HTTP

HyperText Transfer Protocol

- Created by Tim Berners-Lee at CERN
- Standardized and much expanded by the IETF
- Rides on top of TCP protocol
  - TCP provides: reliable, bi-directional, in-order byte stream
- Goal: transfer objects between systems
  - Do not confuse with other WWW concepts:
    - HTTP is not page layout language (that is HTML)
    - HTTP is not object naming scheme (that is URLs)
- Text-based protocol
  - Human readable

HTTP request message

- HTTP method
- URL
- HTTP version
- header field name: field value
- Entity Body

PC running Explorer

Sun running Navigator
HTTP request example

GET /somedir/page.html HTTP/1.0
User-agent: Mozilla/4.0
Accept: text/html, image/gif, image/jpeg
Accept-language: fr
(extra carriage return, line feed)

HTTP response message

HTTP/1.0 200 OK
Date: Thu, 25 Aug 2001 12:00:15 GMT
Server: Apache/1.3.0 (Unix)
Last-Modified: Mon, 22 Aug 2001 ...
Content-Length: 6821
Content-Type: text/html

data data data data data ...
data data data data data ...
data data data data data ...

HTTP 1.0: Problems

- Each request opens new connection
- Opening connection takes several packets (why?)
- Starting up is slow (why?)
**TCP**

- HTTP rides on top of TCP transport service
- TCP provides: reliable, bi-directional, in-order byte stream
- Reliable
  - Prevent packet loss due to congestion
    - Overflow network queues
  - Send at rate at which network can forward packets
  - How to determine sending rate?
    - Dynamic
    - Depends on overall network condition

**TCP Slow Start**

- Determine sending rate by proving network
- Increase sending rate until a packet is dropped
- Double the number of unacknowledged packets (window size) for every new acknowledgement
- After a drop,
  - Reset window size to 1 packet
  - Cut maximum window size in half
  - Grow window with additive increase

---

**Web Page with Single Image**

**Network Congestion**
HTTP 1.1: Persistent Connections

- Reuse connection for multiple requests

  GET index.html
  Connection: keep-alive
  ... multiple HTTP requests ...
  Get banner.gif
  Connection: close

HTTP 1.0 vs. HTTP 1.1

  - Image size 2544 bytes

Persistent Connection Performance

- Benefits greatest for small objects.
- Serialized requests do not improve response time.
- Pipelining requests can result in large win.
- Server resource utilization reduced due to fewer connection establishments and fewer active connections.
- TCP behavior improved.
  - Longer connections help adaptation to available bandwidth.
  - Larger congestion window improves loss recovery.