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

<table>
<thead>
<tr>
<th>Name server</th>
<th>Mail program</th>
<th>User @ cs.princeton.edu</th>
<th>IP address</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.12.69.5</td>
<td>TCP</td>
<td>192.12.69.5</td>
<td>5</td>
</tr>
</tbody>
</table>

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)
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

---

Electronic Mail

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

---

CS Server

(cs.princeton.edu, optima.cs.princeton.edu, MX, IN)
(cheatenham.cs.princeton.edu, 192.12.69.60, A, IN)
(che.cs.princeton.edu, cheatenham.cs.princeton.edu, CNAME, IN)
(optima.cs.princeton.edu, 192.12.69.5, A, IN)
(baskerville.cs.princeton.edu, 192.12.69.35, A, IN)
(bas.cs.princeton.edu, baskerville.cs.princeton.edu, CNAME, IN)
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>
  - 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, …