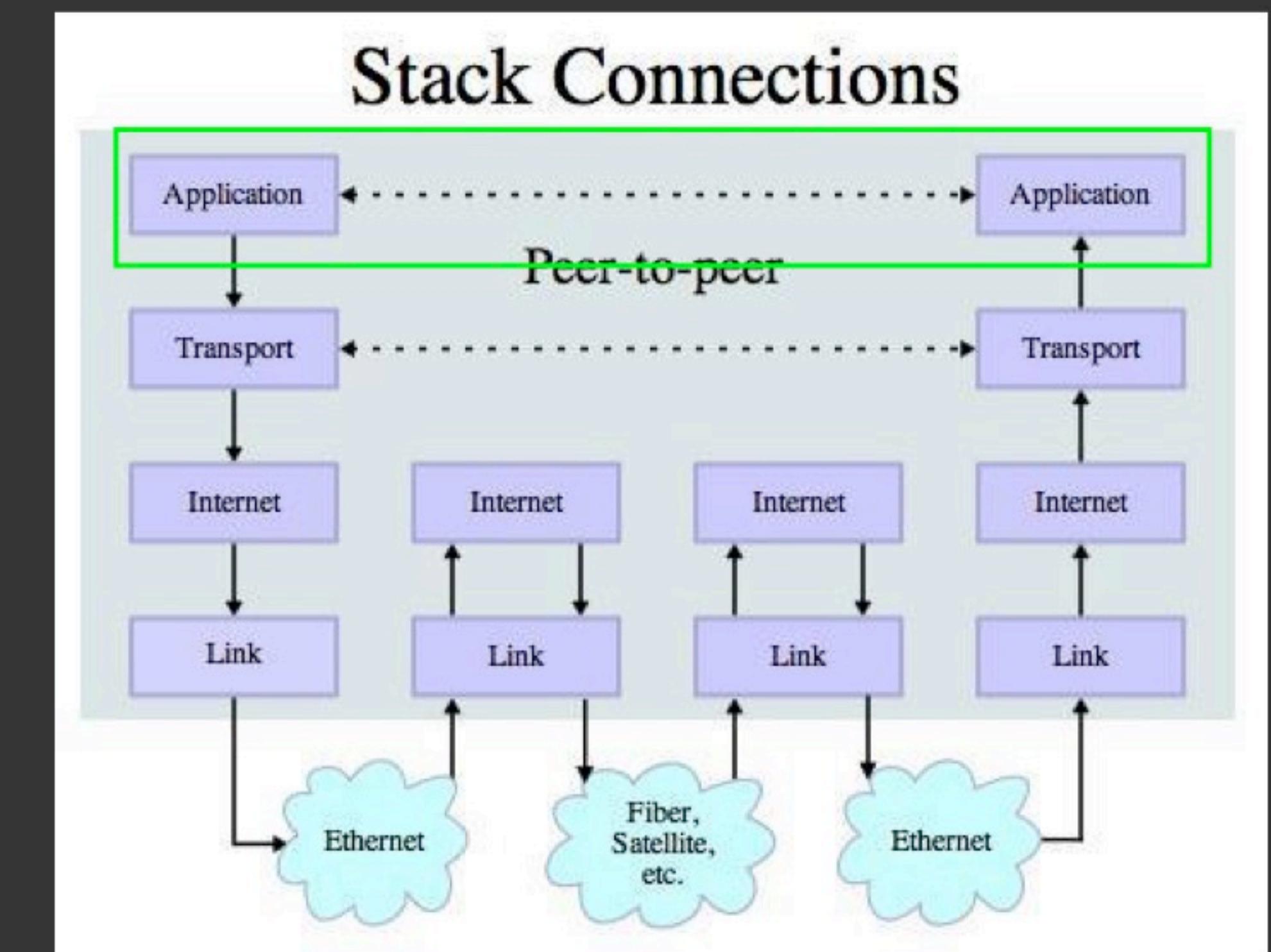


# Application Protocol

- Since TCP (and Python) gives us a reliable **socket**, what do we want to do with the **socket**? What problem do we want to solve?
- Application Protocols
  - Mail
  - World Wide Web



Source: [http://en.wikipedia.org/wiki/Internet\\_Protocol\\_Suite](http://en.wikipedia.org/wiki/Internet_Protocol_Suite)

