Mobile Application Development

Higher Diploma in Science in Computer Science

Produced by

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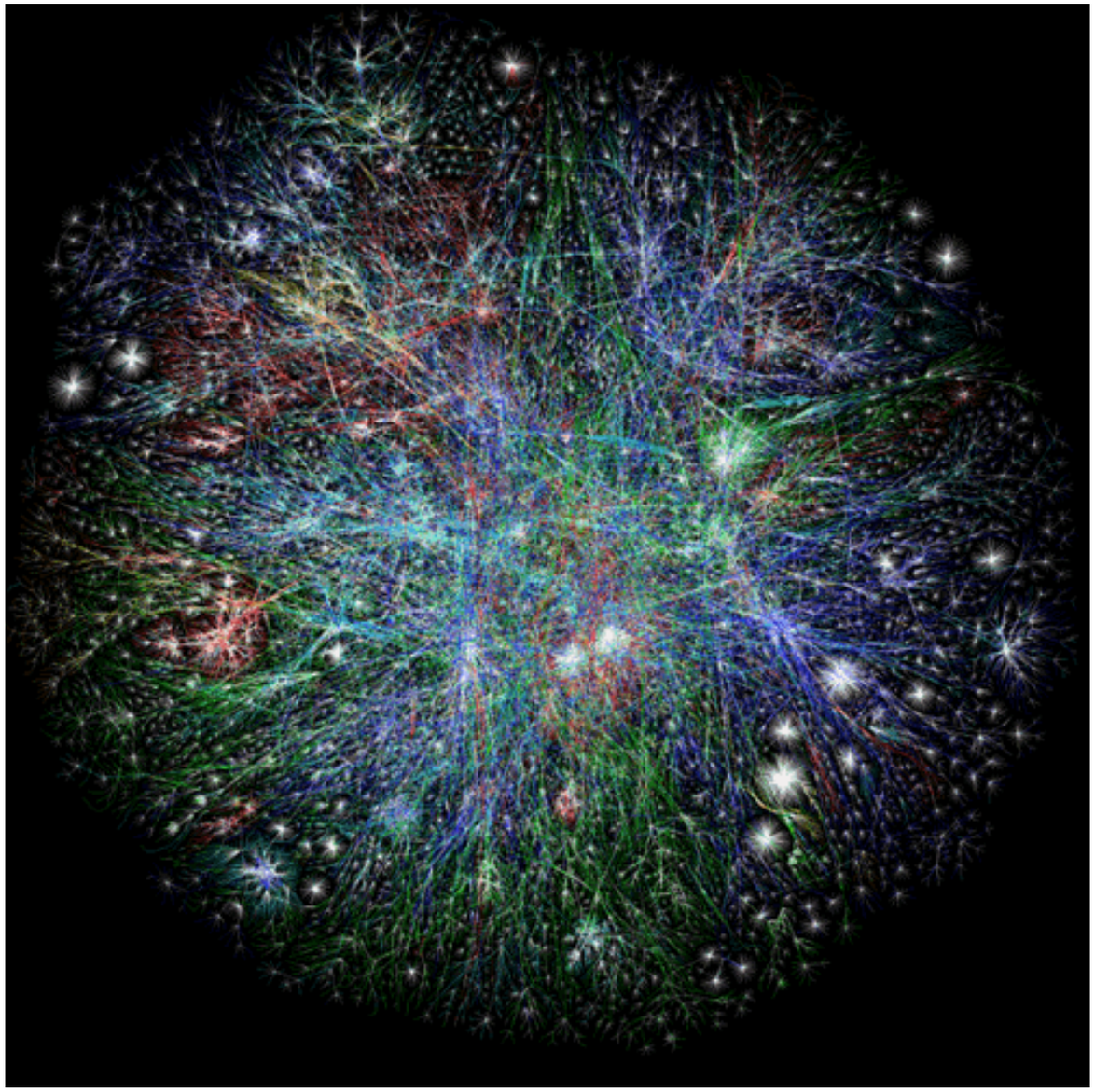
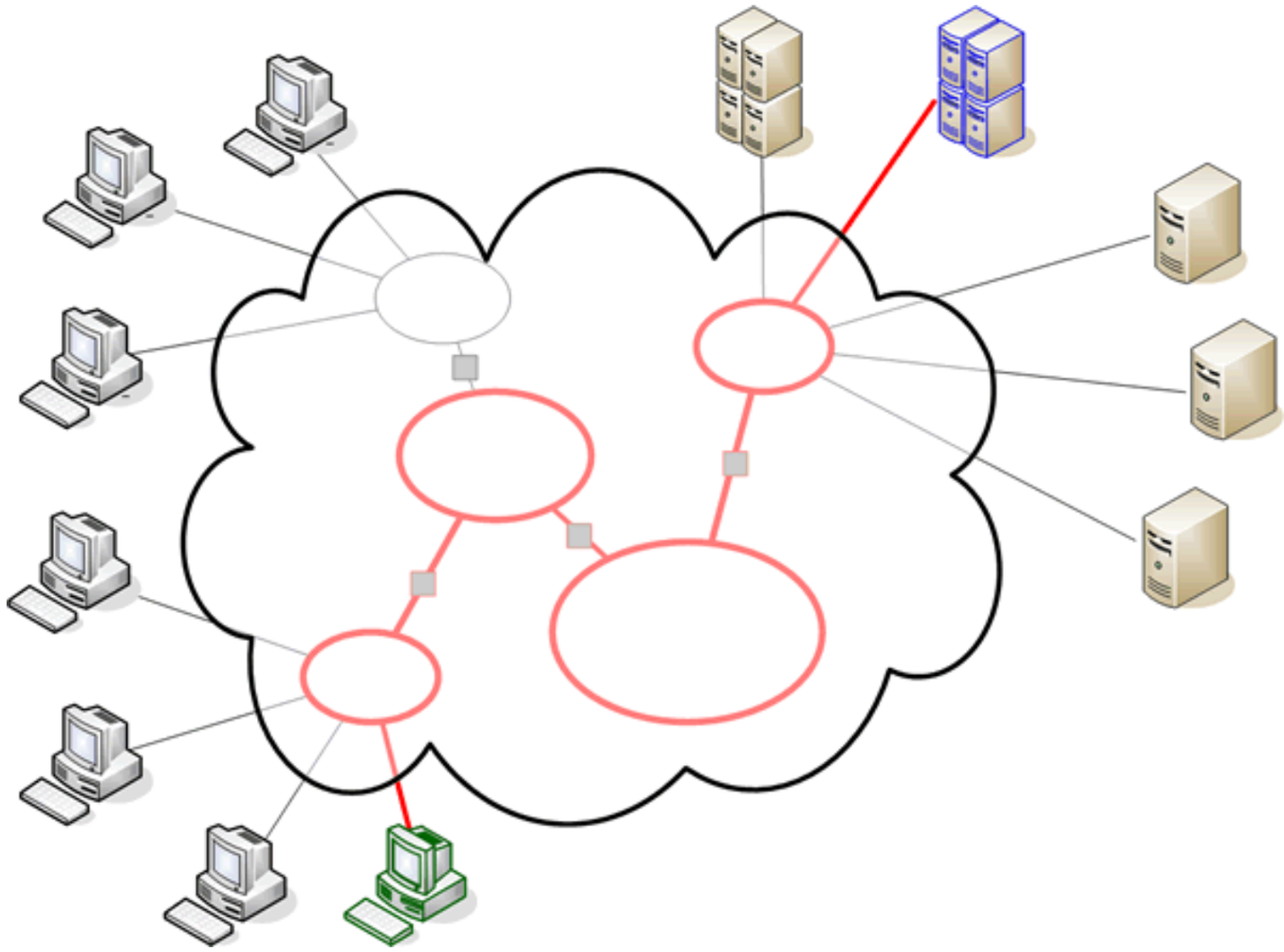
OSI, the Internet & the HTTP Protocol

The Internet





Underlying nature of the Internet - Protocols & Standards

"The irony is that in all its various guises -- commerce, research, and surfing -- the Web is already so much a part of our lives that familiarity has clouded our perception of the Web itself."

