Lecture 2–2
Domain Name System

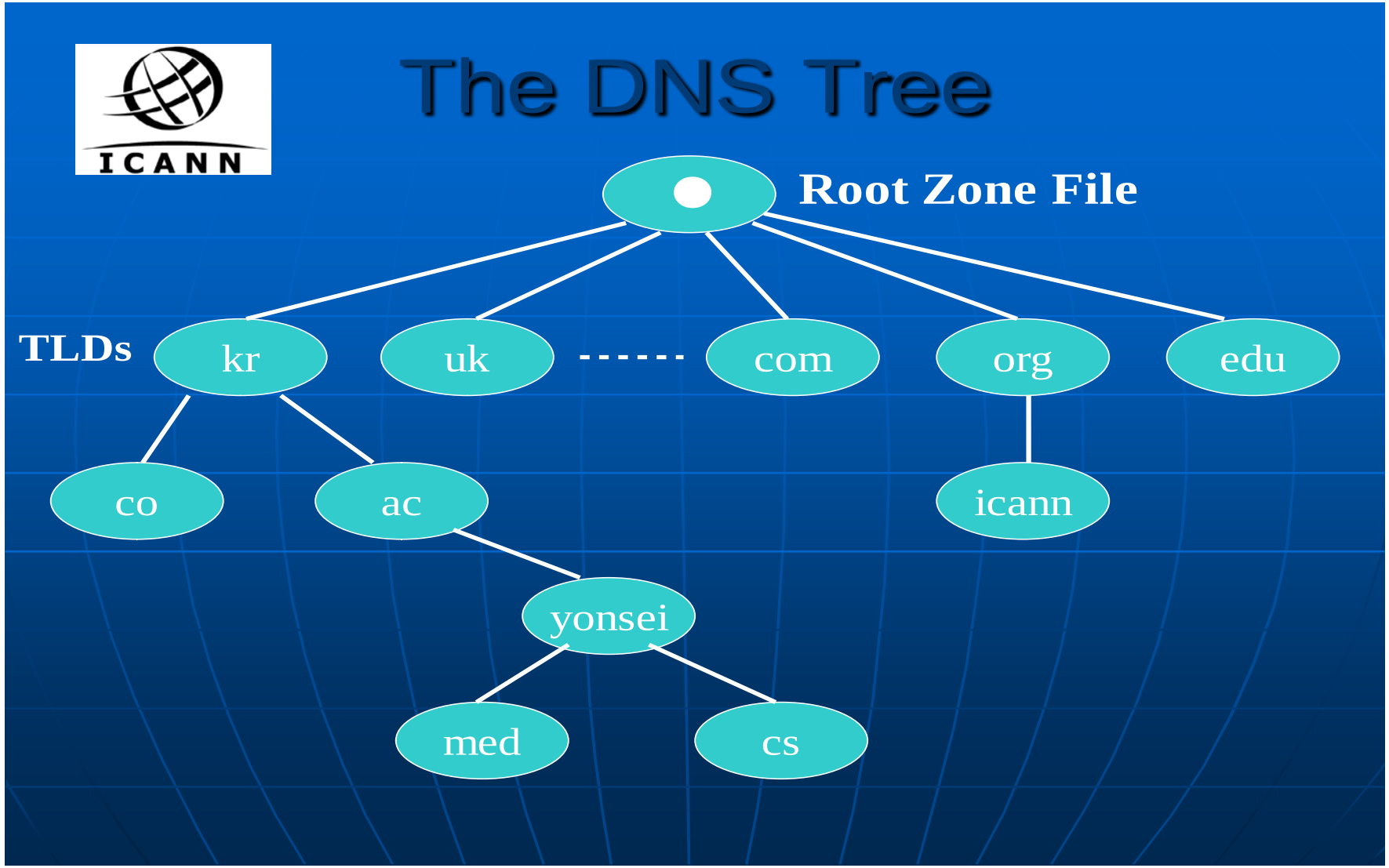
Domain Name System (DNS)