# HTTP - Hypertext Transfer Protocol

- The dominant Application Layer Protocol on the Internet
- Invented for the Web - to Retrieve HTML, Images, Documents, etc
- Extended to be data in addition to documents - RSS, Web Services, etc..Basic Concept - Make a Connection - Request a document - Retrieve the Document - Close the Connection

<http://en.wikipedia.org/wiki/Http>



# HTTP

The HyperText Transfer Protocol is the set of rules to allow browsers to retrieve web documents from servers over the Internet

# What is a Protocol?

- A set of rules that all parties follow so we can predict each other's behavior
- And not bump into each other
  - On two-way roads in USA, drive on the right-hand side of the road
  - On two-way roads in the UK, drive on the left-hand side of the road



<http://www.dr-chuck.com/page1.htm>

protocol

host

document

<http://www.youtube.com/watch?v=x2GyLq59rl>

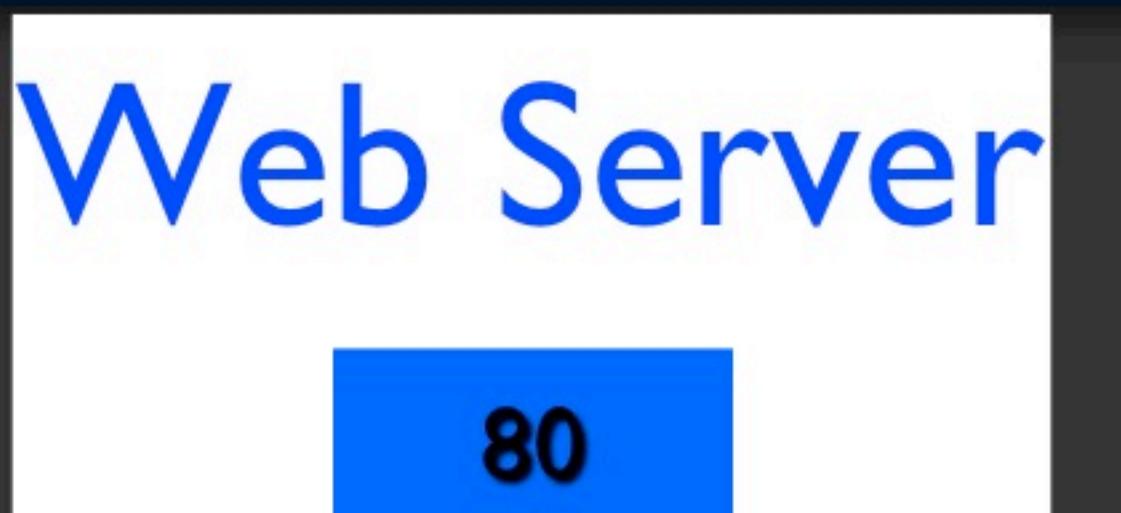
1:17 - 2:19



# Getting Data From The Server

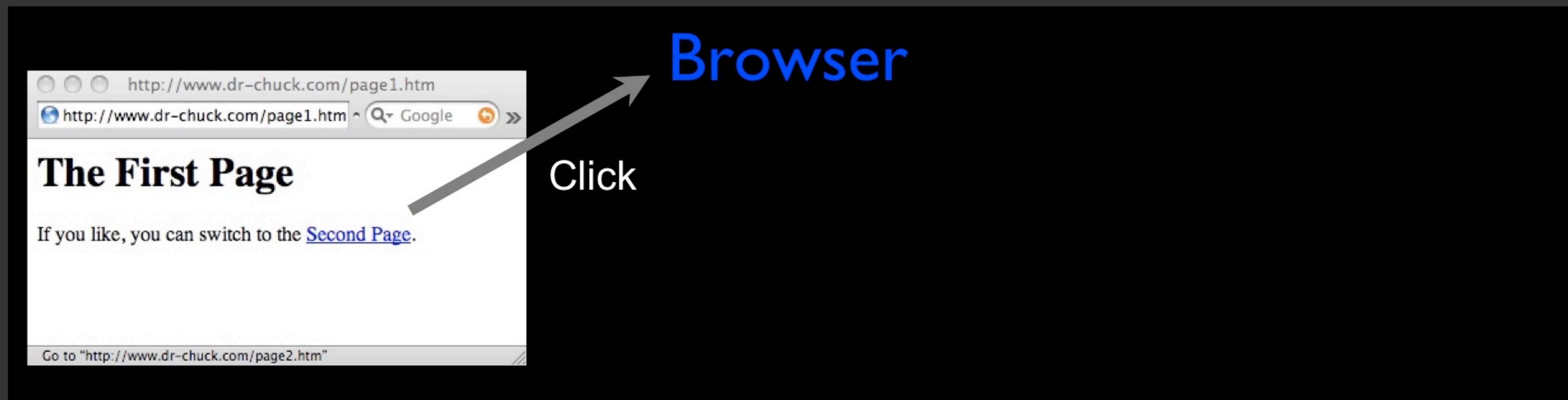
Each time the user clicks on an anchor tag with an href= value to switch to a new page, the browser makes a connection to the web server and issues a “GET” request - to GET the content of the page at the specified URL