Tim Berners-Lee in Weaving the Web

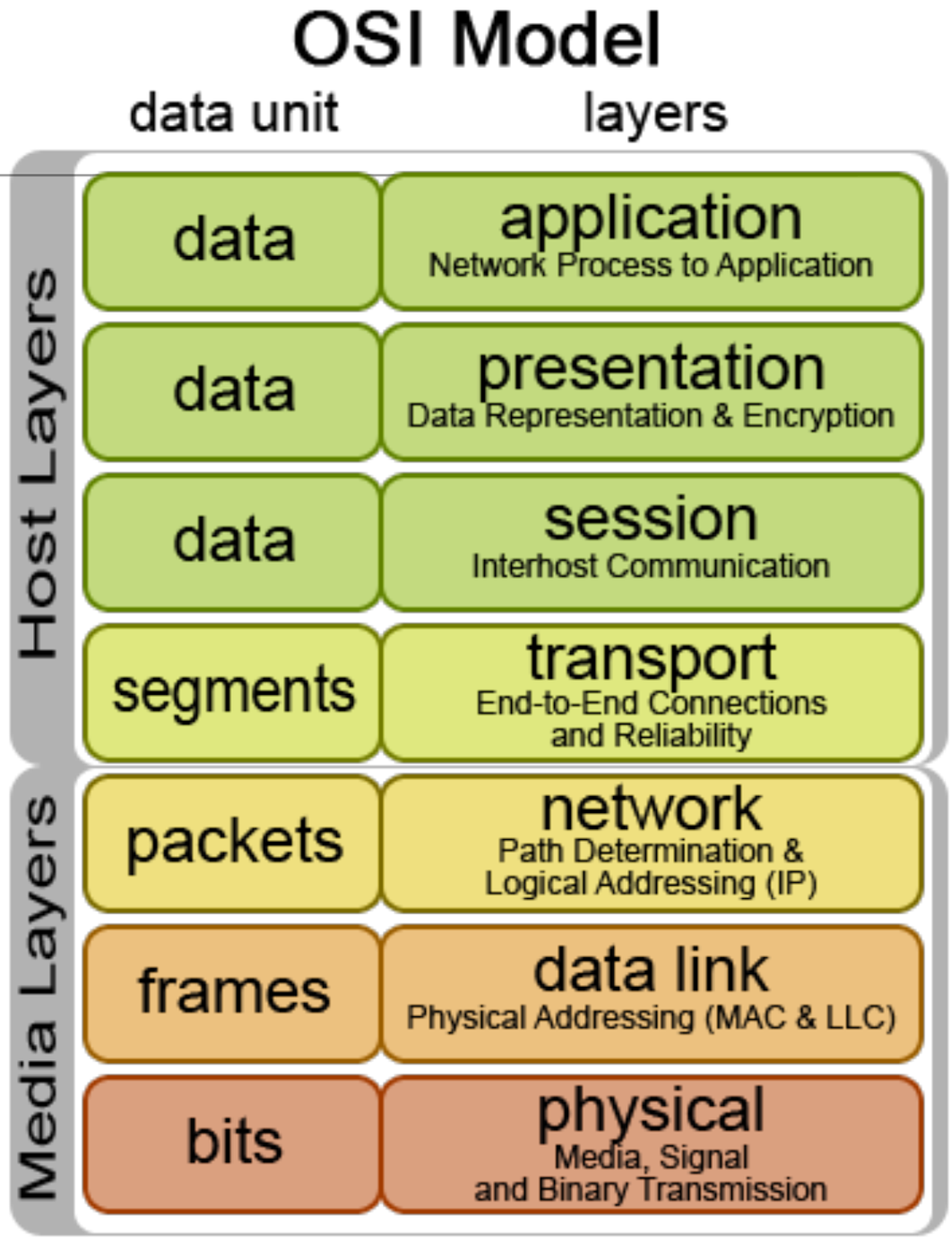
- Email
  - SMTP
  - POP
  - IMAP
- File Transfer
  - FTP
  - SFTP
  - FTP over SSH
- Login
  - Telnet
  - SSH
- Web
  - HTTP, HTML
- Messaging
  - XMPP

OSI Model

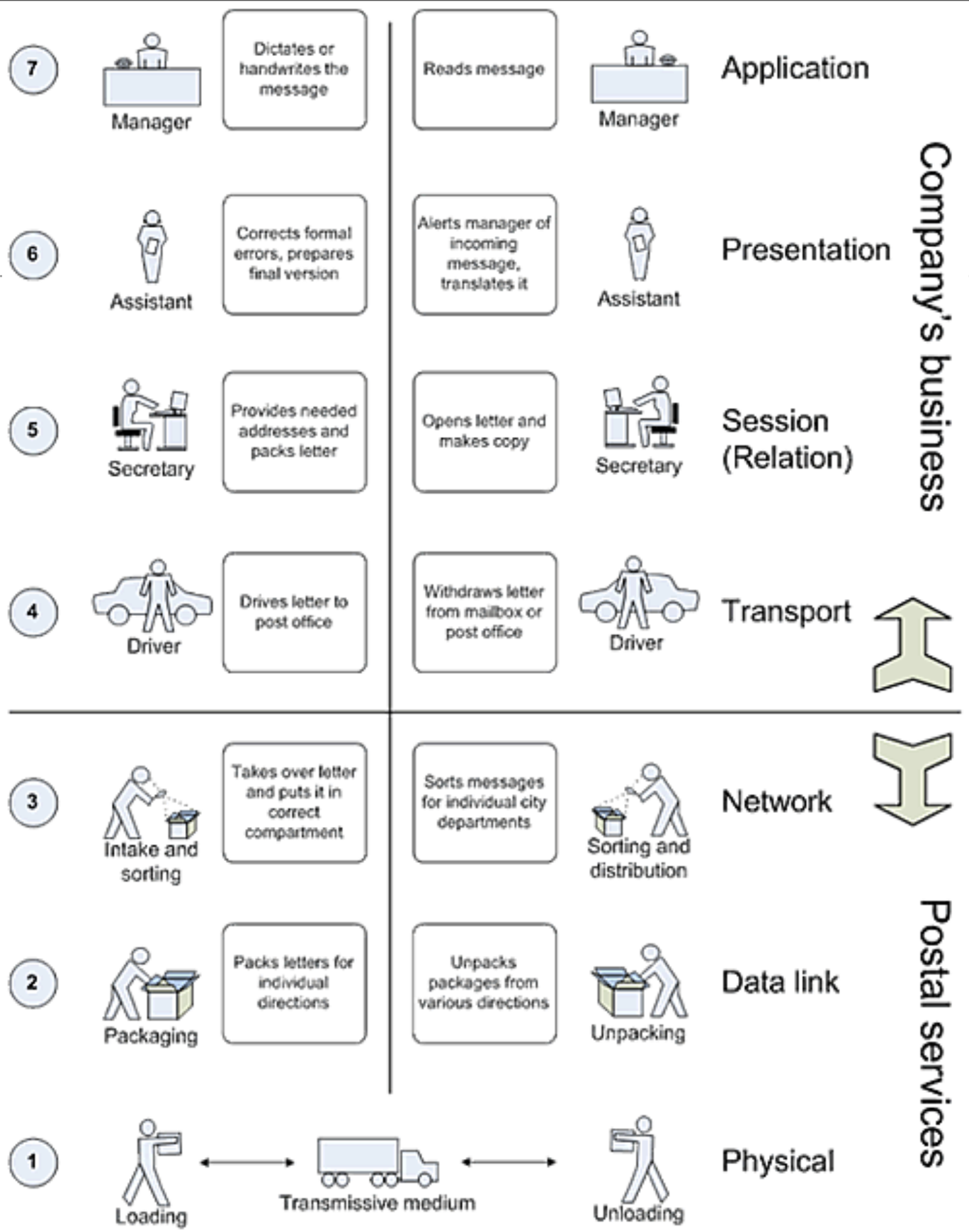
- The OSI model divides the functions of a protocol into a series of layers - each layer only uses the functions of the layer below, and only exports functionality to the layer above.

- A system that implements protocol behavior consisting of a series of these layers is known as a 'protocol stack' or 'stack'

- The interface between layers dictates the specifications on how one layer interacts with another. These specifications are typically known as Requests for Comments or "RFC"s in the TCP/IP community.

