Introduction to the Domain Name System (DNS)
http://condor.depaul.edu/~jkrystof/it263/

John Kristoff
jtk@depaul.edu

IT 263 Spring 2006/2007
The DNS Lookup Process

Step 1: I need an IPv4 address for www.example.com boss!! Show me some love. k thx!

Step 2: Hmm... I just came online. Nothing in my cache. All I have is this list or root (.) server IP addresses. Let me see if they can help.

Step 3: Yo! root server dude! You know anything about an IPv4 address for www.example.com?

Step 4: Sorry little bro, all I have is this NS RRset for the .com zone, maybe that helps?

Step 5: Hook me up with an A RRset for www.example.com??

Step 6: No can do, but how about this NS RRset for example.com?

Step 7: Hey dog, A IN RRset for www.example.com??!!

Step 8: Just one A RR of 192.0.2.1. with TTL 86400, Respect my au-thor-i-TAY!

Step 9: 192.0.2.1. with TTL 86400 word.

End User (stub resolver)

Root Servers
A.root-servers.net
... M.root-servers.net

.com TLD servers
A.gtld-servers.net
... M.gtld-servers.net

depaul.edu
Delegation and Glue Records

- Parent contains non-authoritative name server (NS) resource records (RRs) for the child zone
- Say you want to resolve www.depaul.edu
- Say we start fresh and walk the tree from the top/root (.)
- .edu zone name servers gives referral for ns[1-3].depaul.edu
- But how do you contact those name servers? You need to resolve those names to an address
- Solution: you are also given the IP address (aka glue) records to those name servers
- An aside: Out-of-balliwick versus in-balliwick glue
Resource Record (RR) format
DNS Message Format

+---------------------+
| Header              |
+---------------------+
| Question            | the question for the name server
+---------------------+
| Answer              | RRs answering the question
+---------------------+
| Authority           | RRs pointing toward an authority
+---------------------+
| Additional          | RRs holding additional information
+---------------------+
DNS Message Header Format

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| ID |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|QR| Opcode |AA|TC|RD|RA| Z | RCODE |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| QDCOUNT |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| ANCOUNT |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| NSCOUNT |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| ARCOUNT |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
Sources of Authoritative Data

- Where does authority come from? Zone delegation from a parent.
- However, the child is authoritative for the NS RRset.
- Primary/Master name server - zone data from a local source
- Secondary/Slave name server - zone data obtained from another slave/master
Resolver Types and Terms

- Caching (Recursive) name server - what is typically in your resolv.conf
- Forwarding name server - sometime called proxy DNS
- Stub resolver - what end systems use, simple message passer
- An aside: jtk terminology - full, caching, referral and closed resolvers
Server Types and Terms

- Iterative - querier will chase delegations
- Recursive - querier requests server to chase delegations and return a final answer
- Authoritative - has local knowledge
- Non-authoritative - does not have local knowledge, probably cached or just received auth answer from someone else
Things that make DNS interesting

- General lack of agreement on *what DNS is and how to run it*
- Implementations differ, particularly in handling corner cases
- Admins have great control over configuration and policy
- UDP without authentication in an upper layer required
Administrative Services

- Registry - organization responsible for maintaining TLD (usually) zone data
- Registrar - the interface between registry and domain name holders (sometimes the same as the registry, often not)
- whois - a TCP-based Internet directory service, run by various DNS and address registries, there is no central whois