

# CS631 - Advanced Programming in the UNIX Environment

## HTTP; Group Project Discussions

---

Department of Computer Science  
Stevens Institute of Technology  
Jan Schaumann

`jschauma@stevens.edu`

`https://stevens.netmeister.org/631/`

# HTTP

---

## Hypertext Transfer Protocol

### RFC1945 (HTTP/1.0)

And then RFC2616 (HTTP/1.1); and then RFC7540 (HTTP/2); and then HTTP/3 (Draft); ...

A simple request/response protocol.

# The Hypertext Transfer Protocol

---

HTTP is a request/response protocol:

1. client sends a request to the server
2. server responds

# The Hypertext Transfer Protocol

---

HTTP is a request/response protocol:

1. client sends a request to the server
  - request method
  - URI
  - protocol version
  - request modifiers
  - client information
2. server responds

## HTTP: A client request

---

```
$ telnet www.google.com 80
Trying 2607:f8b0:4006:800::2004...
Connected to www.google.com.
Escape character is '^]'.
GET / HTTP/1.0
```

# The Hypertext Transfer Protocol

---

HTTP is a request/response protocol:

1. client sends a request to the server
  - request method
  - URI
  - protocol version
  - request modifiers
  - client information
2. server responds
  - status line (including success or error code)
  - server information
  - entity metainformation
  - content

## HTTP: a server response

---

HTTP/1.0 200 OK

Date: Fri, 01 Nov 2019 02:34:00 GMT

Content-Type: text/html; charset=ISO-8859-1

Server: gws

X-XSS-Protection: 1; mode=block

X-Frame-Options: SAMEORIGIN

Set-Cookie: 1P\_JAR=2019-11-01-02; expires=Sun, 01-Dec-2019 02:34:00 GMT; path=/; domain=

Set-Cookie: NID=190=s7MFbpfUQ1u26sSNpa3NHj42Rg98cQDw1iggAt0MvpMOYTH8NfmWQToFMruYwAV4I

```
<!doctype html><html itemscope="itemscope" itemtype="http://schema.org/WebPage">
<head><meta content="Search the...
```

# The Hypertext Transfer Protocol

---

Server status codes:

- **1xx** – Informational; Request received, continuing process
- **2xx** – Success; The action was successfully received, understood, and accepted
- **3xx** – Redirection; Further action must be taken in order to complete the request
- **4xx** – Client Error; The request contains bad syntax or cannot be fulfilled
- **5xx** – Server Error; The server failed to fulfill an apparently valid request



## HTTP: A client request

---

```
$ telnet www.cs.stevens-tech.edu 80
Trying 155.246.51.11...
Connected to www.cs.stevens-tech.edu.
Escape character is '^]'.
GET / HTTP/1.0

HTTP/1.1 301 Moved Permanently
Date: Fri, 01 Nov 2019 02:42:36 GMT
Server: Apache
Location: https://www.cs.stevens.edu/
Content-Length: 235
Connection: close
Content-Type: text/html; charset=iso-8859-1

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html><head>
```

## HTTP: A client request

---

```
$ openssl s_client -crlf -servername www.cs.stevens.edu -connect www.cs.stevens.edu:443
```

```
[...]
```

```
GET / HTTP/1.1
```

```
Host: www.cs.stevens.edu
```

```
HTTP/1.1 302 Found
```

```
Date: Fri, 01 Nov 2019 02:43:41 GMT
```

```
Server: Apache
```

```
Location: https://www.stevens.edu/ses/cs
```

```
Vary: Accept-Encoding
```

```
Content-Length: 214
```

```
Content-Type: text/html; charset=iso-8859-1
```

```
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
```

## HTTP: A client request

---

```
$ openssl s_client -crlf -servername www.stevens.edu -connect www.stevens.edu:443
```

```
[...]
```

```
GET /ses/cs HTTP/1.1
```

```
Host: www.stevens.edu
```

```
HTTP/1.1 301 Moved Permanently
```

```
Date: Fri, 01 Nov 2019 02:45:11 GMT
```

```
Content-Type: text/html; charset=UTF-8
```

```
Transfer-Encoding: chunked
```

```
Set-Cookie: __cfduid=dfdf7109985d2521a4717fa0e0d62d8a21572576311; expires=Sat, 31-Oct-20 02:45:11 GMT
```

```
Last-Modified: Thu, 31 Oct 2019 23:59:21 GMT
```

```
Location: https://www.stevens.edu/schaefer-school-engineering-science/departments/computer-science
```

```
Via: varnish
```

```
Server: cloudflare
```

## HTTP: A client request

---

[...]

```
GET /schaefer-school-engineering-science/departments/computer-science HTTP/1.1
```

```
Host: www.stevens.edu
```

```
HTTP/1.1 200 OK
```

```
Date: Fri, 01 Nov 2019 02:46:52 GMT
```

```
Content-Type: text/html; charset=utf-8
```

```
Set-Cookie: __cfduid=dd5d6da1261bad72024f790c023a1a6561572576412; expires=Sat, 31-Oct-20 02:46:52 GMT
```

```
Last-Modified: Fri, 01 Nov 2019 00:22:20 GMT
```

```
Via: varnish
```

```
X-Generator: Drupal 7 (http://drupal.org)
```

```
Server: cloudflare
```

```
<!DOCTYPE html>
```

```
<html lang="en" class="no-js">
```

# HTTP: A client request

The screenshot shows a web browser displaying the Stevens Institute of Technology Department of Computer Science page. The browser's developer tools are open to the Network tab, showing a waterfall chart and a table of network requests.

The waterfall chart shows the following requests:

Name	Status	Type	Initiator	Size	Time
www.cs.stevens.edu	301	text/html	Other	295 B	485 ms
www.cs.stevens.edu	302	text/html	www.cs.steve...	286 B	429 ms
cs	301	text/html	www.cs.steve...	544 B	337 ms
computer-science	200	docum...	/ses/cs	116 KB	167 ms
d0b486e3-1465-45e2-b0d2-2f285e3dd330.css	200	stylesh...	computer-scie...	2.0 KB	495 ms

## HTTP - more than just text

---

HTTP is a *Transfer Protocol* – serving *data*, not any specific text format.

- Accept-Encoding client header can specify different formats such as *gzip*, *Shared Dictionary Compression over HTTP (SDCH)* etc.
- corresponding server headers: Content-Type and Content-Encoding



## HTTP - more than just static data

---

HTTP is a *Transfer Protocol* – what is transferred need not be static; resources may generate different data to return based on many variables.

- CGI – resource is *executed*, needs to generate appropriate response headers
- server-side scripting (ASP, PHP, Perl, ...)
- client-side scripting (JavaScript/ECMAScript/JScript,...)
- applications based on HTTP, using:
  - AJAX
  - RESTful services
  - JSON, XML, YAML to represent state and abstract information

## HTTP in your final project

---

- protocol versions supported: 1.0
- request methods supported: GET, HEAD
- request headers supported: If-Modified-Since
- response headers included: Date, Server, Last-Modified, Content-Type, Content-Length



## HTTP in your final project

---

Let's create your building blocks:

- program startup and dæmonization
- rough network logic
- input / request parsing and validation
- cgi handling
- user directory handling
- directory index generation
- regular file serving

## Reading

---

HTTP etc.:

- RFC 1945, 2616, 2818, 3875, 7540
- <https://httpd.apache.org/docs/current/>
- <https://www.w3.org/Protocols/>
- REST: <https://is.gd/1eSvGa>

Homework: **Vote.** (Sorry, US Citizens only.)

<https://www.vote411.org/>