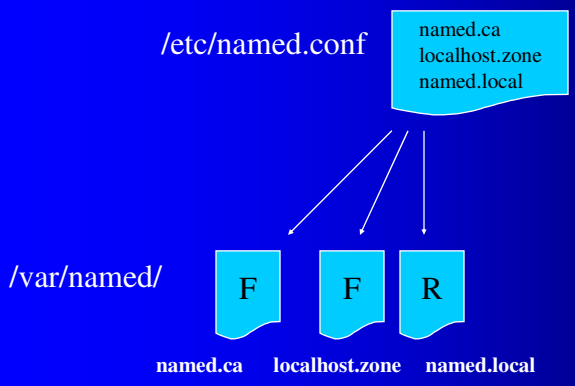
DNS implements 2 lookup types

- Forward lookup – given a name provides a number
- Reverse lookup – give a number provides a name

BIND's files

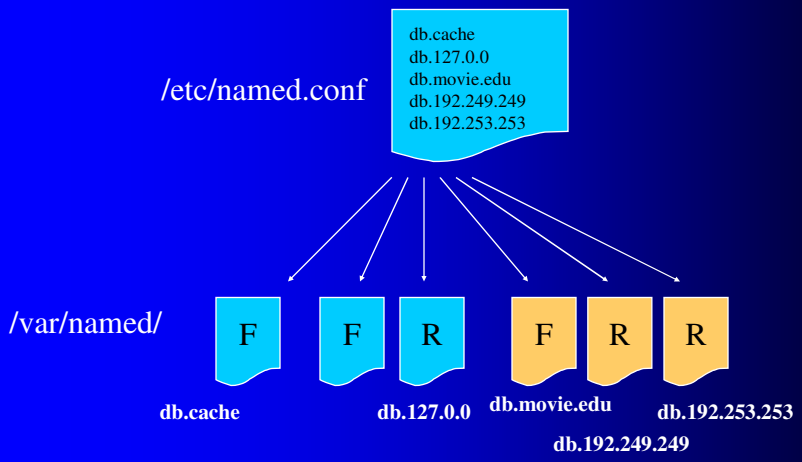


RedHat 8 default fileset

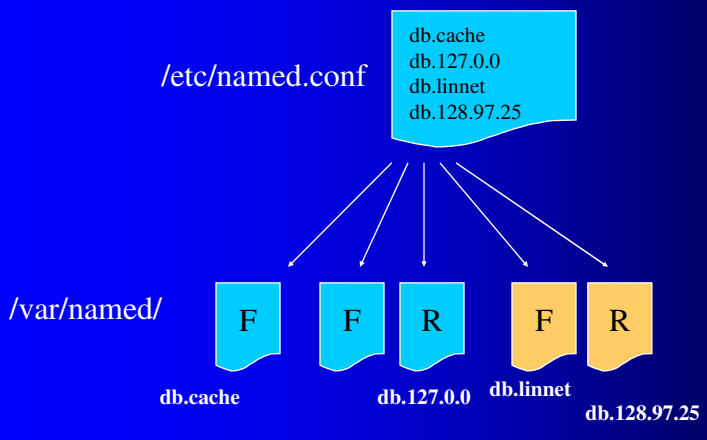


No created zones!

DNS and BIND's example fileset



Homegrown fileset



Zone data files have resource records of several types

- SOA – indicates authority for this zone
- NS – lists name server for this zone
- A – name-to-address mapping
- PTR – address-to-name mapping
- … others

SOA record – start of authority

<zone> IN SOA <zone's nameserver> <mail address>
<numeric data for slaves>

```
movie.edu.  IN  SOA  terminator.movie.edu.  al.robocop.movie.edu. (
                              1         ; serial
                              3h        ; Refresh after 3 hours
                              1h        ; Retry after 1 hour
                              1w        ; Expire after 1 week
                              1h)       ; Negative caching TTL of 1 day
```

NS record – name server

<name> IN NS <zone's nameserver>

movie.edu. IN NS terminator.movie.edu.
movie.edu. IN NS wormhole.movie.edu.

A record – address

<name> IN A <address>

terminator.movie.edu. IN A 192.249.249.3
diehard.movie.edu. IN A 192.249.249.4

PTR record – pointer

<adddress in a name form> IN PTR <name>

3.249.249.192.in-addr.arpa. IN PTR terminator.movie.edu.
4.249.249.192.in-addr.arpa. IN PTR wormhole.movie.edu.

Notation shortcuts

- Appending domain names
- @ notation
- Repetition of name from last resource record

Appending domain names

- 2nd field of named.conf's "zone" statement is a domain name
- Serves as "origin" of corresponding zone file's data
- Gets auto-appended to all names in zone file that don't end with a .

@ notation

- found in a zone file
- abbreviates that zone file's origin/domain name (from named.conf), with trailing dot
- most common in SOA records

Name repetition

- for lines that begin with space or tab
- name from last resource record is implied at beginning of such lines

Running the nameserver

- conventional, as other servers

- /etc/rc.d/init.d/named { start, stop, restart, status }
- service named { start, stop, restart, status }

Client side – resolver configuration

- /etc/resolv.conf and /etc/host.conf
- resolv.conf contains directives of type
  - nameserver
  - domain
  - search
- host.conf contains directives of type
  - order
  - trim
  - multi
- man resolv.conf man host.conf

tools

- dig
- nslookup
- h2n – converts /etc/hosts to DNS fileset
  ftp://ftp.oreilly.com/published/oreilly/nutshell/dnsbind/dns.4ed.tar.Z

  $ zcat dns.tar.Z | tar xf –

  or (may be more up to date)
  ftp://ftp.hpl.hp.com/pub/h2n/h2n.tar.gz
- webmin
- redhat-config-bind

Biblio

- DNS and BIND, Albitz and Liu, O'Reilly, 4th ed. 2001
- http://www.ibiblio.org/pub/Linux/docs/HOWTO/other-formats/html_single/DNS-HOWTO.html#ss5.1