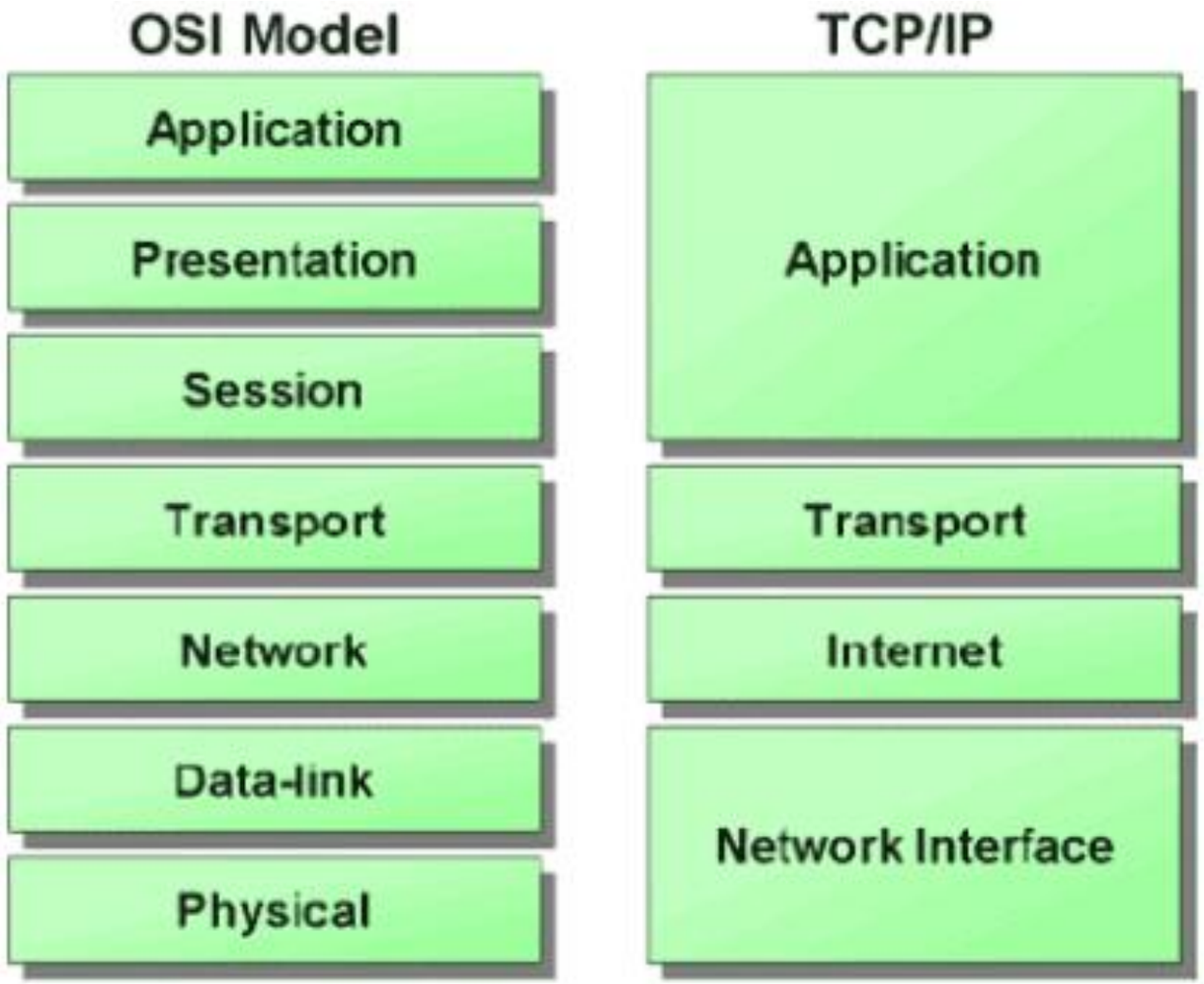


OSI Analogy



RM – OSI and letter communication parallel

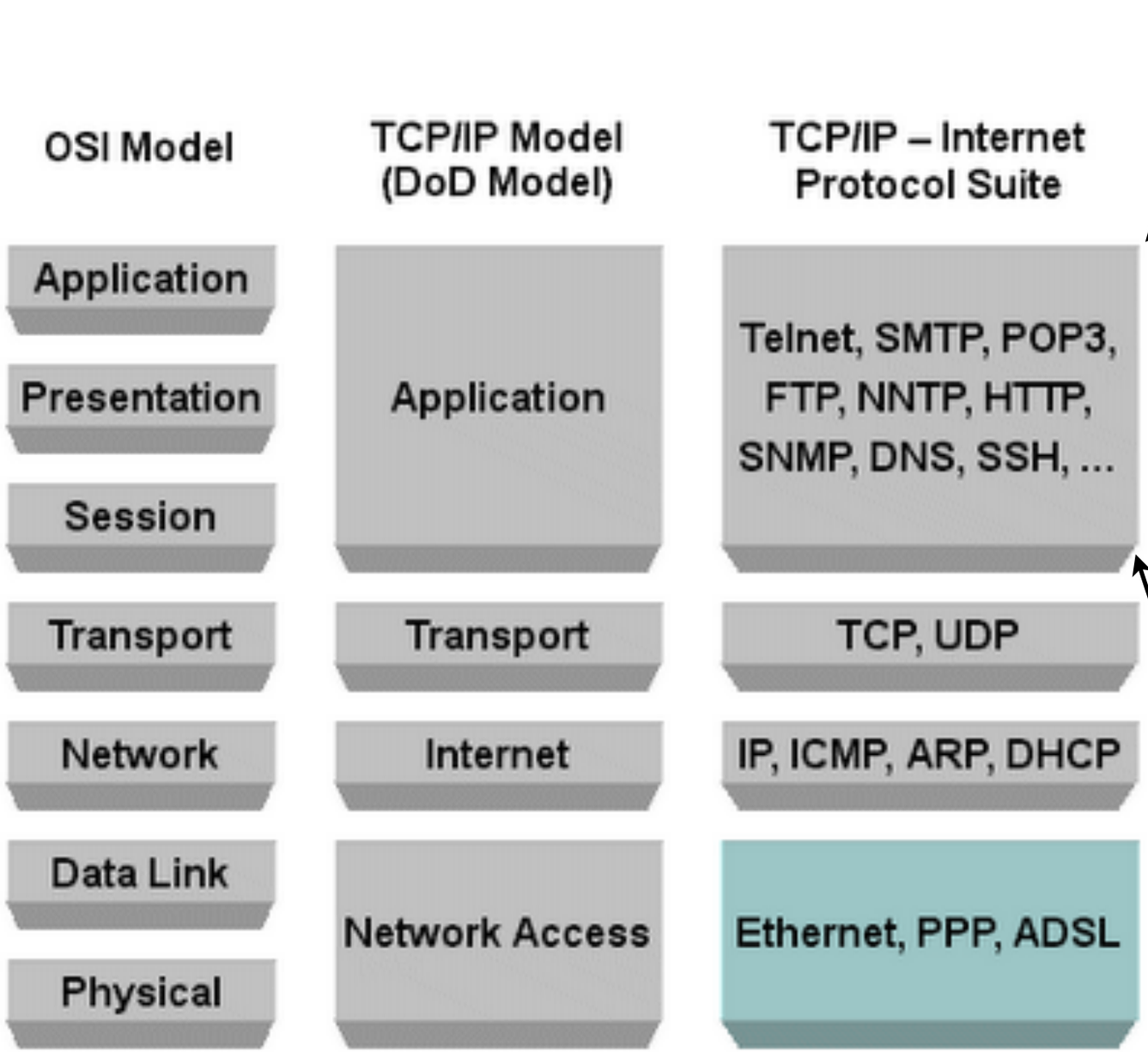
OSI & TCP/IP



TCP/IP and the OSI model

- The application-centric layers of the 7-layer model are condensed into a single application layer protocol in the TCP/IP stack
- the TCP/IP protocol stack defines a Network Interface instead of the Data-Link layer of the ISO model, and the Internet Layer of the TCP/IP mode is broadly equivalent to the Network Layer in the ISO model.