The server returns the HTML document to the Browser which formats and displays the document to the user.



## Browser





Request

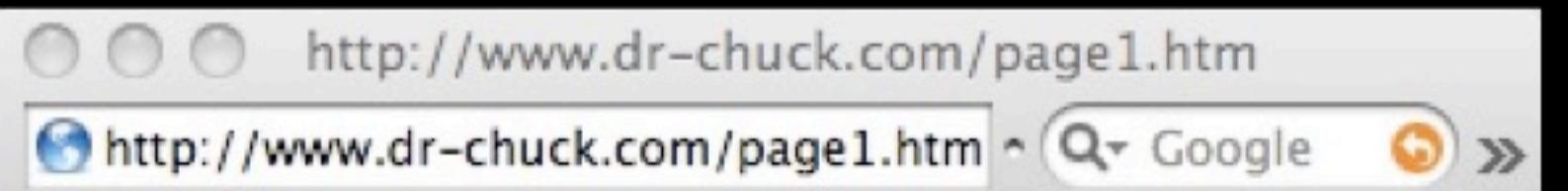
GET http://www.dr-chuck.com/page2.htm

Web Server

80



Browser



The First Page

If you like, you can switch to the [Second Page](#).

Go to "http://www.dr-chuck.com/page2.htm"

Click

Request

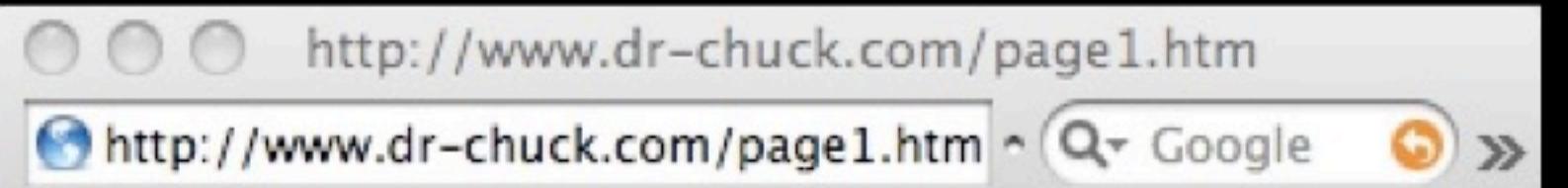
GET http://www.dr-chuck.com/page2.htm

Web Server

80



Browser



The First Page

If you like, you can switch to the [Second Page](#).

Go to "http://www.dr-chuck.com/page2.htm"

