Overview

- Names vs. addresses
  - Human-friendly vs. Machine-readable
- Naming
  - name $\rightarrow$ IP address bindings
  - One-to-one map
  - Also ARP: IP address $\rightarrow$ Eth address
- Location transparent
- Hierarchical Management
  - Name and address hierarchy
  - Organizational and geographical hierarchy
**Domain Naming System**

- **Naming**
  - `goliath.cs.fiu.edu` → `131.94.130.72`

- **Hierarchy**

```
  edu  com  gov  mil  org  net  uk  fr
  |     |     |     |     |     |     |
  su  mit  cisco  yahoonasa  nsf  arpa  navy  acm  ieee
  |     |     |     |     |     |     |
  cs  ee  physics
  |     |     |
  goliath  mozart

  Root name server
```

**Name Servers**

- **Partition hierarchy into zones**

```
  edu  com  gov  mit  org  net  uk  fr
  |     |     |     |     |     |     |
  su  mit  cisco  yahoonasa  nsf  arpa  navy  acm  ieee
  |     |     |     |     |     |     |
  cs  ee  physics
  |     |     |
  CS  CS  CS
  |     |     |
  CS  CS  CS

  Root name server
```

- **Each zone implemented by two or more name servers**
Name Resolution

- **Strategy**
  - forward
  - iterative

- **Local server**
  - At every site, need to know root at only one place (not each host)
  - site-wide cache

Resource Records

- Each name server maintains a collection of *resource records* (Name, Value, Type, Class, TTL)

- Name/Value: not necessarily host names to IP addresses

- Type
  - NS: a domain → domain name of its name server
    - e.g. fiu.edu → ns.fiu.edu
  - A: the domain name of a host → its IP address
    - e.g. ns.fiu.edu → 131.94.128.2
    - e.g. goliath.cs.fiu.edu → 131.94.130.72

- Class: allow other entities to define types

- TTL: how long the resource record is valid
The DNS Name Space

<table>
<thead>
<tr>
<th>Type of record</th>
<th>Associated entity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOA</td>
<td>Zone</td>
<td>Holds information on the represented zone</td>
</tr>
<tr>
<td>A</td>
<td>Host</td>
<td>Contains an IP address of the host this node represents</td>
</tr>
<tr>
<td>MX</td>
<td>Domain</td>
<td>Refers to a mail server to handle mail addressed to domain</td>
</tr>
<tr>
<td>SRV</td>
<td>Domain</td>
<td>Refers to a server handling a specific service</td>
</tr>
<tr>
<td>NS</td>
<td>Zone</td>
<td>Refers to a name server that implements the represented zone</td>
</tr>
<tr>
<td>CNAME</td>
<td>Node</td>
<td>Symbolic link with the primary name of the represented node</td>
</tr>
<tr>
<td>PTR</td>
<td>Host</td>
<td>Contains the canonical name of a host</td>
</tr>
<tr>
<td>HINFO</td>
<td>Host</td>
<td>Holds information on the host this node represents</td>
</tr>
<tr>
<td>TXT</td>
<td>Any kind</td>
<td>Contains any entity-specific information considered useful</td>
</tr>
</tbody>
</table>

The most important types of resource records forming the contents of nodes in the DNS name space.

DNS Implementation

- An excerpt from the DNS database for the zone cs.vu.nl.