TCP/IP Protocol Suite



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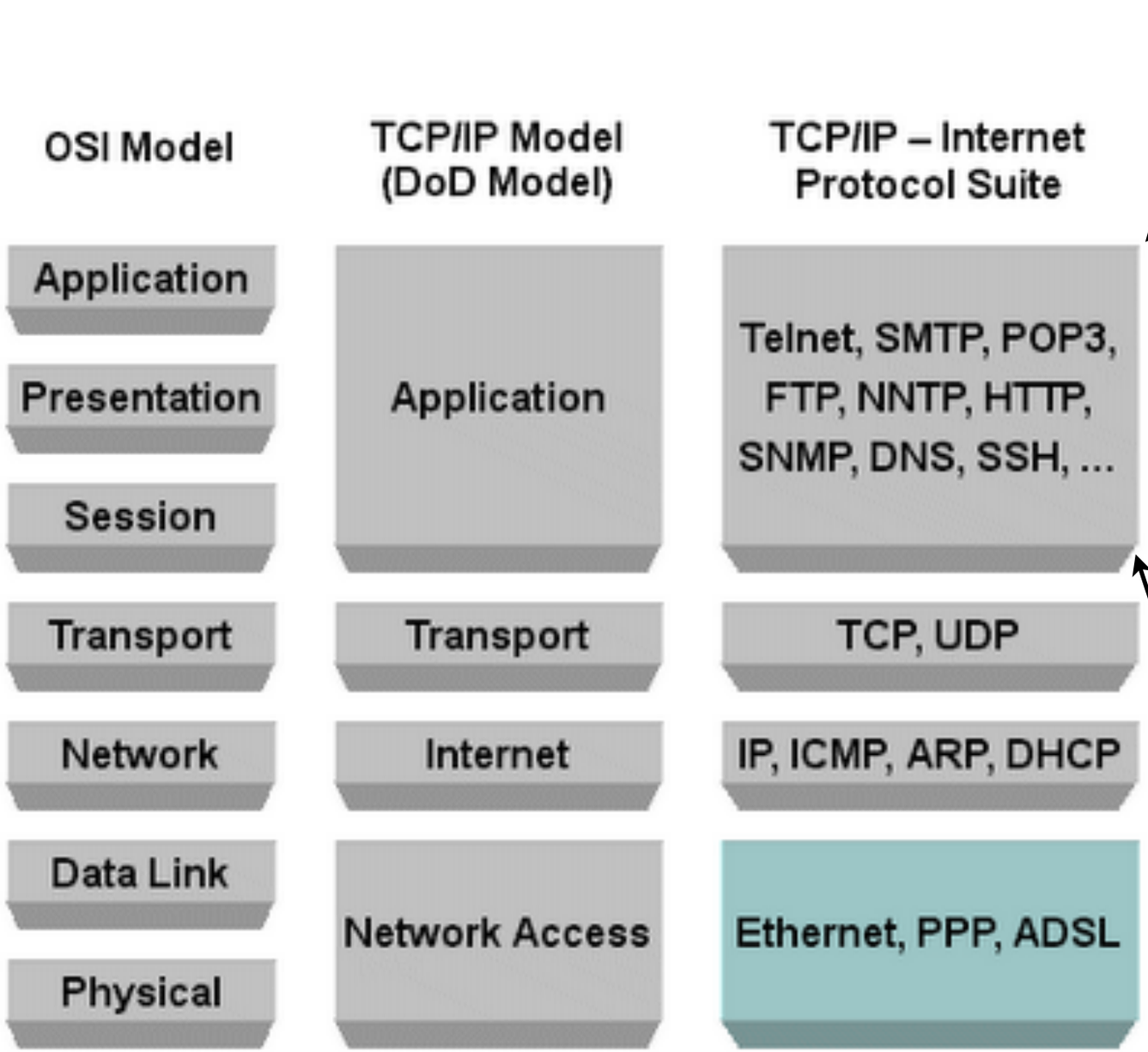
TCP/IP Protocol Suite



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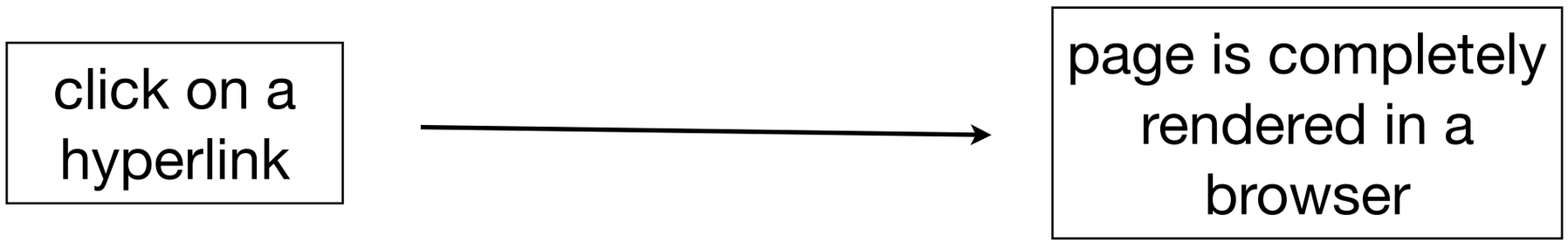
Lifecycle of a Hyperlink

- What happens when:




Browser
The Internet
Web Server


client
Browser
The Internet
server
Web Server
vle.wit.ie

client

Browser

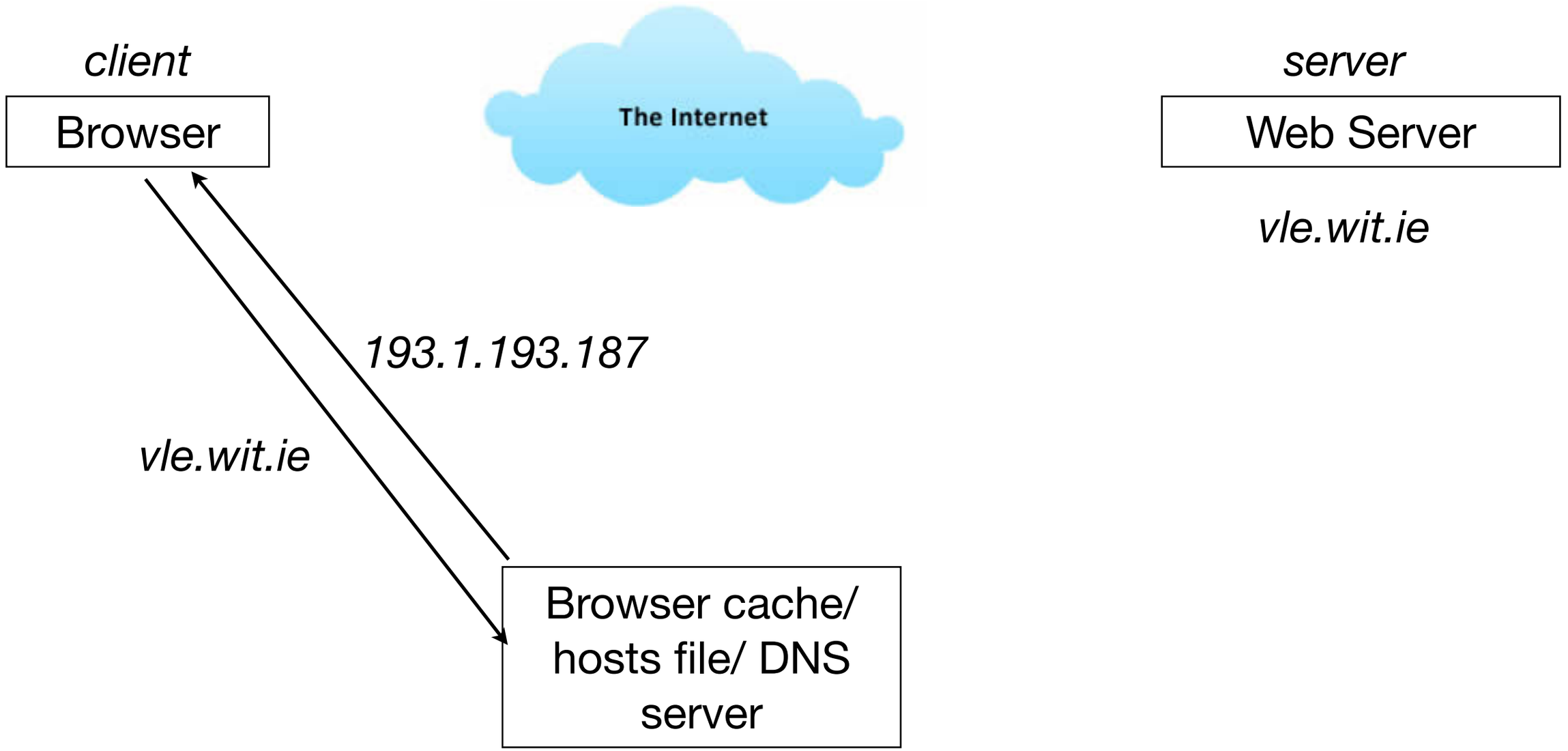
vle.wit.ie

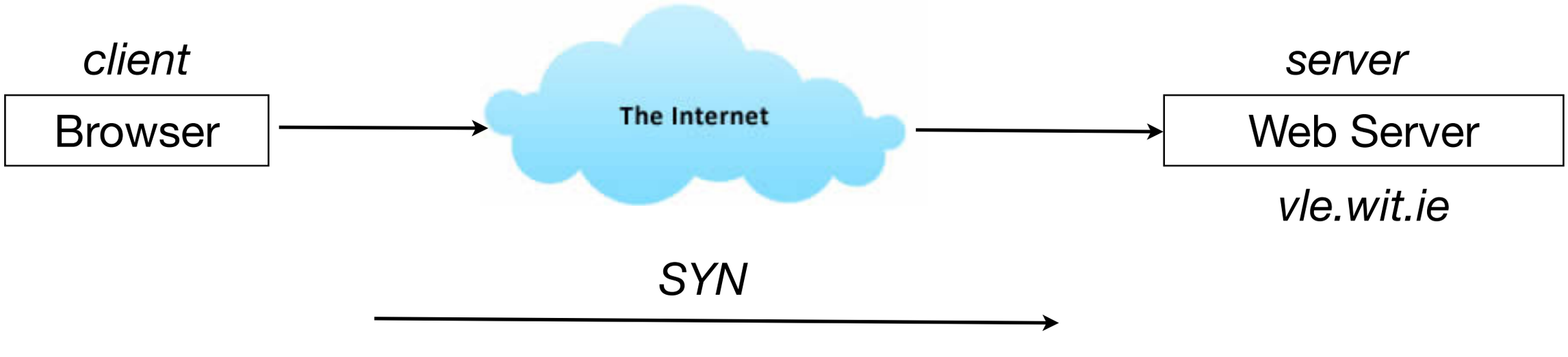
server

Web Server

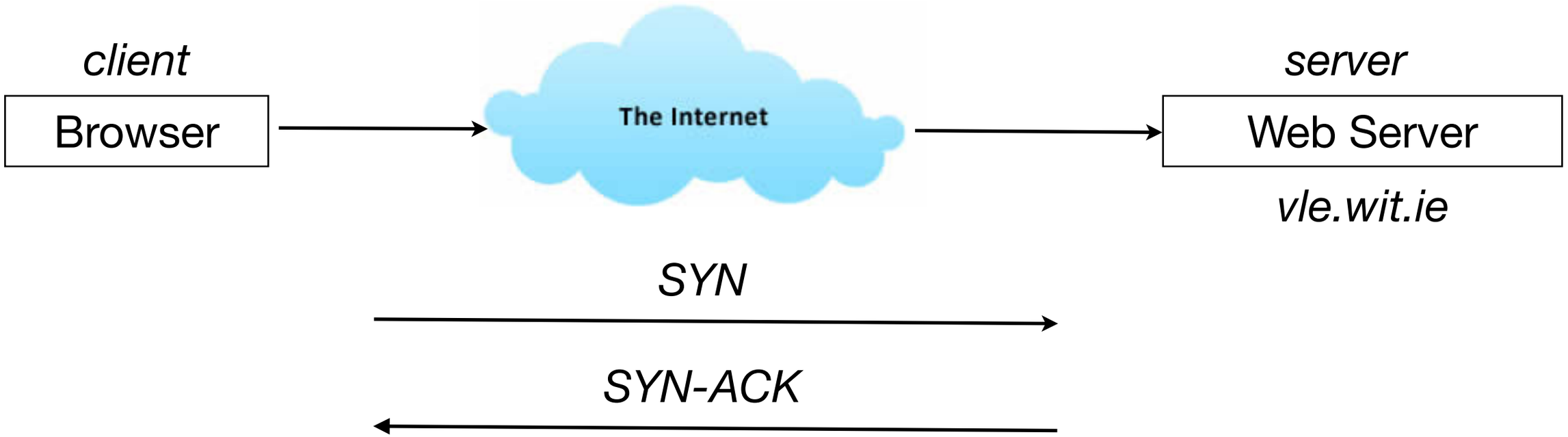
vle.wit.ie

Browser cache/ hosts file/ DNS server

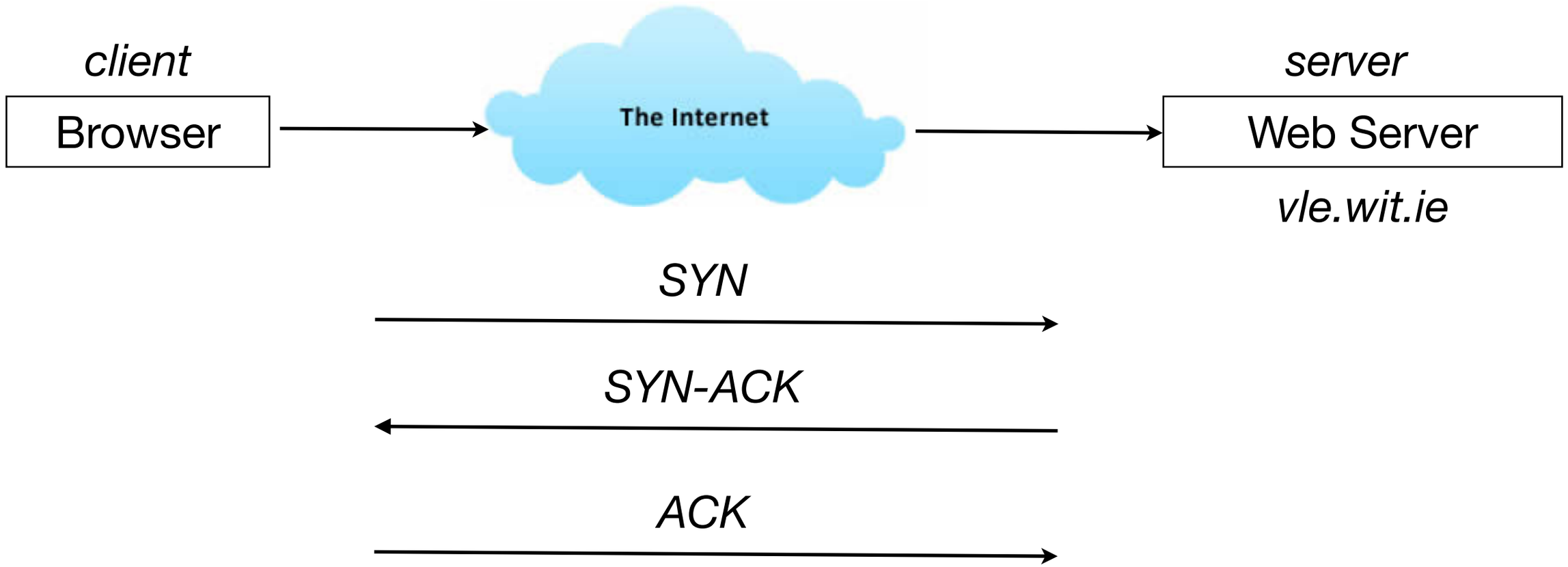

client
Browser
The Internet
server
Web Server
vle.wit.ie
193.1.193.187
vle.wit.ie
Browser cache/
hosts file/ DNS
server



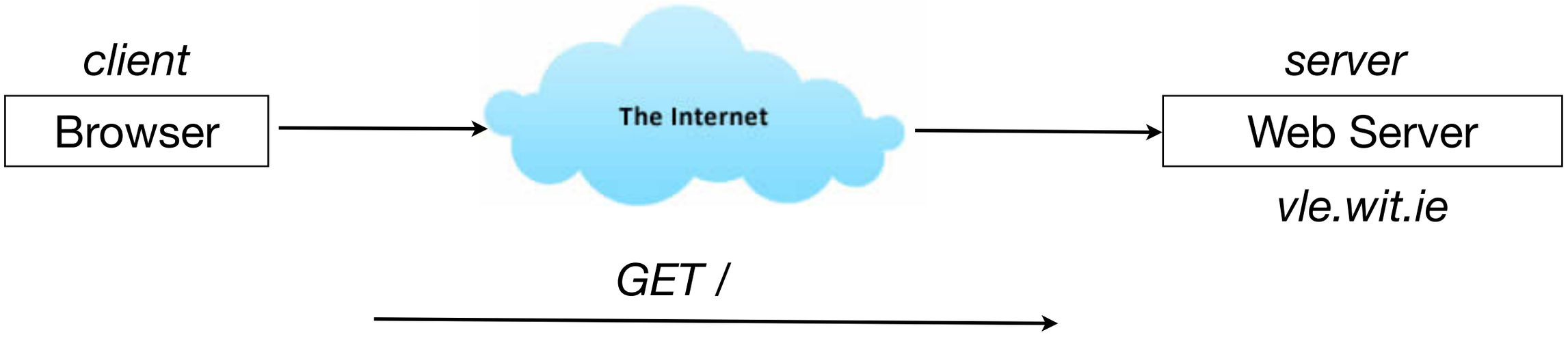
TCP: Are you there?