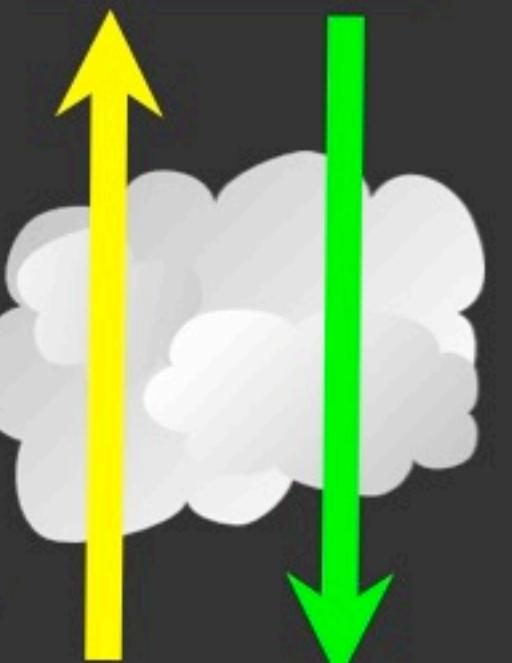
Click

Request

GET http://www.dr-chuck.com/page2.htm

Web Server

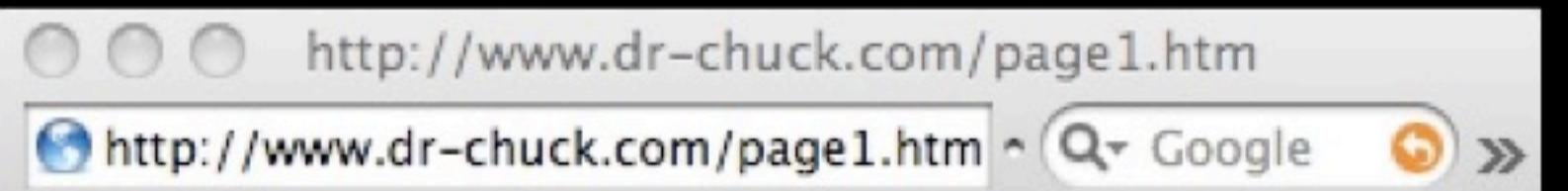
80



Response

<h1>The Second Page</h1><p>If you like, you can switch back to the <a href="page1.htm">First Page</a>.</p>

Browser



The First Page

If you like, you can switch to the [Second Page](#).

Go to "http://www.dr-chuck.com/page2.htm"

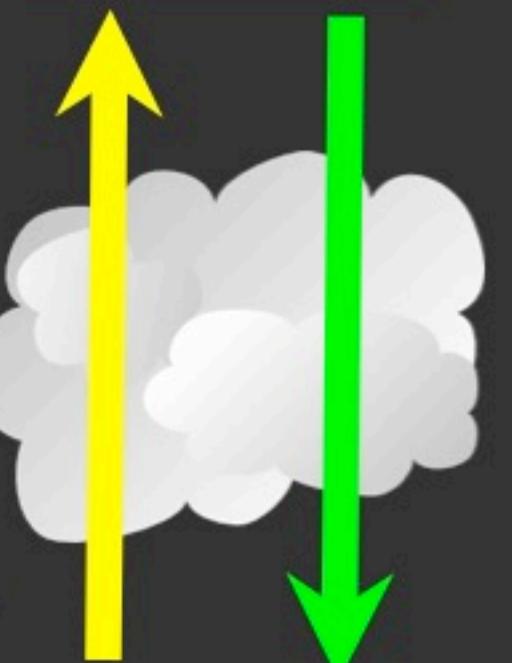
Click

Request

GET http://www.dr-chuck.com/page2.htm

Web Server

80



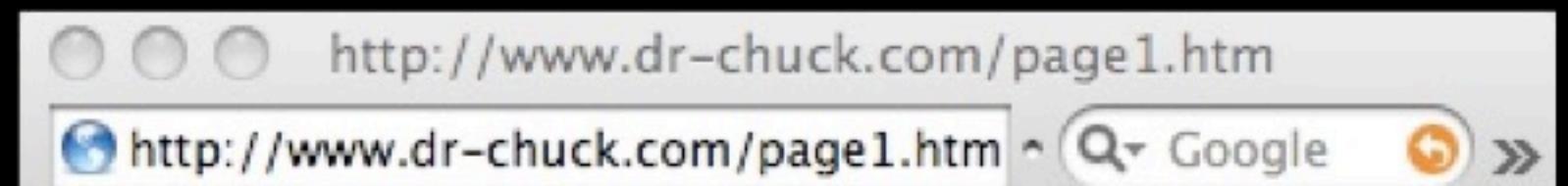
Response

```
<h1>The Second Page</h1><p>If you like, you can switch back to the <a href="page1.htm">First Page</a>.</p>
```

