National Institute of Technology Karnataka Surathkal
Department of Information Technology

IT 200 **Computer Communication and Networking**

Application Layer 3

Dr. Geetha V

Assistant Professor

Dept of Information Technology

NITK Surathkal

Syllabus

- **Evolution of Data Communication and Networks,**
- **Transmission Fundamentals: Signaling Schemes, Encoding and Modulation,**
- Data Transmission over Networks – Switching Techniques, Layered Architecture of Computer Networks,
- OSI & TCP/IP Architectures and Layers with protocols,
- Data Link Control and Protocols, Error Detection and Correction,
- Internetworking & Routing,
- Transport Layer Protocols,
- Applications: DNS, **E-Mail, HTTP, WWW, Multimedia;**
- Implementation of Signaling and Modulation, Bit, Byte & Character Stuffing and Error Detection/Correction Coding Techniques, TCP/IP Level Programming, Routing Algorithms, Exercises comprising simulation of various protocols.

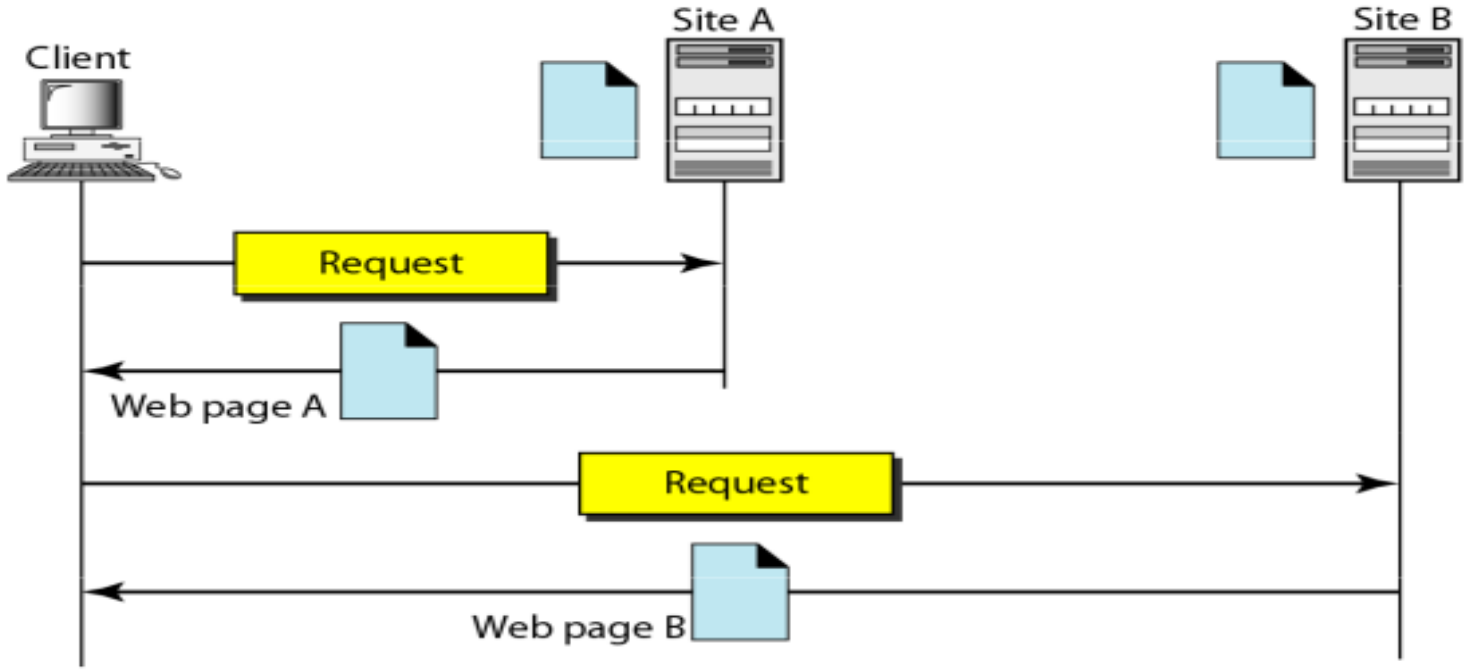
Index

Application Layer

- DNS : Domain Name System
- Client Server Architecture
- Email
- **HTTP**
- **WWW**
- Multimedia