- Developed by Postel & Mockapetris
- www.internic.net is a good site to browse
- The phone book of the internet
  - But more restrictive … Each entry must be
    - Unique
    - Authentic
  - Universal Resolvability is ensured
  - Distributed Database

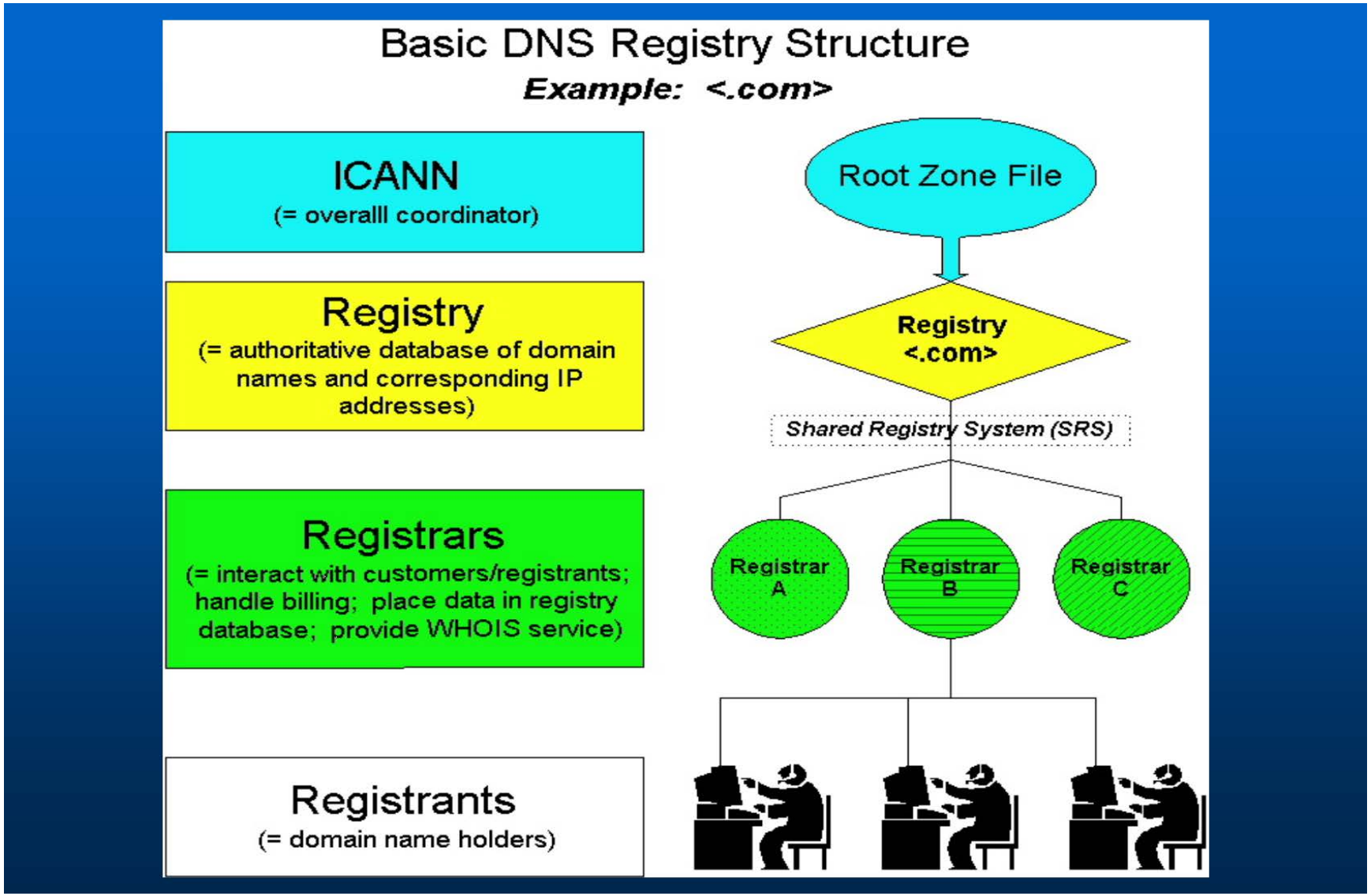
History of DNS

- Early Internet had no Domain Name System – Just HOSTS file
  - Win: C:₩WINNT₩system32₩drivers₩etc₩HOSTS
  - Unix/Linux: /etc/hosts
- Ancient History: Before DNS,
  - The master HOSTS file was maintained by SRI International
  - Periodically, *every computer in the internet* reloaded HOSTS file
- ~1984 someone realized that millions of computers and domains needed a central database – DNS was born
- Still, when a host needs to translate yahoo.com,
  - First, HOSTS file is scanned
  - Then DNS is used.

DNS Tree


The DNS Tree
ICANN
Root Zone File
TLDs
kr
uk
com
org
edu
co
ac
icann
yonsei
med
cs

