

**HTTP**  
**Hypertext Transfer Protocol**

Refs:  
RFC 1945 (HTTP 1.0)  
RFC 2616 (HTTP 1.1)

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**HTTP Usage**

- HTTP is the protocol that supports communication between web browsers and web servers.
- A "Web Server" is a HTTP server
- We will look at HTTP Version 1.0 +

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**From the RFC**

"HTTP is an application-level protocol with the lightness and speed necessary for distributed, hypermedia information systems."

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## Transport Independence

- The RFC states that the HTTP protocol generally takes place over a TCP connection, but the protocol itself is not dependent on a specific transport layer.

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## Request - Response

- HTTP has a simple structure:
  - client sends a request
  - server returns a reply.
- HTTP can support multiple request-reply exchanges over a single TCP connection.

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## Well Known Address

- The “well known” TCP port for HTTP servers is port 80.
- Other ports can be used as well...

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## HTTP Versions

- The original version now goes by the name "HTTP Version 0.9"
  - HTTP 0.9 was used for many years.
- Starting with HTTP 1.0 the version number is part of every request.
- HTTP is still changing...

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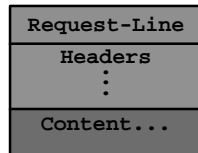
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## HTTP 1.0+ Request

- Lines of text (ASCII).
- Lines end with CRLF "`\r\n`"
- First line is called "Request-Line"



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## Request Line

*Method* *URI* *HTTP-Version* `\r\n`

- The request line contains 3 *tokens* (words).
- space characters " " separate the tokens.
- Newline (`\n`) seems to work by itself (but the protocol requires CRLF)

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## Request Method

- The Request Method can be:

**GET**      **HEAD**      **PUT**  
**POST**    **DELETE**    **TRACE**  
**OPTIONS**

*future expansion is supported*

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## Methods

- GET: retrieve information identified by the URI.
- HEAD: retrieve meta-information about the URI.
- POST: send information to a URI and retrieve result.

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## Methods (cont.)

- PUT: Store information in location named by URI.
- DELETE: remove *entity* identified by URI.

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## More Methods

- TRACE: used to trace HTTP forwarding through proxies, tunnels, etc.
- OPTIONS: used to determine the capabilities of the server, or characteristics of a named resource.

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## Common Usage

- GET, HEAD and POST are supported everywhere (including HW#2!).
- HTTP 1.1 servers often support PUT, DELETE, OPTIONS & TRACE.

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## URI: Universal Resource Identifier

- URIs defined in RFC 2396.
- Absolute URI:  
`scheme://hostname[:port]/path`  
`http://www.cs.rpi.edu:80/blah/foo`
- Relative URI:     /path  
                      /blah/foo  
No server mentioned ↗

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## URI Usage

- When dealing with a HTTP 1.1 server, only a *path* is used (no scheme or hostname).
  - HTTP 1.1 servers are required to be capable of handling an absolute URI, but there are still some out there that won't...
- When dealing with a *proxy* HTTP server, an absolute URI is used.
  - client has to tell the proxy where to get the document!
  - *more on proxy servers in a bit...*

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## HTTP Version Number

“HTTP/1.0” or “HTTP/1.1”

HTTP 0.9 did not include a version number in a request line.

If a server gets a request line with no HTTP version number, it assumes 0.9

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## The Header Lines

- After the *Request-Line* come a number (possibly zero) of HTTP *headers*.
- Each header line contains an attribute name followed by a “:” followed by the attribute value.

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## Headers

- Request Headers provide information to the server about the client
  - what kind of client
  - what kind of content will be accepted
  - who is making the request
- There can be 0 headers

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## Example HTTP Headers

```
Accept: text/html
From: neytmann@cybersurg.com
User-Agent: Mozilla/4.0
Referer: http://foo.com/blah
```

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## End of the Headers

- Each header ends with a CRLF
- The end of the header section is marked with a blank line.
  - just CRLF
- For GET and HEAD requests, the end of the headers is the end of the request!

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## POST

- A POST request includes some *content* (some *data*) after the headers (after the blank line).
- There is no format for the data (just raw bytes).
- A POST request must include a Content-Length line in the headers:  
`Content-Length: 267`

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## Example GET Request

```
GET ~/hollingd/testanswers.html HTTP/1.0
Accept: */*
User-Agent: Internet Explorer
From: cheater@cheaters.org
Referer: http://foo.com/
    ← There is a blank line here!
```

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## Example POST Request

```
POST ~/hollingd/changegrade.cgi HTTP/1.1
Accept: */*
User-Agent: SecretAgent V2.3
Content-length: 35
Referer: http://monte.cs.rpi.edu/blah

stuid=6660182722&item=test1&grade=99
```

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## Typical Method Usage

GET used to retrieve an HTML document.