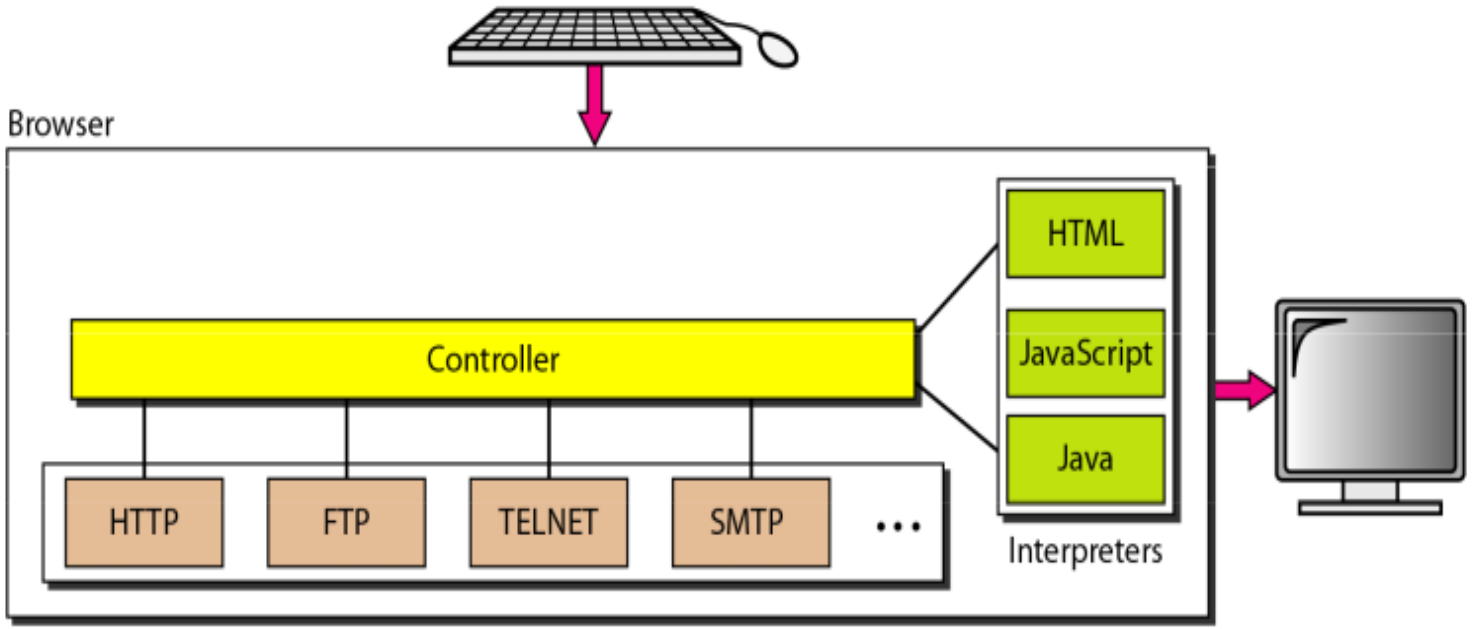
3.1 WWW and HTTP

- The WWW today is a distributed client/server service, in which a client using a browser can access a service using a server. However, the service provided is distributed over many locations called sites.
- Architecture of WWW



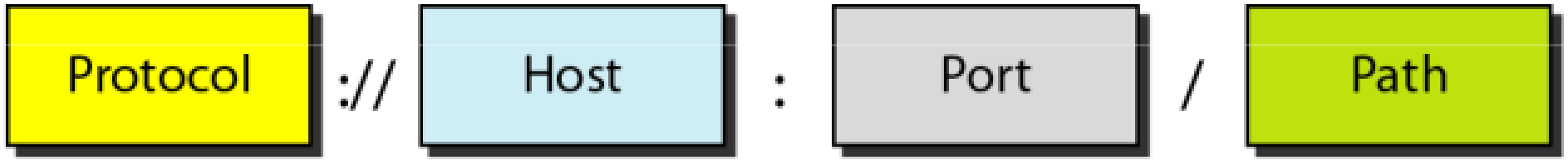
3.1 WWW and HTTP

- The WWW today is a distributed client/server service, in which a client using a browser can access a service using a server. However, the service provided is distributed over many locations called sites.
- Browser



3.1 WWW and HTTP

- The WWW today is a distributed client/server service, in which a client using a browser can access a service using a server. However, the service provided is distributed over many locations called sites.
- URL: Uniform Resource Locator



3.1 WWW and HTTP

- Web Documents: The documents in the WWW can be grouped into three broad categories: static, dynamic and active.
- The category is based on the time at which the contents of the documents are determined.