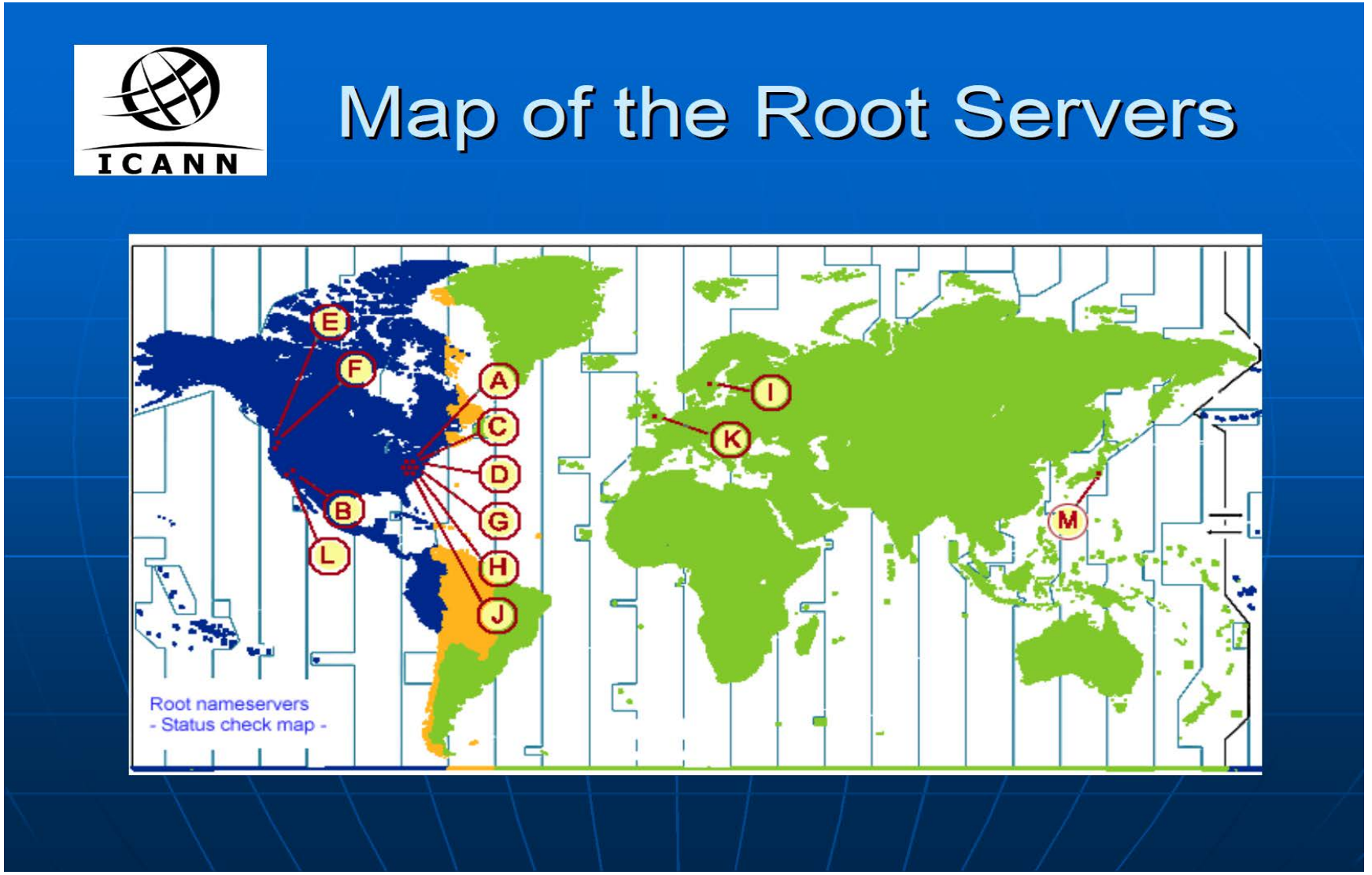
Basic DNS Registry Structure



DNS

- 13 Identical Root Servers
  - All Top Level Domain (TLD) Registries
  - Database for each TLD
    - .com .org .edu .biz …. (gTLDs)
    - .fr .ca etc. country-specific TLDs, or ccTLDs
- Root Servers are
  - Authoritative
  - Maintained by ICANN, www.icann.org
    (International Corporation for Assigned Names and Numbers)

Map of the Root DNS Servers