client
Browser
The Internet
server
Web Server
vle.wit.ie
SYN
SYN-ACK

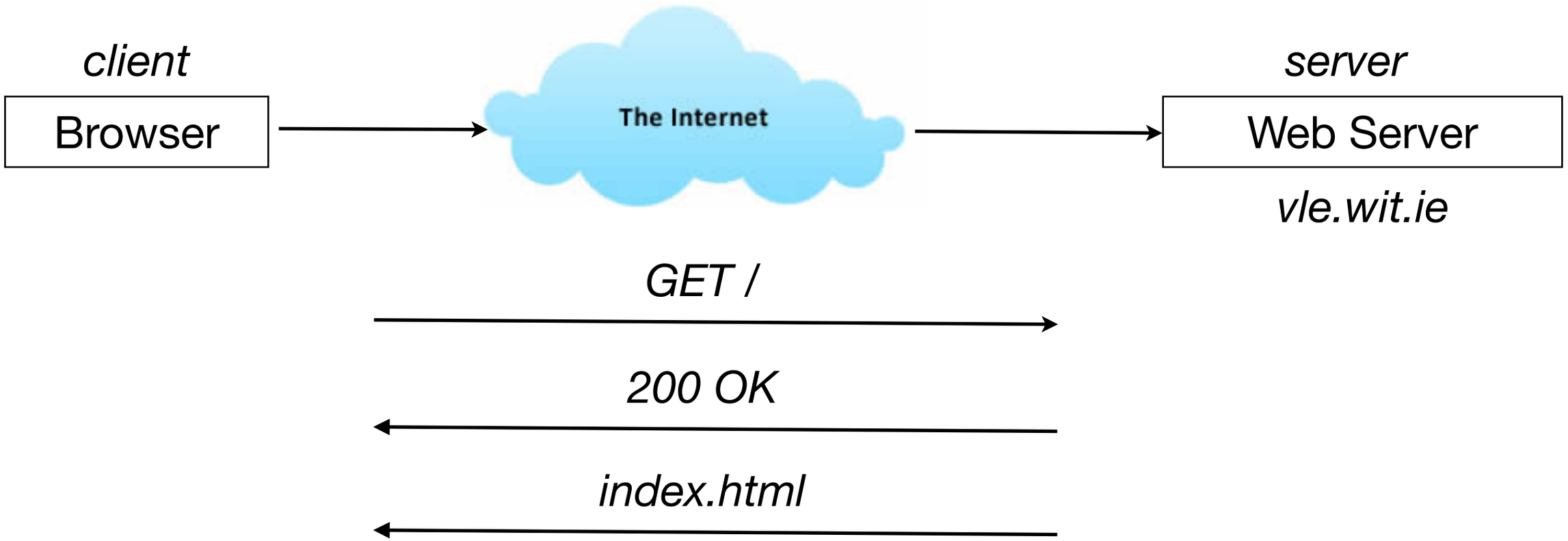
TCP: I’m here



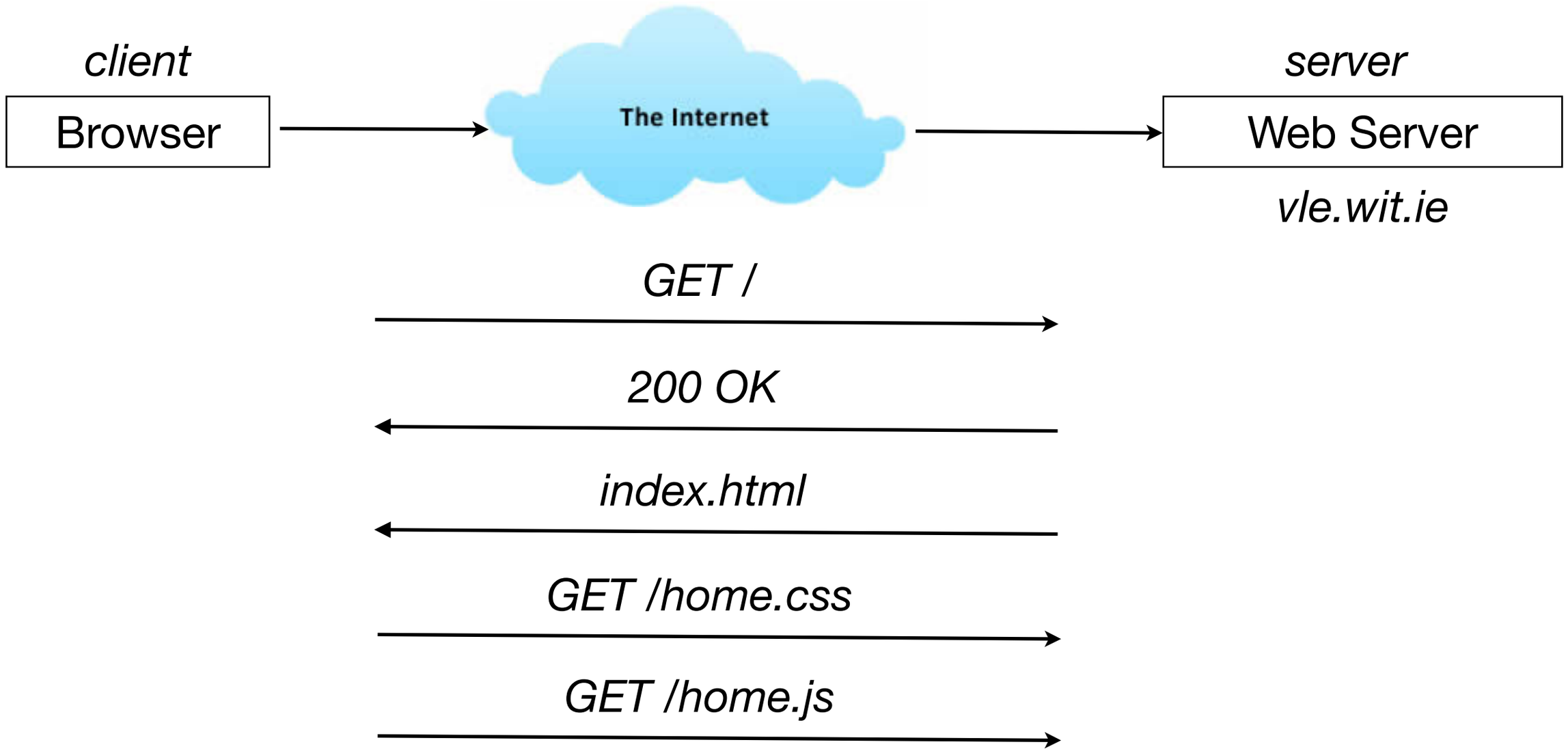
TCP: Acknowledged