Browser

Click

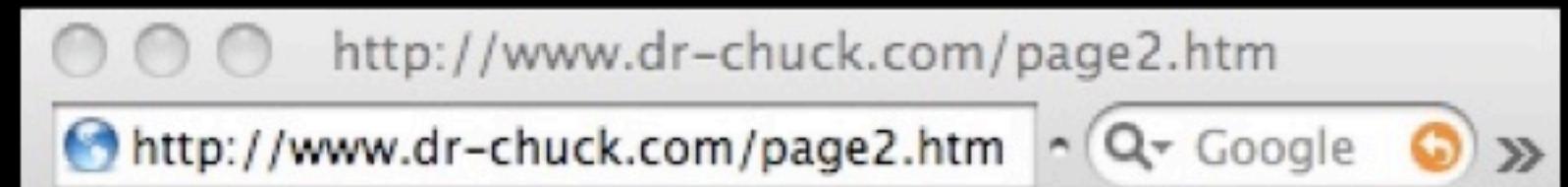
Parse/  
Render



The First Page

If you like, you can switch to the [Second Page](#).

Go to "http://www.dr-chuck.com/page2.htm"

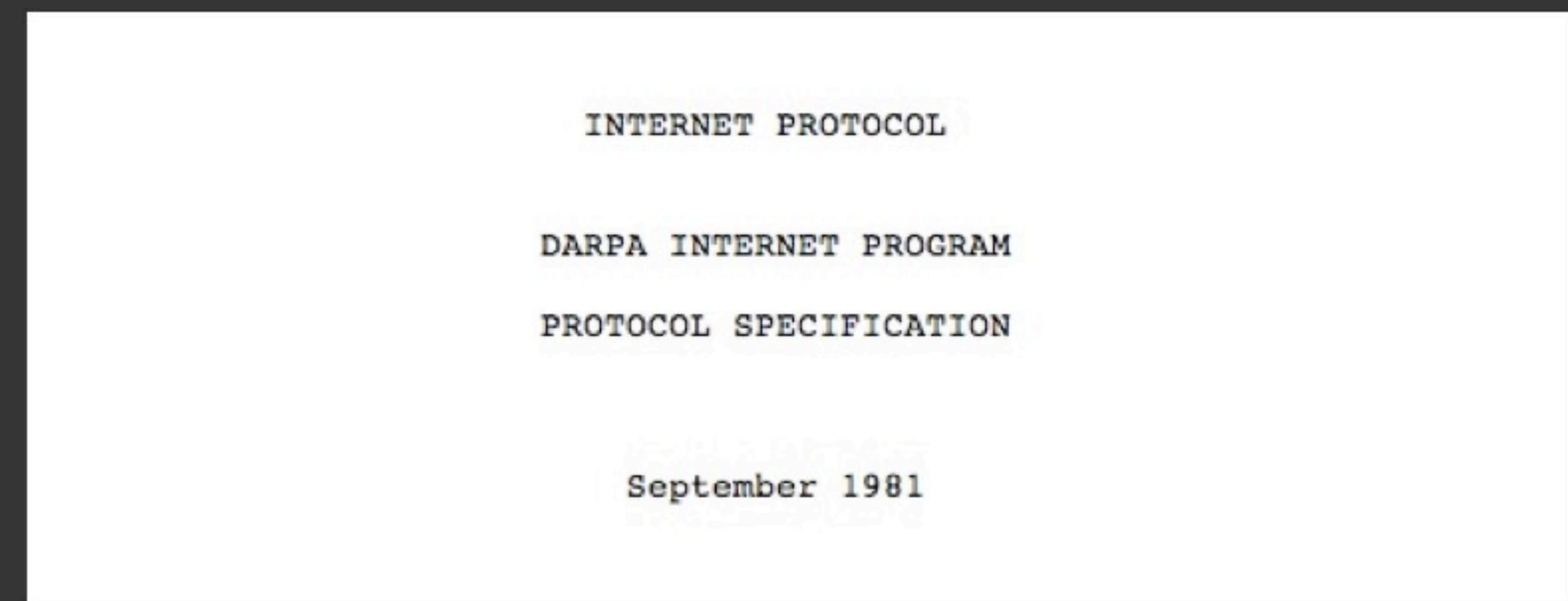


The Second Page

If you like, you can switch back to the [First Page](#).

# Internet Standards

- The standards for all of the Internet protocols (inner workings) are developed by an organization
- Internet Engineering Task Force (IETF)
- [www.ietf.org](http://www.ietf.org)
- Standards are called “RFCs” - “Request for Comments”



The internet protocol treats each internet datagram as an independent entity unrelated to any other internet datagram. There are no connections or logical circuits (virtual or otherwise).