Click here to see the exact location of Root Servers (http://www.root-servers.org/)

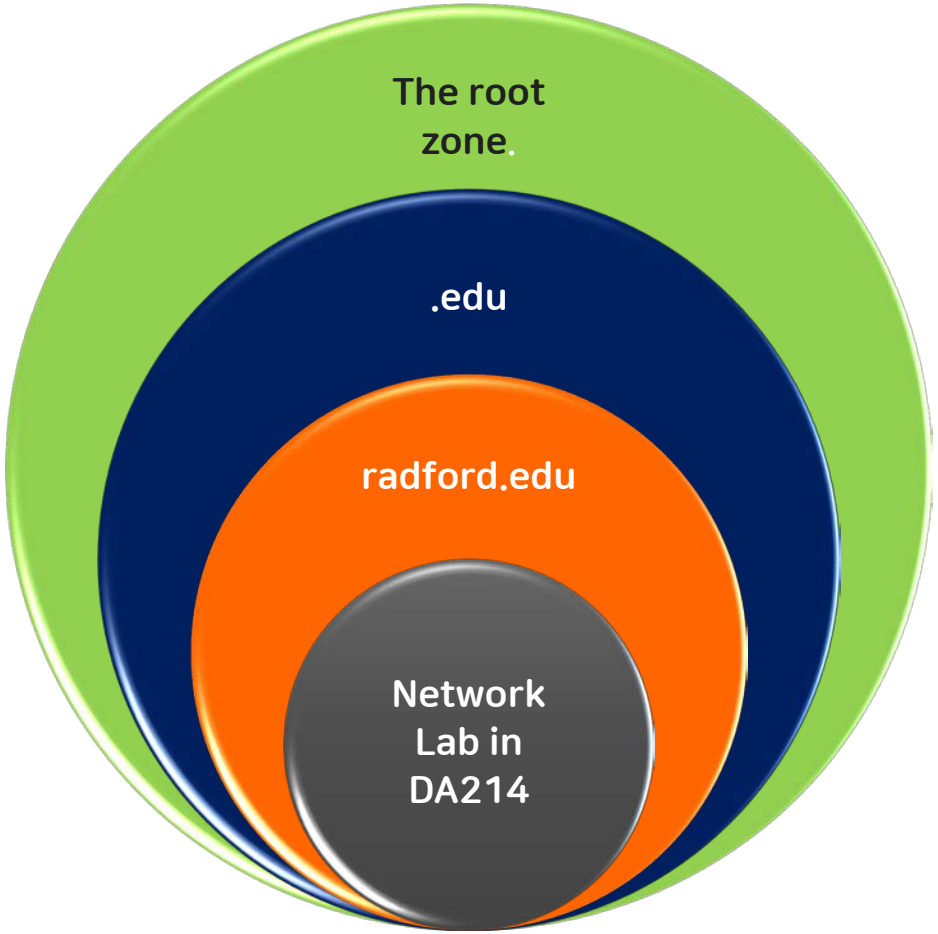
U.S. Top Level Domains

Affiliation ID	Affiliation
aero	air transport industry
biz	alternative to com
com	business organization
coop	non-profit cooperatives
edu	educational sites
firm	businesses and firms
gov	government sites
info	unrestricted use
mil	military sites
museum	museums
name	individuals
net	networking organizations
org	organizations
pro	accountants, lawyers, physicians

