

HTTP

# Outline

- HTTP overview
- Proxies

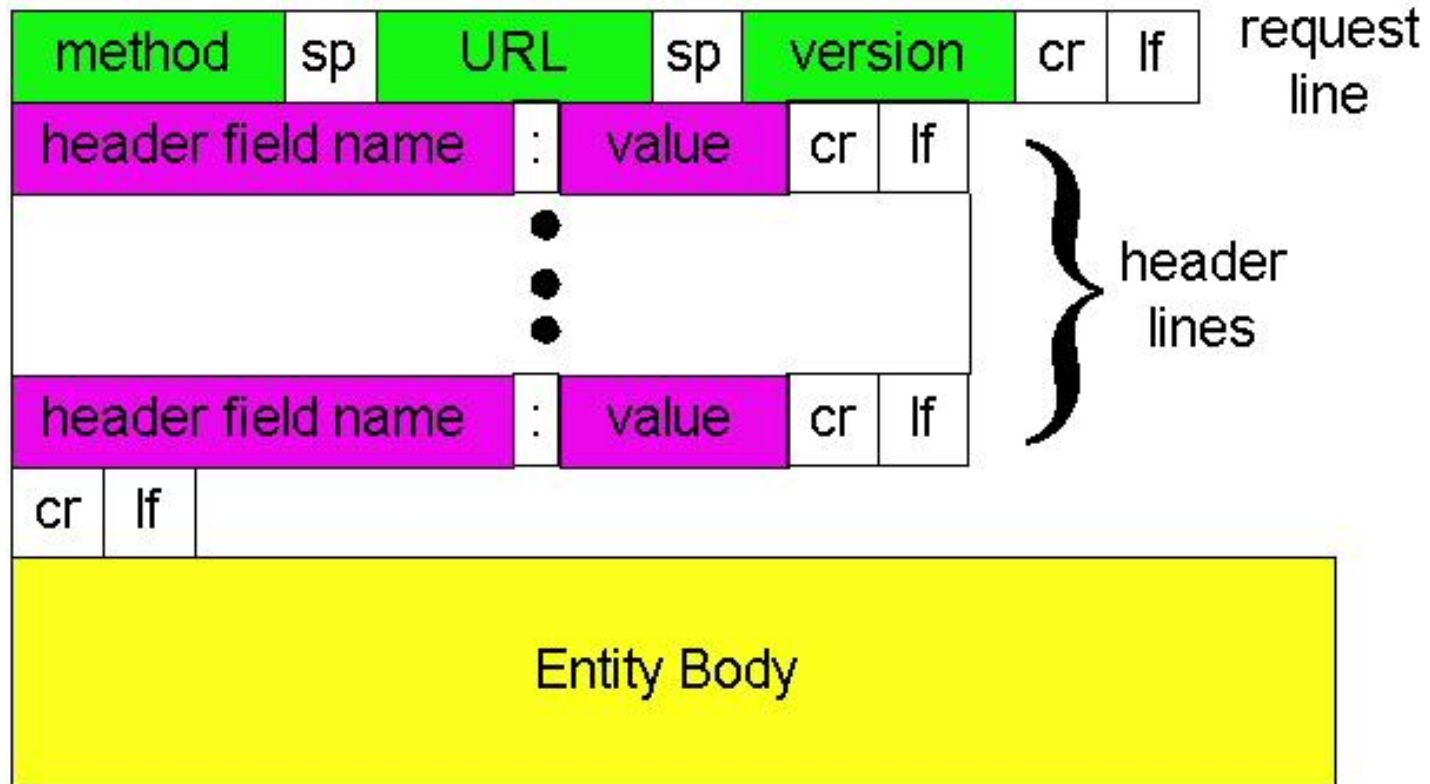
# Application Layer Protocols

- Variable Headers vs. Fixed Headers
  - App headers handled by program rather than hardware
  - Variable headers allow for incrementally adding features
- Human Readable
  - Easy for programmers to reason about
  - Parsed by humans / programs rather than hardware
- More later on, but useful for understanding HTTP's design