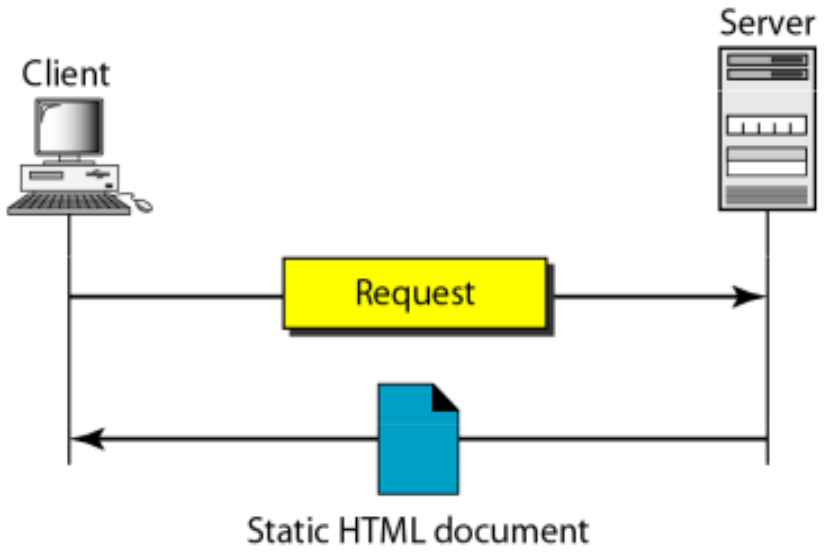
Static Documents

Dynamic Documents

Active Documents

3.1 WWW and HTTP

- Web Documents: **Static Documents**




```
<!DOCTYPE html>
<html>
<head>
<title>IT 200 </title>
</head>
<body>

<h1>Computer Communicaiton and Networking</h1>
<h2>Course Instructor : Dr Geetha V</h2>
<p>Applications: DNS, E-Mail, HTTP, WWW, Multimedia; •</p>
</body>
</html>
```

Computer Communicaiton and Networking

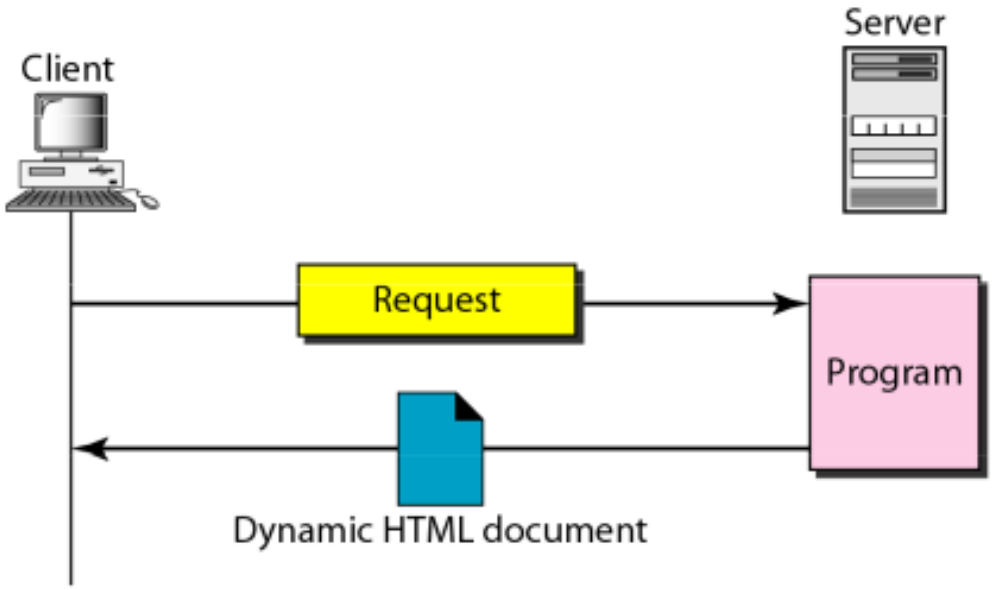
Course Instructor : Dr Geetha V

Applications: DNS, E-Mail, HTTP, WWW, Multimedia;