The internet protocol uses four key mechanisms in providing its service: Type of Service, Time to Live, Options, and Header Checksum.

Source: <http://tools.ietf.org/html/rfc791>



Network Working Group  
Request for Comments: 2616  
Obsoletes: 2068  
Category: Standards Track

R. Fielding  
UC Irvine  
J. Gettys  
Compaq/W3C  
J. Mogul  
Compaq  
H. Frystyk  
W3C/MIT  
L. Masinter  
Xerox  
P. Leach  
Microsoft  
T. Berners-Lee  
W3C/MIT  
June 1999

## <http://www.w3.org/Protocols/rfc2616/rfc2616.txt>

### Hypertext Transfer Protocol -- HTTP/1.1

#### Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

#### Copyright Notice

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#### Abstract

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information



## 5 Request

A request message from a client to a server includes, within the first line of that message, the method to be applied to the resource, the identifier of the resource, and the protocol version in use.

```
Request      = Request-Line ; Section 5.1
               *(( general-header
                 | request-header        ; Section 4.5
                 | entity-header ) CRLF) ; Section 5.3
               CRLF
               [ message-body ]       ; Section 7.1
                                         ; Section 4.3
```

### 5.1 Request-Line

The Request-Line begins with a method token, followed by the Request-URI and the protocol version, and ending with CRLF. The elements are separated by SP characters. No CR or LF is allowed except in the final CRLF sequence.

```
Request-Line = Method SP Request-URI SP HTTP-Version CRLF
```

# Making an HTTP request

Connect to the server like `www.dr-chuck.com`"

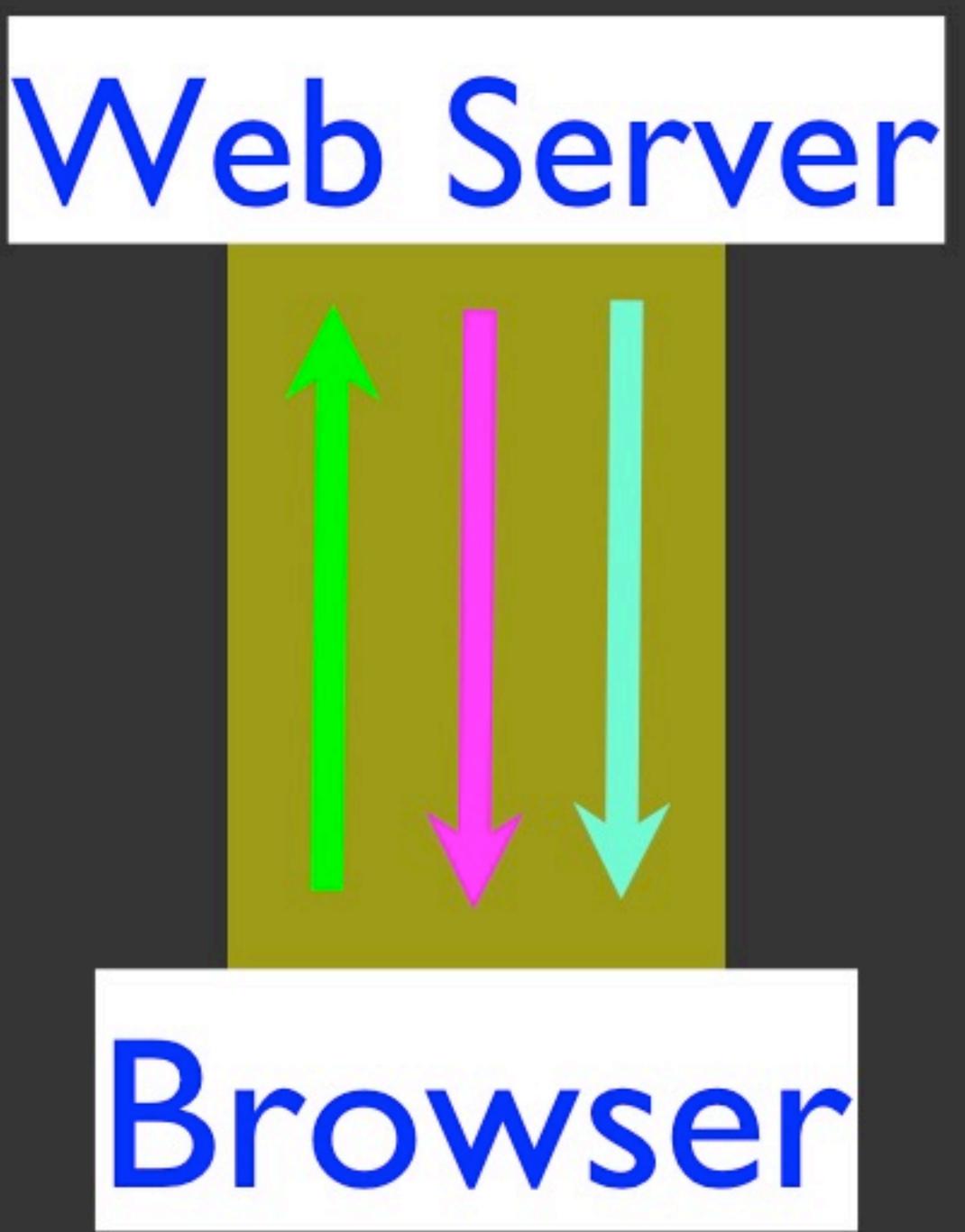
Request a document (or the default document)