# HTTP Basics (Overview)

- HTTP layered over bidirectional byte stream
  - Almost always TCP
- Interaction
  - Client looks up host (DNS)
  - Client sends request to server
  - Server responds with data or error
  - Requests/responses are encoded in text
- Stateless
  - Server maintains no info about past client requests

# HTTP Request



"cr" is \r                      "lf" is \n  
sp is " "

# HTTP Request

- Request line
  - Method
    - GET – return URI
    - HEAD – return headers only of GET response
    - POST – send data to the server (forms, etc.)
  - URL (relative)
    - E.g., /index.html
  - HTTP version

# HTTP Request (cont.)

- Request headers
  - Variable length, human-readable
  - Uses:
    - Authorization – authentication info
    - Acceptable document types/encodings
    - From – user email
    - If-Modified-Since
    - Referrer – what caused this page to be requested
    - User-Agent – client software
- Blank-line
- Body

# HTTP Request Example

GET /index.html HTTP/1.1

Host: www.example.com



# HTTP Request Example

GET /index.html HTTP/1.1

Host: www.example.com

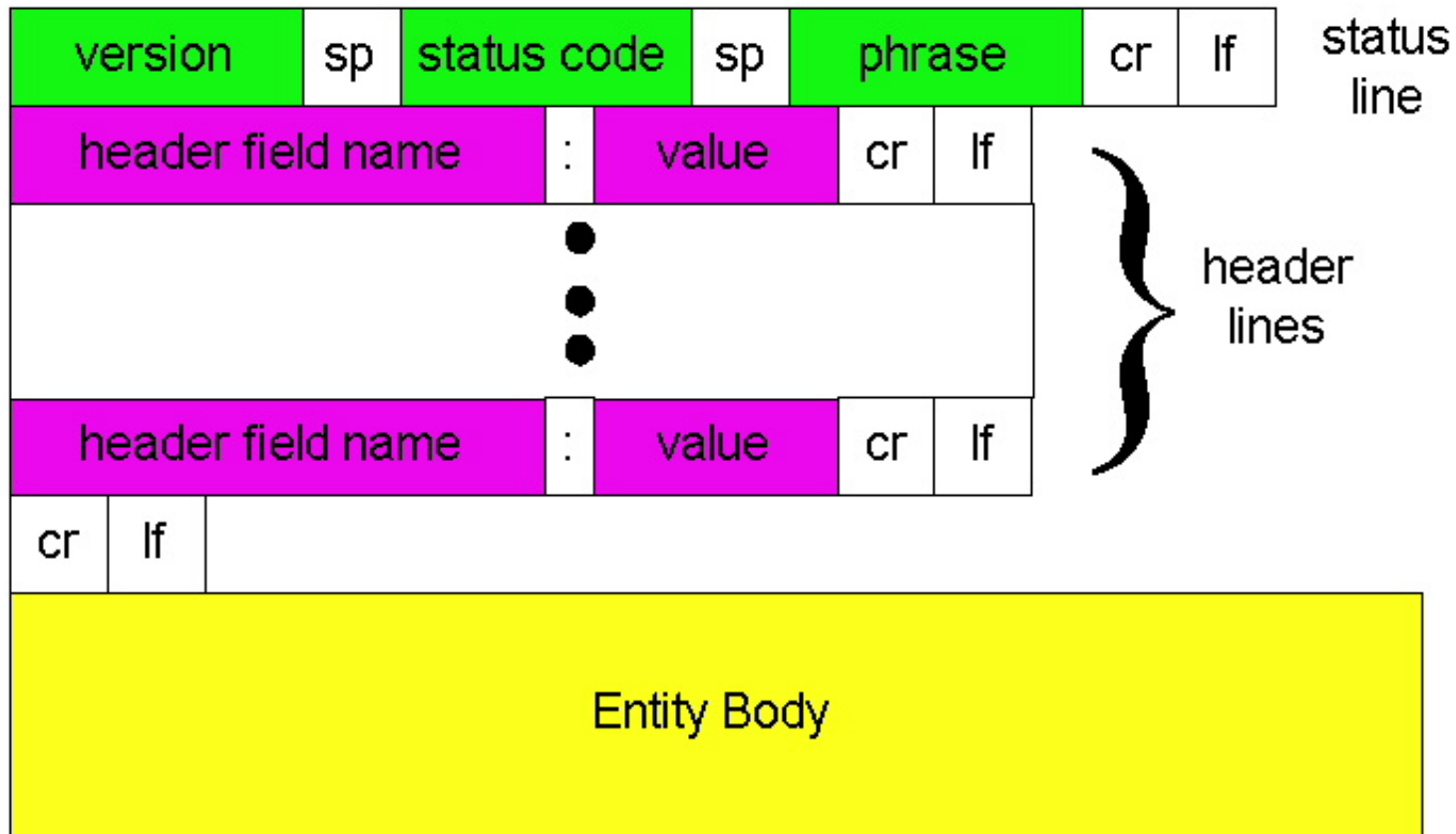
Accept-Language: en-us

Accept-Encoding: gzip, deflate

User-Agent: Mozilla/4.0 (compatible; MSIE 5.5; Windows NT 5.0)

Connection: Keep-Alive

# HTTP Response



# HTTP Response

- Status-line
  - HTTP version
  - 3 digit response code
    - 1XX – informational
    - 2XX – success
      - 200 OK
    - 3XX – redirection
      - 301 Moved Permanently
      - 303 Moved Temporarily
      - 304 Not Modified
    - 4XX – client error
      - 404 Not Found