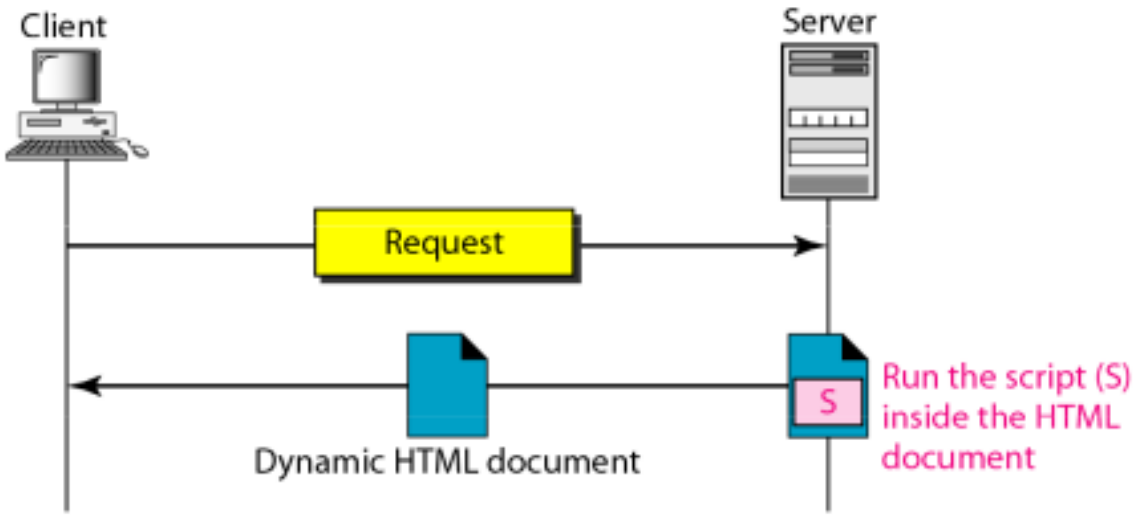
3.1 WWW and HTTP

- Web Documents: **Dynamic Documents : referred as server site dynamic documents**

Dynamic Document Using CGI



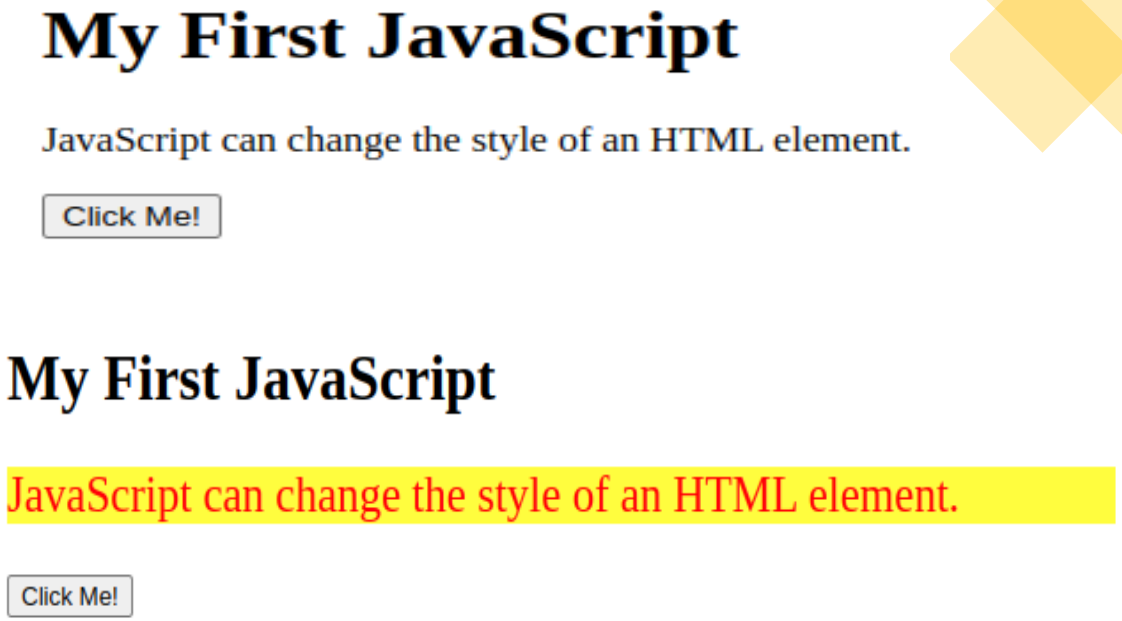
Dynamic Document Using server site script



3.1 WWW and HTTP

- Web Documents: **Dynamic Documents : referred as server site dynamic documents**

```
<!DOCTYPE html>
<html>
<body>

<h1>My First JavaScript</h1>

<p id="demo">JavaScript can change the style of an HTML element.</p>

<script>
function myFunction() {
  document.getElementById("demo").style.fontSize = "25px";
  document.getElementById("demo").style.color = "red";
  document.getElementById("demo").style.backgroundColor = "yellow";

}
</script>

<button type="button" onclick="myFunction()">Click Me!</button>

</body>
</html>
```