HEAD used to find out if a document has changed.

POST used to submit a form.

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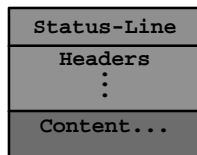
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## HTTP Response

- ASCII Status Line
- Headers Section
- Content can be anything (not just text)
  - typically is HTML document or some kind of image.



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## Response Status Line

*HTTP-Version Status-Code Message*

- *Status Code* is 3 digit number (for computers)
- *Message* is text (for humans)

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## Status Codes

- 1xx Informational
- 2xx Success
- 3xx Redirection
- 4xx Client Error
- 5xx Server Error

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## Example Status Lines

`HTTP/1.0 200 OK`

`HTTP/1.0 301 Moved Permanently`

`HTTP/1.0 400 Bad Request`

`HTTP/1.0 500 Internal Server Error`

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## Response Headers

- Provide the client with information about the returned *entity* (document).
  - what kind of document
  - how big the document is
  - how the document is encoded
  - when the document was last modified
- Response headers end with blank line

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## Response Header Examples

Date: Wed, 30 Jan 2002 12:48:17 EST

Server: Apache/1.17

Content-Type: text/html

Content-Length: 1756

Content-Encoding: gzip

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## Content

- Content can be anything (sequence of raw bytes).
- Content-Length header is required for any response that includes content.
- Content-Type header also required.

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## Single Request/Reply

- The client sends a complete request.
- The server sends back the entire reply.
- The server closes it's socket.
- If the client needs another document it must open a new connection.

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## Persistent Connections

- HTTP 1.1 supports persistent connections (this is supposed to be the default).
- Multiple requests can be handled.
- Most servers seem to close the connection after the first response...

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## Try it with telnet

```
> telnet www.cs.rpi.edu Request
GET / HTTP/1.0
      Blank Line
      (end of headers)
HTTP/1.0 200 OK
Server: Apache Response
...
```

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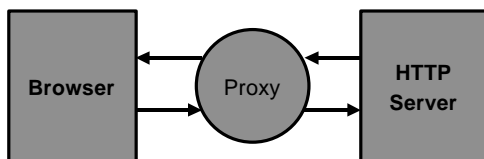
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## HTTP Proxy Server



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## Project #2 HTTP Proxy

- You need to write a proxy server.
- Test it with a browser.
- Must be able to handle GET, HEAD and POST requests.

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## What you need to know

- **You** need to understand HTTP
- You **need** to understand HTTP
- You need to **understand** HTTP
- You need to understand **HTTP**

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## The code you need

- Proxy is both a client and a server
- Parsing the HTTP request is needed.
  - feel free to find some existing code, but make sure you understand it and tell us where you got it!

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## Testing

- Tell your browser to use a proxy
  - Edit preferences/options.
- Interrupt a long transfer (press stop).
- Fill out a form (probably uses POST).

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## What is expected

- We should be able to surf through your proxy!
- We should not be able to kill your proxy by sending a bad request.
- Proxy should print some info about each request (print the request line).

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## More Expectations

- Iterative Server is fine (concurrency is not required).
- No memory leaks!
- No crashes, no matter what kind of nonsense we send your proxy.

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## HTTP V1.1 Details

- The RFC is 176 pages!
  - we don't expect you to read it all or to support every nitty-gritty detail.
  - work on creating a working proxy (one you can use through a browser).
    - performance is not a big deal (but it shouldn't be horribly worse than without your proxy).
  - Don't worry about persistence, chunking, etc.

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## HTTP Headers and HW2

- You will need to look at the Content-type header in a POST.
  - you need to know how many bytes to read after the end of the headers.
- This is the only header you need to look at, but you must forward all headers (both request and reply headers).

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## Stuff you might need to know (that we have not covered)

- Converting hostnames to IP addresses.
- Handling signals (SIGPIPE)
  - Check out section 5.13 in the text
- Providing Concurrency (not required, but not hard either).
  - just fork the server after calling accept.
  - MAKE SURE YOU TAKE CARE OF ZOMBIES!

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