- *GET http://www.dr-chuck.com/page1.htm HTTP/1.0*
- *GET http://www.mlive.com/ann-arbor/ HTTP/1.0*
- *GET http://www.facebook.com HTTP/1.0*

```
$ telnet www.dr-chuck.com 80
Trying 74.208.28.177...
Connected to www.dr-chuck.com. Escape character is '^]'.
GET http://www.dr-chuck.com/page1.htm HTTP/1.0
```

```
HTTP/1.1 200 OK
Date: Thu, 08 Jan 2015 01:57:52 GMT
Last-Modified: Sun, 19 Jan 2014 14:25:43 GMT
Connection: close
Content-Type: text/html
```

```
<h1>The First Page</h1>
<p>If you like, you can switch to
the <a href="http://www.dr-chuck.com/page2.htm">Second
Page</a>.</p>
Connection closed by foreign host.
```



# Accurate Hacking in the Movies

Matrix Reloaded  
Bourne Ultimatum  
Die Hard 4

...

<http://nmap.org/movies.html>



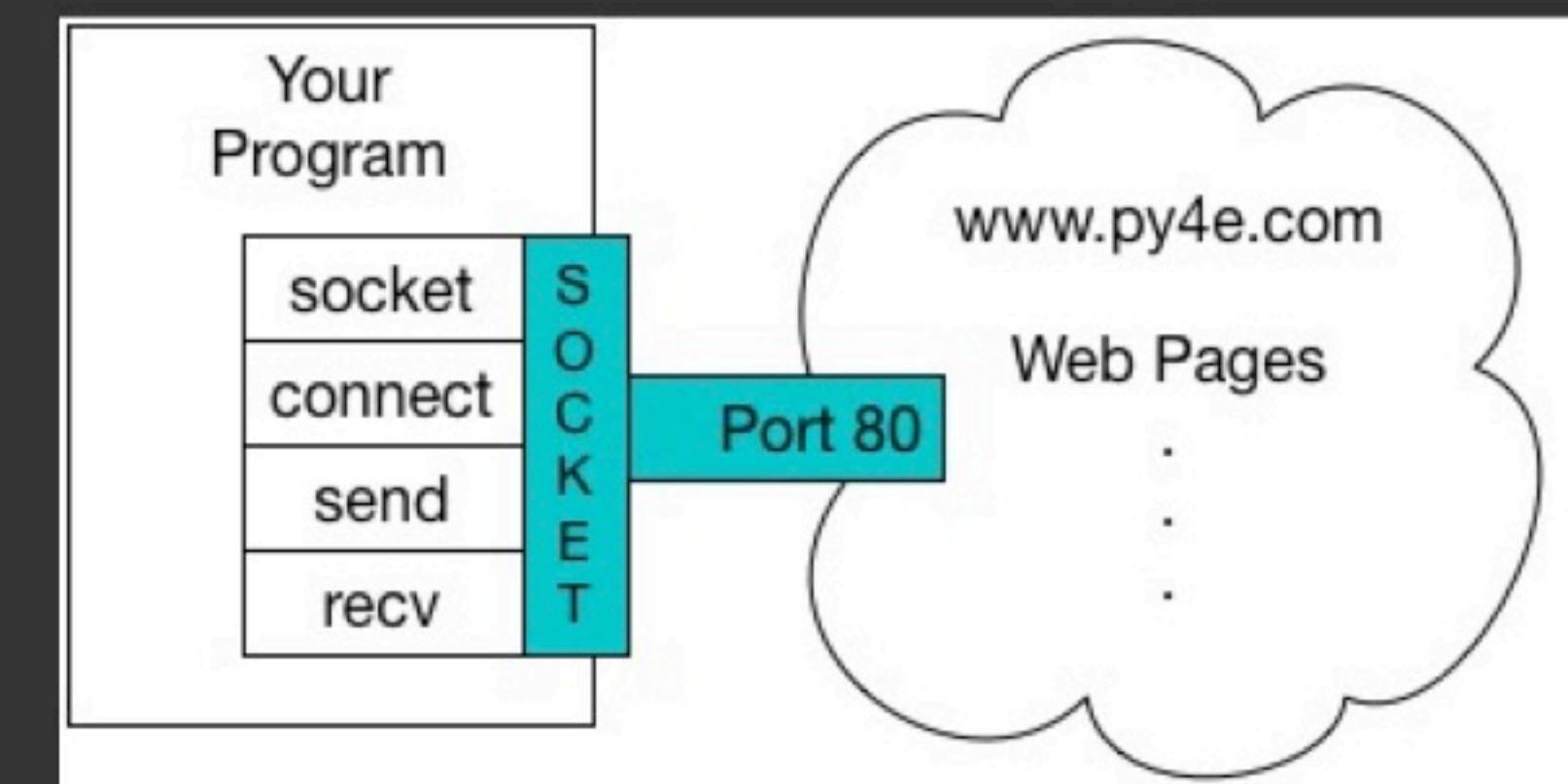
```
88/tcp      open     http          host=2...[mobile]
81/tcp      open     host=2...
10/...[mobile]
8 nmap -v -sS -O 10.2.2.2
11
13 Starting nmap 0.2.54BETA2S
13 Insufficient responses for TCP sequencing (3), OS detection is
13 inaccurate
14 Interesting ports on 10.2.2.2:
14 (The 1539 ports scanned but not shown below are in state: cl...
51 Port      State       Service
51 22/tcp    open        ssh
58
68 No exact OS matches for host
68
24 Nmap run completed -- 1 IP address (1 host up) scanned
50 & sshnuke 10.2.2.2 -rootpw="Z10H0101"
Connecting to 10.2.2.2:ssh ... successful.