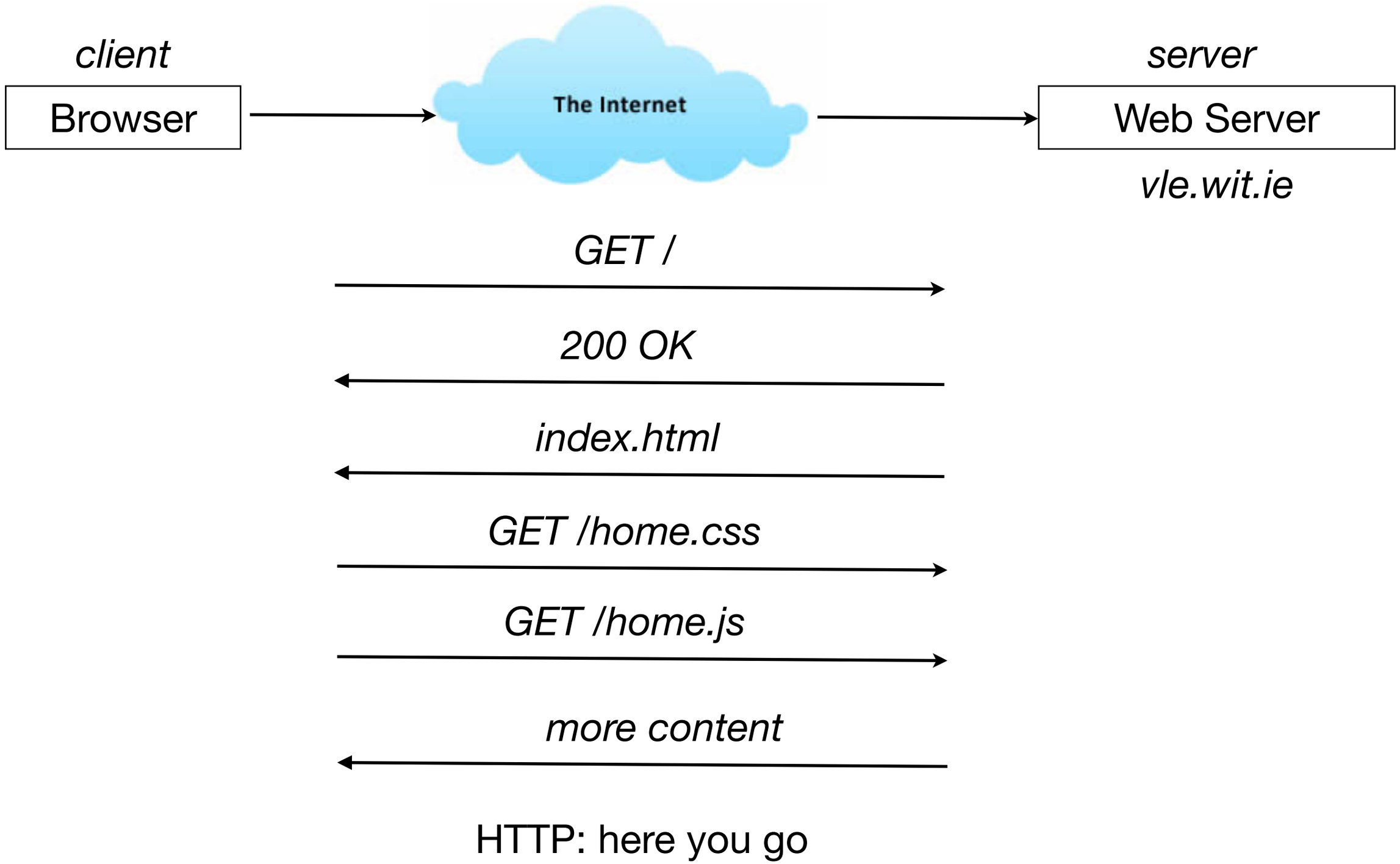
HTTP: Got this file?



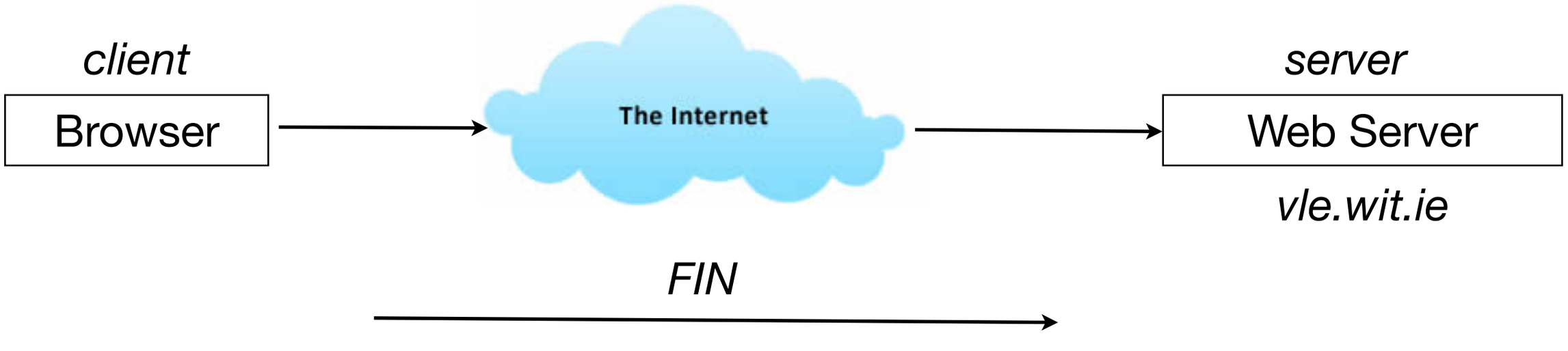
HTTP: Yes, here you go



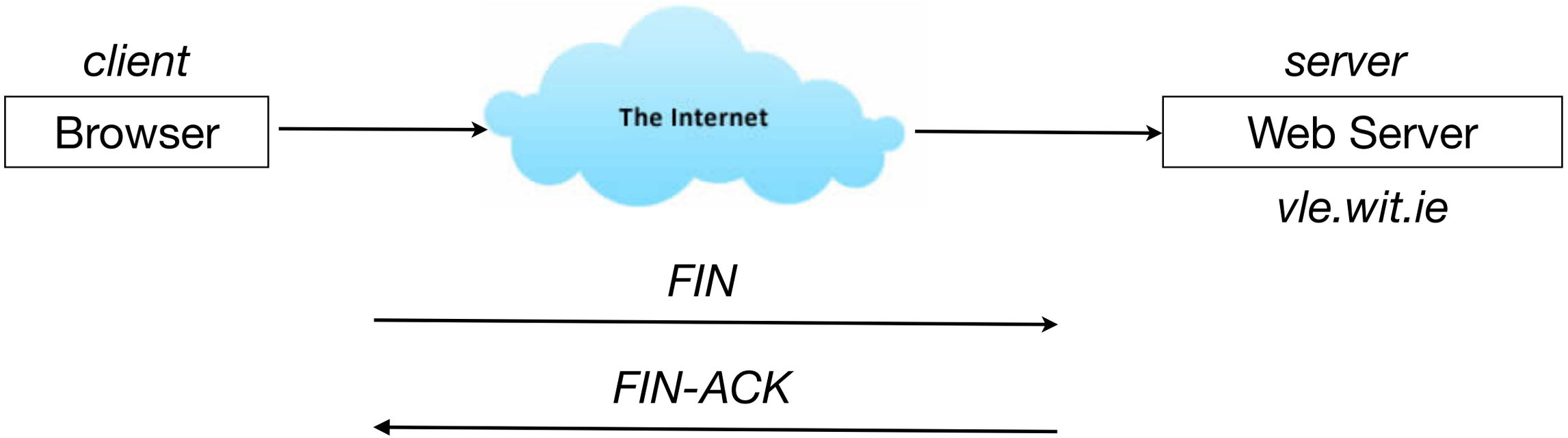
HTTP: And these as well?