    - 5XX – server error
      - 505 HTTP Version Not Supported
  - Reason phrase

# HTTP Response (cont.)

- Headers

- Variable length, human-readable
- Uses:
  - Location – for redirection
  - Server – server software
  - WWW-Authenticate – request for authentication
  - Allow – list of methods supported (get, head, etc)
  - Content-Encoding – E.g x-gzip
  - Content-Length
  - Content-Type
  - Expires (caching)
  - Last-Modified (caching)

- Blank-line

- Body

# HTTP Response Example

HTTP/1.1 200 OK

Date: Tue, 27 Mar 2001 03:49:38 GMT

Server: Apache/1.3.14 (Unix) (Red-Hat/Linux) mod\_ssl/2.7.1  
OpenSSL/0.9.5a DAV/1.0.2 PHP/4.0.1pl2 mod\_perl/1.24

Last-Modified: Mon, 29 Jan 2001 17:54:18 GMT

Accept-Ranges: bytes

Content-Length: 4333

Keep-Alive: timeout=15, max=100

Connection: Keep-Alive

Content-Type: text/html

.....

# How to Mark End of Message?

- **Content-Length**
  - Must know size of transfer in advance
- **Close connection**
  - Only server can do this
- **Implied length**
  - E.g., 304 never have body content
- **Transfer-Encoding: chunked (HTTP/1.1)**
  - After headers, each chunk is content length in hex, CRLF, then body. Final chunk is length 0.

# Example: Chunked Encoding

HTTP/1.1 200 OK <CRLF>

Transfer-Encoding: chunked <CRLF>

<CRLF>

25 <CRLF>

This is the data in the first chunk <CRLF>

1A <CRLF>

and this is the second one <CRLF>

0 <CRLF>

- Especially useful for dynamically-generated content, as length is not a priori known
  - Server would otherwise need to cache data until done generating, and then go back and fill-in length header before transmitting