Domain Names

- Hierarchical, right to left
  - nth level ……. Top Level Domain (Label)
  - yadda.yadda.yadda.yadda…….edu
- TLD, or Label may be up to 63 chars long
- Total length of name must be <= 255 chars
- Total length <= 127 labels
- DNS Names are either
  - Relative (newriver)
  - Fully qualified (newriver.radford.edu, an actual host or server)

DNS Zones



DNS Servers

- Each DNS zone has
  - A domain name
  - At least a primary server
  - Probably a secondary server as well
- A computer that maintains a single master list of DNS Names and IP Addresses for a zone
  - Has Authority for that Zone
  - Is known as the primary server for the zone

Address "Translation"

- Domain Name System (DNS)
  - Given a Domain Name (e.g., yahoo.com), lookup the IP address.
  - Command nslookup <somedomain.com> returns:
    - DNS Server name & IP addr
    - IP address(es) of the domain

```
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

H:\>nslookup yahoo.com
Server:  newriver.radford.edu
Address:  137.45.26.19

Non-authoritative answer:
Name:    yahoo.com
Addresses:  64.58.79.230, 66.218.71.198
```

nslookup – DNS Translation

- Manual Page for nslookup can be found at

  http://cr.yp.to/djbdns/intro-dns.html

  http://www.kloth.net/services/nslookup-man.php
- It is for Unix shell, but most operation is same for WIN2K or up.
- The command nslookup allows DNS translation to a DOS cmd window.

nslookup

```
H:\>nslookup
Default Server:  newriver.radford.edu
Address:  137.45.26.19
> ?
Commands:   (identifiers are shown in uppercase, [] means optional)
NAME            - print info about the host/domain NAME using default server
NAME1 NAME2     - as above, but use NAME2 as server
help or ?       - print info on common commands
set OPTION      - set an option
    all               - print options, current server and host
    [no]debug         - print debugging information
    [no]d2            - print exhaustive debugging information
    [no]defname       - append domain name to each query
    [no]recurse       - ask for recursive answer to query
    [no]search        - use domain search list
    [no]vc            - always use a virtual circuit
    domain=NAME       - set default domain name to NAME
    srchlist=N1[/N2/.../N6] - set domain to N1 and search list to N1,N2, etc.
    root=NAME         - set root server to NAME
    retry=X           - set number of retries to X
    timeout=X         - set initial time-out interval to X seconds
    type=X            - set query type (ex. A,ANY,CNAME,MX,NS,PTR,SOA,SRV)
    querytype=X       - same as type
    class=X           - set query class (ex. IN (Internet), ANY)
    [no]msxfr         - use MS fast zone transfer
    ixfrver=X         - current version to use in IXFR transfer request
server NAME     - set default server to NAME, using current default server
lserver NAME    - set default server to NAME, using initial server
finger [USER]   - finger the optional NAME at the current default host
root            - set current default server to the root
ls [opt] DOMAIN [> FILE] - list addresses in DOMAIN (optional: output to FILE)
    -a          -  list canonical names and aliases
    -d          -  list all records
    -t TYPE     -  list records of the given type (e.g. A,CNAME,MX,NS,PTR etc.)
view FILE           - sort an 'ls' output file and view it with pg
exit            - exit the program
```

.arpa

- An explicit way to signal for reverse translation
  http://cr.yp.to/djbdns/dot-arpa.html

- Reverse lookups
  http://cr.yp.to/djbdns/intro-dns.html#reverse