ReAttempting to exploit SSHv1 CRC32 ... successful.
IP Resetting root password to "Z10H0101".
System open: Access Level (9)
Hn & ssh 10.2.2.2 -l root
root@10.2.2.2's password: [REDACTED]
[REDACTED] RTF CONTROL
[REDACTED] ACCESS GRANTED
```

# An HTTP Request in Python

```
import socket

mysock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
mysock.connect(('data.pr4e.org', 80))
cmd = 'GET http://data.pr4e.org/romeo.txt HTTP/1.0\n\n'.encode()
mysock.send(cmd)

while True:
    data = mysock.recv(512)
    if (len(data) < 1):
        break
    print(data.decode())
mysock.close()
```





```
HTTP/1.1 200 OK
Date: Sun, 14 Mar 2010 23:52:41 GMT
Server: Apache
Last-Modified: Tue, 29 Dec 2009 01:31:22 GMT
ETag: "143c1b33-a7-4b395bea"
Accept-Ranges: bytes
Content-Length: 167
Connection: close
Content-Type: text/plain
```

But soft what light through yonder window breaks  
It is the east and Juliet is the sun  
Arise fair sun and kill the envious moon  
Who is already sick and pale with grief

## HTTP Header

```
while True:
    data = mysock.recv(512)
    if ( len(data) < 1 ) :
        break
    print(data.decode())
```

## HTTP Body



# About Characters and Strings...



## Acknowledgements / Contributions



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...

Initial Development: Charles Severance, University of Michigan School of Information

... Insert new Contributors here