Miscellaneous

Outline

- Domain Name System
- Peer-to-Peer Networks

Name Service

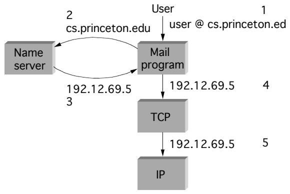
- Names versus addresses
- Location transparent versus location-dependent
- Flat versus hierarchical
- Resolution mechanism
- Name server
- DNS: domain name system

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`** → **`fileid`**

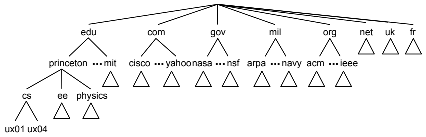
Examples (cont)

- Mailboxes



Domain Naming System

- Hierarchy

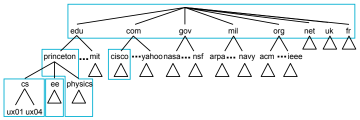


- Name

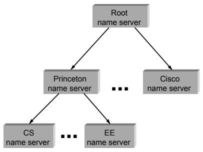
`wizard.cse.nd.edu`

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
  - A: IP addresses
  - 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 a host; used to define aliases.
  - MX: value gives domain name for host running mail server that accepts messages for specified domain.
- Class: allows 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

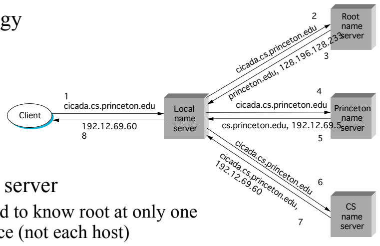
```
(cs.princeton.edu, optima.cs.princeton.edu, NS, IN)
(optima.cs.princeton.edu, 192.12.69.5, A, IN)
(ee.princeton.edu, helios.ee.princeton.edu, NS, IN)
(helios.ee.princeton.edu, 128.196.28.166, A, IN)
(jupiter.physics.princeton.edu, 128.196.4.1, A, IN)
(saturn.physics.princeton.edu, 128.196.4.2, A,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

- Strategy



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

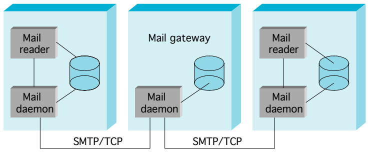
Electronic Mail

- RFC 822: header and body
- MIME: Multi-purpose Internet Mail Extensions

```
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="-------417CA6E2DE4ABCAFBC5"
From: Alice Smith Alice@cisco.com
To: Bob@cse.nd.edu
Subject: look at the attached image!
Date: Mon, 07 Sep 1998 19:45:19 -0400

-------417CA6E2DE4ABCAFBC5
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

Bob,
here's the jpeg image I promised.

-- Alice

-------417CA6E2DE4ABCAFBC5
Content-Type: image/jpeg
Content-Transfer-Encoding: base64

[unreadable encoding of a jpeg figure]
```

SMTP

- Mail reader, mail daemon, mail gateway
- SMTP messages: HELO, MAIL, RCPT, DATA, QUIT; server responds with code.



World Wide Web

- URL: uniform resource locator
  `http://www.cse.nd.edu`
- HTTP:
  START_LINE <CRLF>
  MESSAGE_HEADER <CRLF>
  <CRLF>
  MESSAGE_BODY <CRLF>

HTTP

- Request:
  - GET: fetch specified web page
  - HEAD: fetch status information about specified page

  GET http://www.cse.nd.edu/index.html HTTP/1.1
- Response:
  - HTTP/1.1 202 Accepted
  - HTTP/1.1 404 Not Found
  - HTTP/1.1 301 Moved Permanently
    Location: http://www.nd.edu/cs/index.html

HTTP

- HTTP 1.0: separate TCP connection for each request (each data item).
- HTTP 1.1: persistent connections
- Caching:
  - client: faster retrieval of web pages
  - server: reduced load
  - location: client, sitewide cache, ISP, etc.
  - EXPIRES header field (provided by server)
  - IF-MODIFIED-SINCE header field (issued by cache)

SNMP

- Request/reply protocol (on top of UDP)
- 2 main operations:
  - GET: retrieve state info from hosts
  - SET: set new state on host
- Relies on Management Information Base (MIB)
  - system: uptime, name, …
  - interfaces: physical address, packets sent/received, …
  - address translation: ARP (contents of table)
  - IP: routing table, number of forwarded datagrams, reassembly statistics, dropped packets, …
  - TCP: number of passive and active opens, resets, timeouts, …
  - UDP: number of packets sent/received, …