Naming

Outline

- Terminology
- Domain Naming System
- Distributed File Systems

Overview

- What do names do?
  - identify objects
  - help locate objects
  - define membership in a group
  - specify a role
  - convey knowledge of a secret
- Name space
  - defines set of possible names
  - consists of a set of name to value *bindings*

Properties

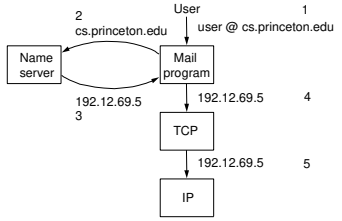
- Names versus addresses
- Location transparent versus location-dependent
- Flat versus hierarchical
- Global versus local
- Absolute versus relative
- By architecture versus by convention
- Unique versus ambiguous

Examples

- Hosts
  `cheltenham.cs.princeton.edu` ⟶ `192.12.69.17`
  `192.12.69.17` ⟶ `80:23:A8:33:5B:9F`
- Files
  `/usr/llp/tmp/foo` ⟶ `(server, fileid)`
- Users
  `Larry Peterson` ⟶ `llp@cs.princeton.edu`

Examples (cont)

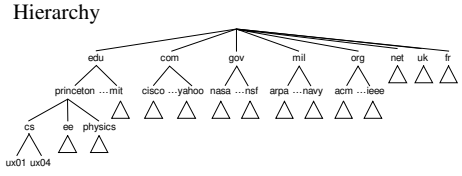
- Mailboxes



- Services
  `nearby ps printer with short queue and 2MB`

Domain Naming System

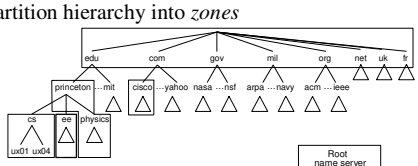
- Hierarchy



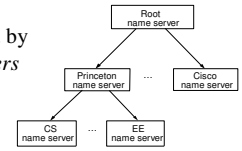
- Name
  `chinstrap.cs.princeton.edu`

Name Servers

- Partition hierarchy into *zones*



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



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: Value gives domain name for host running name server that knows how to resolve names within specified domain.
  - CNAME: Value gives canonical name for particle host; used to define aliases.
  - MX: Value gives domain name for host running mail server that accepts messages for specified domain.
- Class: allow other entities to define types
- TTL: how long the resource record is valid

Root Server

```
(princeton.edu, cit.princeton.edu, NS, IN)
(cit.princeton.edu, 128.196.128.233, A, IN)

(cisco.com, thumper.cisco.com, NS, IN)
(thumper.cisco.com, 128.96.32.20, A, IN)

…
```

Princeton Server

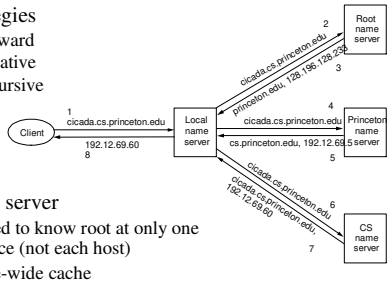
```
(cs.princeton.edu, optima.cs.princeton.edu, NS, IN)
(optima.cs.princeton.edu, 192.12.69.5, A, IN)
(ee.princeton.edu, helios.ee.princeton.edu, NS, IN)
(helios.ee.princeton.edu, 128.196.28.166, A, IN)
(jupiter.physics.princeton.edu, 128.196.4.1, A, IN)
(saturn.physics.princeton.edu, 128.196.4.2, A, IN)
(mars.physics.princeton.edu, 128.196.4.3, A, IN)
(venus.physics.princeton.edu, 128.196.4.4, A, IN)
```


CS Server

```
(cs.princeton.edu, optima.cs.princeton.edu, MX, IN)
(cheltenham.cs.princeton.edu, 192.12.69.60, A, IN)
(che.cs.princeton.edu, cheltenham.cs.princeton.edu,
  CNAME, IN)
(optima.cs.princeton.edu, 192.12.69.5, A, IN)
(opt.cs.princeton.edu, optima.cs.princeton.edu,
  CNAME, IN)
(baskerville.cs.princeton.edu, 192.12.69.35, A, IN)
(bas.cs.princeton.edu, baskerville.cs.princeton.edu,
  CNAME, IN)
```


Name Resolution

- Strategies
  - forward
  - iterative
  - recursive

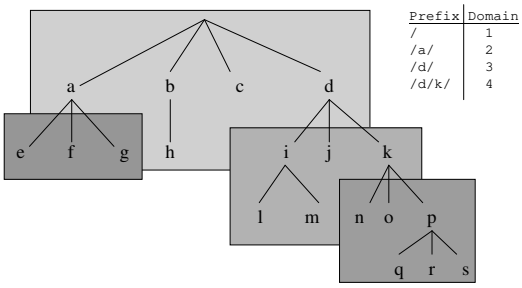


- Local server
  - need to know root at only one place (not each host)
  - site-wide cache

Distributed File Systems

- No Transparency
  Global AFS: **`/cs.princeton.edu/usr/llp/tmp/foo`**
  Windows: **`f:/usr/llp/tmp/foo`**
- Transparency by Convention
  - NFS: **`/usr/llp/tmp/foo`**
  - Or Not: **`/n/fs/fac5/llp/tmp/foo`**
- Transparency by Architecture
  - Sprite: **`/usr/llp/tmp/foo`**
- Private versus Shared
  - ASF: **`/usr/llp/tmp/foo`** versus **`/afs/shared`**

Example



Prefix	Domain
/	1
/a/	2
/d/	3
/d/k/	4

Stupid Naming Tricks

- Symbolic links and mount points
- Per-User and logical name spaces
- Computed directories
- Load balancing and content distribution
- Attribute-based names
- Hash-based schemes