3.1 WWW and HTTP

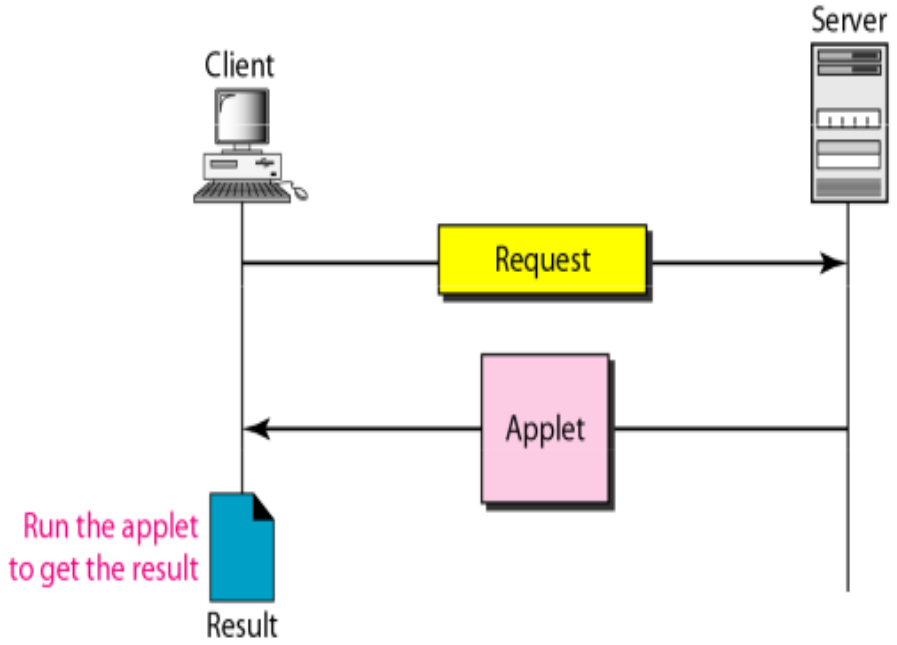
- Web Documents: **Dynamic Documents : referred as server site dynamic documents**

```
<!DOCTYPE html>
<html>
<body>

<h2>HTML Forms</h2>

<form action="/action_page.php">
  <label for="fname">First name:</label><br>
  <input type="text" id="fname" name="fname" value="John"><br>
  <label for="lname">Last name:</label><br>
  <input type="text" id="lname" name="lname" value="Doe"><br><br>
  <input type="submit" value="Submit">
</form>

<p>If you click the "Submit" button, the form-data will be sent to a
page called "/action_page.php".</p>

</body>
</html>
```