HTTP: here you go

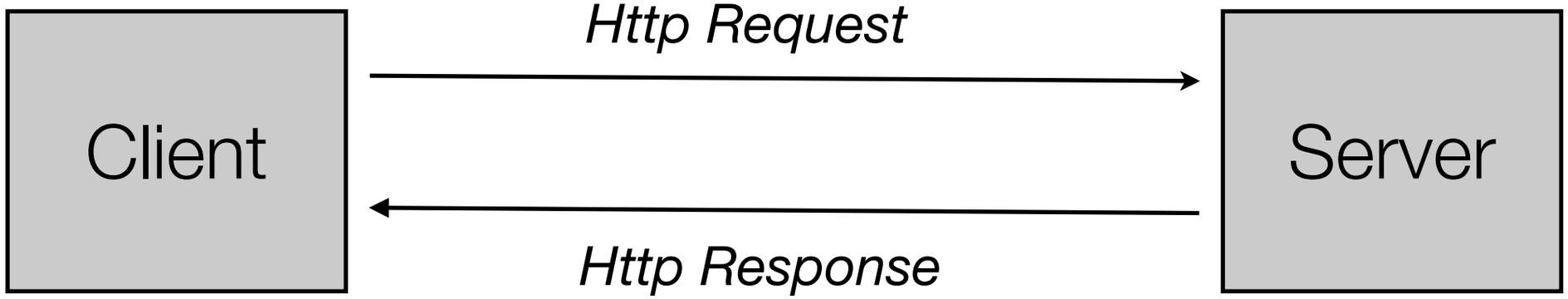


TCP: Finished



TCP: Acknowledged

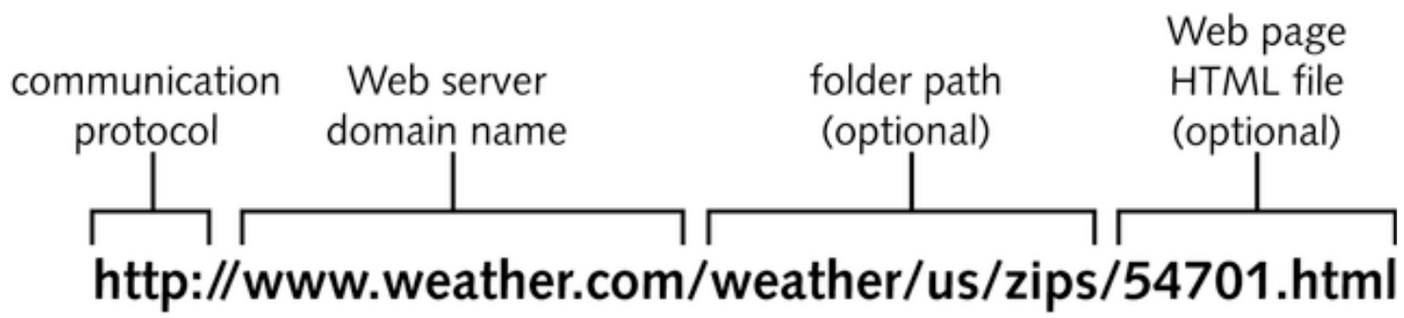
Client / Server



- Conventionally, client sends an HTTP request
- Server responds with an HTTP response
- AJAX & HTML5 has merged these roles somewhat

HTTP URLs

- HTTP is a request/response standard of a client and a server.
- Typically, an HTTP client initiates a request.
- Resources to be accessed by HTTP are identified using Uniform Resource Locaters (URLs).
- They contain four distinct parts: the protocol type, the machine name, the directory path and the file name.
- There are several kinds of URLs: file URLs, FTP URLs, and HTTP URLs.



HTTP Components

- HTTP Requests and Response are comprised of these components

- Request Methods
- Response Status Codes

- Request Headers
- Response Headers

- General Headers
- Entity Headers

- Content (MIME Media Types)

HTTP Request Methods

- HTTP defines eight methods (sometimes referred to as "verbs") indicating the desired action to be performed on the identified resource.
- Two types :
  - Safe Methods -no side effects
    - HEAD: Request for data on resource.
    - GET: Request for resource.
    - TRACE: Echoes back the request just as it was received on the receiver for debugging.
    - OPTIONS: Used to check server capacity
  - Unsafe - intended for actions that have side effects
    - POST: Request for resource by passing parameters
    - PUT: Creation or sending of resource
    - DELETE: Deletion of resource
    - CONNECT: Reserved for use on intermediate servers that can operate as tunnels.

Response Status Codes

- Indicate the server's disposition corresponding to a request
- Combination of a numerical code, and a short description
- Can be categorized in 5 categories:
    - 1xx--Informational
    - 2xx --Successful
    - 3xx--Redirection
    - 4xx--Client Error
    - 5xx--Server Error

Request Headers

- Specific to an HTTP Request
- Carry information about the client, and the type of request
- Facilitates better understanding between client and server

Host
Accept-Language
If-Modified-Since
Referer
User-Agent
Authorization
If-None-Match
Expect
Accept
Proxy-Authorization
If-Range
From
Accept-Charset
Max-Forwards
If-Unmodified-Since
TE
Accept-Encoding
If-Match
Range

Response Headers

- Specific to an HTTP Response
- Carry information about the server, and the type of response

Accept-Ranges
ETag
Retry-After
WWW-Authenticate
Age
Location
Server
Proxy-Authenticate
Vary

General Headers

- Carry information about the HTTP transaction
- Can be a part of request, as well as response

Cache-Control
Keep-Alive
Pragma
Via
Connection
Upgrade
Trailer
Warning
Transfer-Encoding
Date

Entity Headers

- Carry information about the content
- Mainly a part of HTTP response

Allow
Content-Language
Content-Location
Content-Range
Content-Encoding
Content-Length
Content-MD5
Content-Type
Expires
Last-Modified

Content

- IANA maintains a list of valid content types
- It is specified by the Content-TypeEntity header
- Categorized in 9 MIME Media types

application
audio
example
image
message
model
multipart
text

Statelessness

- Because of the Connect, Request, Response, Disconnect nature of HTTP it is said to be a stateless protocol
- i.e. from one web page to the next there is nothing in the protocol that allows a web program to maintain program “state” (like a desktop program).
- “state” can be maintained by various techniques
- E.g: Cookies:
    - are text files stored by client browser
    - maintain session by storing information
    - are non-executable

GET Example

```
GET /index.html HTTP/1.1
Host: www.example.com
User-Agent: Mozilla/4.5 [en]
Accept: image/gif, image/jpeg, text/html
Accept-language: en
Accept-Charset: iso-8859-1
```

Request Line

- Request line: contains the requested resource. Consists of

  1. Method: name of HTTP method called (GET,POST,etc.).
  2. Resource identifier: URL (Uniform Resource Locator) of the requested resource.
  3. Protocol version: protocol version requested for the response.

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Accept-language: en
Accept-Charset: iso-8859-1
```

Request Header

- Contains additional information to help the server to process the request correctly.
- Examples:
  - Host:name of requested server.
  - User-Agent: name of browser or program used to access the resource.
  - Accept: some text and image formats accepted by the client.
  - Accept-Language: languages supported (preferred) by the client, useful for automatically personalising the response.

```
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Host: www.example.com
User-Agent: Mozilla/4.5 [en]
Accept: image/gif, image/jpeg, text/html
Accept-language: en
Accept-Charset: iso-8859-1
```

Request Parameters (1)

- A HTTP request can also contain parameters. e.g:
    - as a response to a registration form, the selection of a product in an online store, etc.
- These parameters can be passed in two ways:
    - As part of the request chain encrypted as part of the URL
    - As extra request data

Request Parameters: as part of request chain

- To encrypt parameters as part of the URL, they are added to the URL after the name of the resource, separated from the latter by the character ?.
  - The different parameters are separated from one another by the character &.
  - Spaces are replaced by +.
  - Special characters are represented by %xx where xx represents the hexadecimal ASCII code of the character

url

```
http://www.example.com/index.php?name=Mr+Nobody&OK=1
```

request

```
GET /index.php?name=Mr+Nobody&OK=1 HTTP/1.0
Host: www.example.com
User-Agent: Mozilla/4.5 [en]
Accept: image/gif, image/jpeg, text/html
Accept-language: en
Accept-Charset: iso-8859-1
```

Extra Request Data

- To pass the parameters as the body of the request, the POST method rather than GET needs to be used.

```
POST /index.php HTTP/1.0
Host: www.example.com
User-Agent: Mozilla/4.5 [en]
Accept: image/gif, image/jpeg, text/html
Accept-language: en
Accept-Charset: iso-8859-1

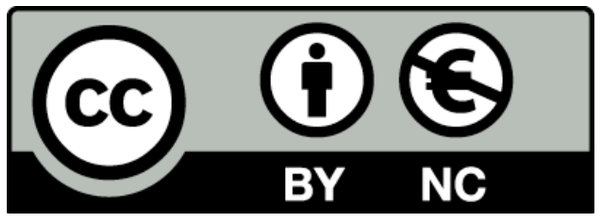
name=Mr+Nobody&OK=1
```

Response

- Response Code
- HTML

```
HTTP/1.1 200 OK
Date: Mon, 04 Aug 2011 15:19:10 GMT
Server: Apache/2.0.40 (Red Hat Linux)
Last-Modified: Tue, 25 Mar 2011 08:52:53 GMT
Accept-Ranges: bytes
Content-Length: 428

<html>
<body>
<h1>My Dvd List</h1>
(more file contents)
   .
   .
   .
</body>
</html>
```



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