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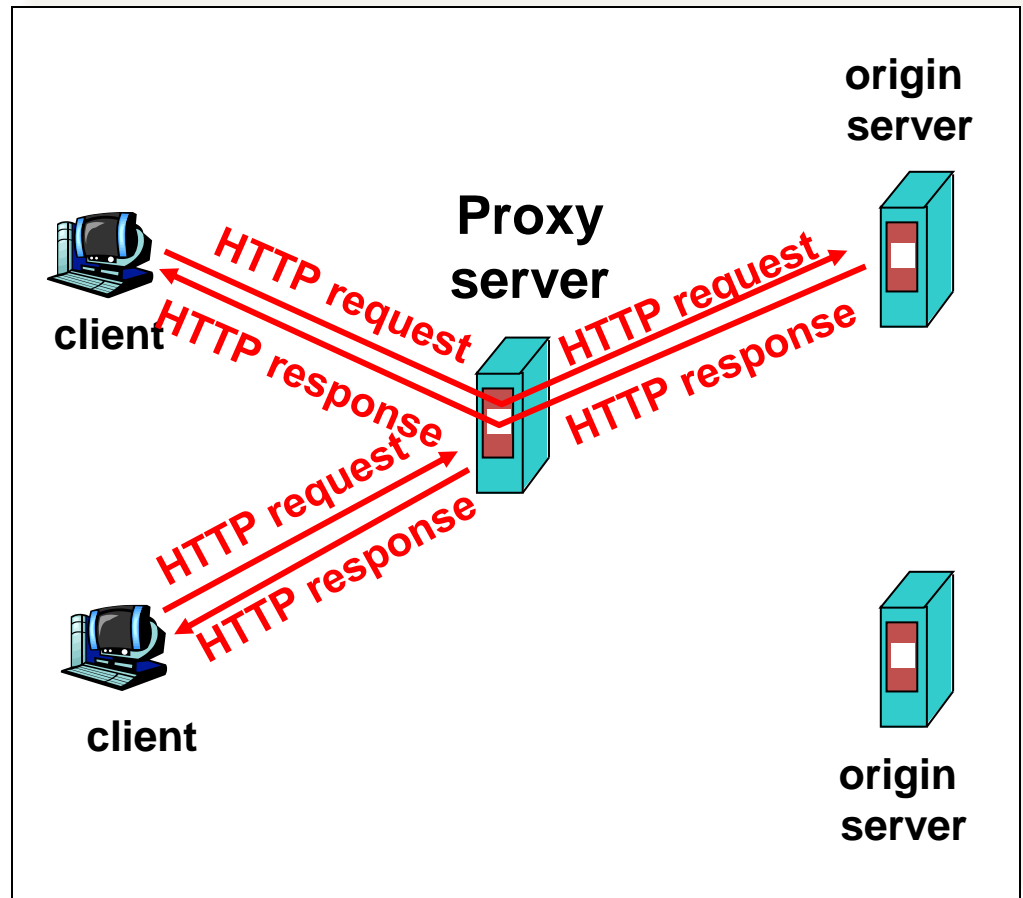


# Proxies

- End host that acts a broker between client and server
  - Speaks to server on client's behalf
- Why?
  - Privacy
  - Content filtering
  - Can use caching (coming up)

# Proxies (Cont.)

- Accept requests from multiple clients
- Takes request and reissues it to server
- Takes response and forwards to client



# Assignment 1

- Non-caching, HTTP 1.0 proxy
  - Support only GET requests
- Multi-process
  - Use fork()
- Simple binary that takes a port number
  - ./proxy 12345 (proxy listens on port 12345)
- Work in Firefox & Chrome
  - Use settings to point browser to your proxy

# Assignment 1 (Cont.)

- What you need from a client request: host, port, and URI path
  - GET `http://www.jhu.edu:80/` HTTP/1.0
- What you send to a remote server:
  - GET `/` HTTP/1.0
  - Host: `www.jhu.edu:80`
  - Connection: `close`
- Check request line and header format
- Forward the response to the client

# Assignment 1 (Cont.)

- Non-GET request?
  - return “Not Implemented” (code 501)
- Unparseable request?
  - return “Bad Request” (code 400)
- Use provided parsing library
- Postel’s law
  - Be liberal in what you accept, and conservative in what you send
  - convert HTTP 1.1 request to HTTP 1.0
  - convert `\r` to `\r\n`
  - etc

# Advice

- **Networking is hard**
  - Hard to know what's going on in network layers
  - Start out simple, test often
- **Build in steps**
  - Incrementally add pieces
  - Make sure they work
  - Will help reduce the effect of “incomplete” information

# Assignment 1 – Getting Started

- Modify Assn 0 to have server respond
  - Simple echo of what client sent
- Modify Assn 0 to handle concurrent clients
  - Use `fork()`
- Create “proxy” server
  - Simply “repeats” client msg to a server, and “repeats” server msg back
- Client sends HTTP requests, proxy parses

# Summary

- HTTP: Simple text-based file exchange protocol
  - Support for status/error responses, authentication, client-side state maintenance, cache maintenance