The Domain Name System

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DNS

• The domain name system...
  • Resolves names to IP addresses
    – `lemuria.cis.vtc.edu` to `155.42.13.24`
  • Is a distributed database
    – Each organization maintains its own part.
    – Several fields associated with each domain name.
      • Not just (or not only) IP addresses.
      – Is extensible. New fields can be added.
      • Although this is rarely done.
  • Is described in RFC-1034 and RFC-1035 (plus updates)
Basic Idea

cis.vtc.edu domain

Name server

What address: lemuria.cis.vtc.edu?
Reply: 155.42.13.24

Connect to 155.42.13.24

Client

Web server
DNS Resolution

• Client needs to know IP address of name server
  • This is a configuration detail
  • Typically handled with DHCP at client boot time
  • Can be hand specified by user if necessary

• Client sends DNS query
  • Asks for address resolution.
  • Sends name to resolve.

• Name server sends answer
  • Requested IP address or error code.
More Complex Example

What address: lemuria.cis.vtc.edu?
Reply: Talk to 155.42.16.33

What address: lemuria.cis.vtc.edu?
Reply: Talk to 155.42.13.4

What address: lemuria.cis.vtc.edu?
Reply: 155.42.13.24

Connect to 155.42.13.24
Remote Resolution

• Client in another domain...
  • First contacts the “root” name server and asks.
    – Is told the IP address of a name server that might know
    – Root servers know IP addresses of all the “top level” domain servers (e.g. vtc.edu).
  • Contacts next name server and asks again.
    – Is told the answer or referred to a lower level name server.
  • Must have built in knowledge of root server's IP.
    – Actually there are several root servers spread over the world. IP addresses are published regularly.
Hierarchy

• This allows a hierarchy of names
  • Name server only needs to know about the names in its domain or... the name servers controlling the subdomains.
  • An organization must register its top level name server(s) with the root servers.
    – “Domain registration”... costs some money.
• The root servers are incredibly busy
  – Thousands of queries per second!
  – Managed very carefully.
  – Without them, the Internet would fail.
Iterative vs Recursive

- Previous example showed an *iterative* query.
  - Client took responsibility for contacting all necessary name servers.
    - Significant burden to the client.
    - Other clients can't benefit from the results.

- Recursive queries are better.
  - Client asks the local name server to do all the work.
    - Easier for the client.
    - Local name server caches results for other clients.
"Recursive"

Local name server contacts other name servers on behalf of the client

foo.bar.com's local name server


Client

foo.bar.com
UDP and the DNS

• UDP is an excellent protocol for DNS transport
  • Request and reply fit into a single datagram.
    – Request is just a name (+ additional bits)
    – Reply is just an address (+ additional bits)
  • Service is idempotent.
    – Resolving the same name twice produces the same result.
      • We assume that IP address assignments change slowly.
  • Service has no side effects.
    – Resolving a name does not change the state of the server.
  • Low overhead of UDP is very desirable.
DNS Details

- [Cover the specifics of the DNS protocol]
  - [See your lab notes]