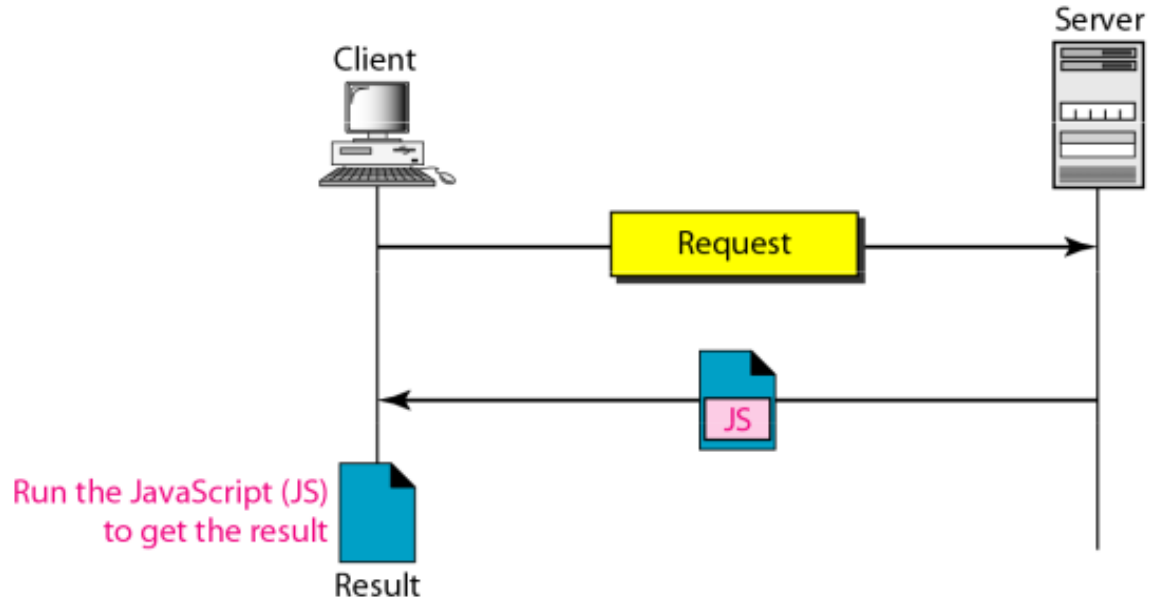
3.1 WWW and HTTP

- Web Documents: **Active Documents : They are sometimes referred as client-site dynamic documents**

Active Document using Java applet



Active Document using Client –site script



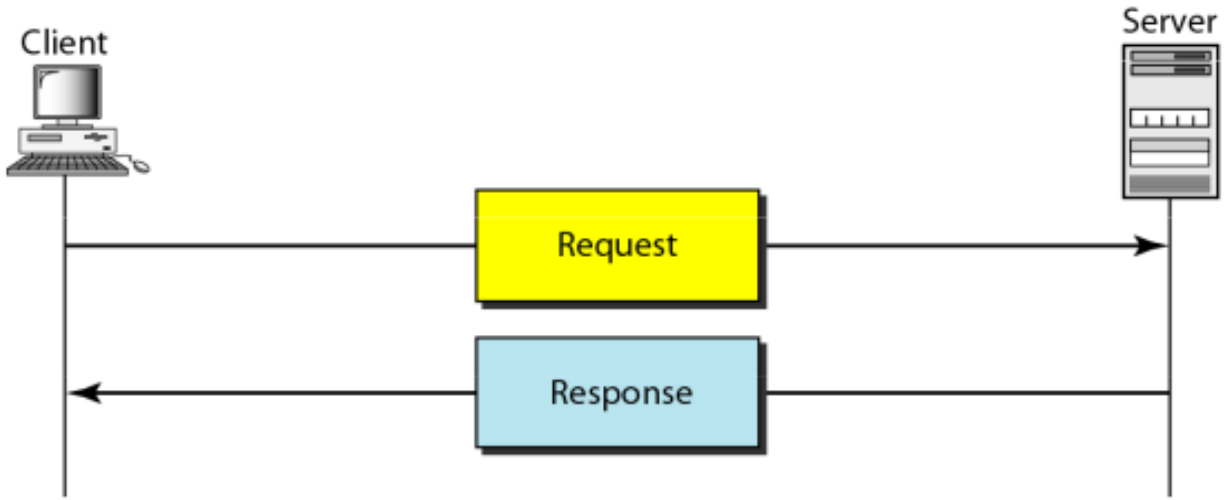
3.1 WWW and HTTP

- Web Documents: **Active Documents :** **They are sometimes referred as client-site dynamic documents**

JavaScript	Java Applet
▪ No need to compile	▪ Need to compile all the classes
▪ Can use functions without defining them	▪ Should define all the methods before using them
▪ Can use variables without defining them	▪ Should define all the variables before using them
▪ Can be embed in HTML using <script> tags	▪ CLASS/JAR files are needed in addition to HTML
▪ Users can view source codes	▪ Compiled source codes

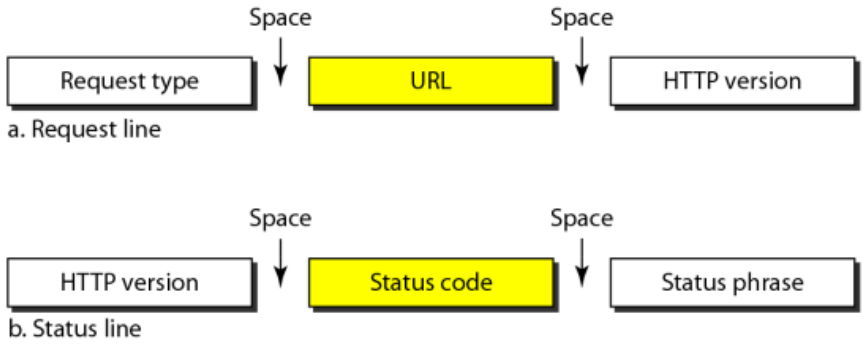
3.1 WWW and HTTP

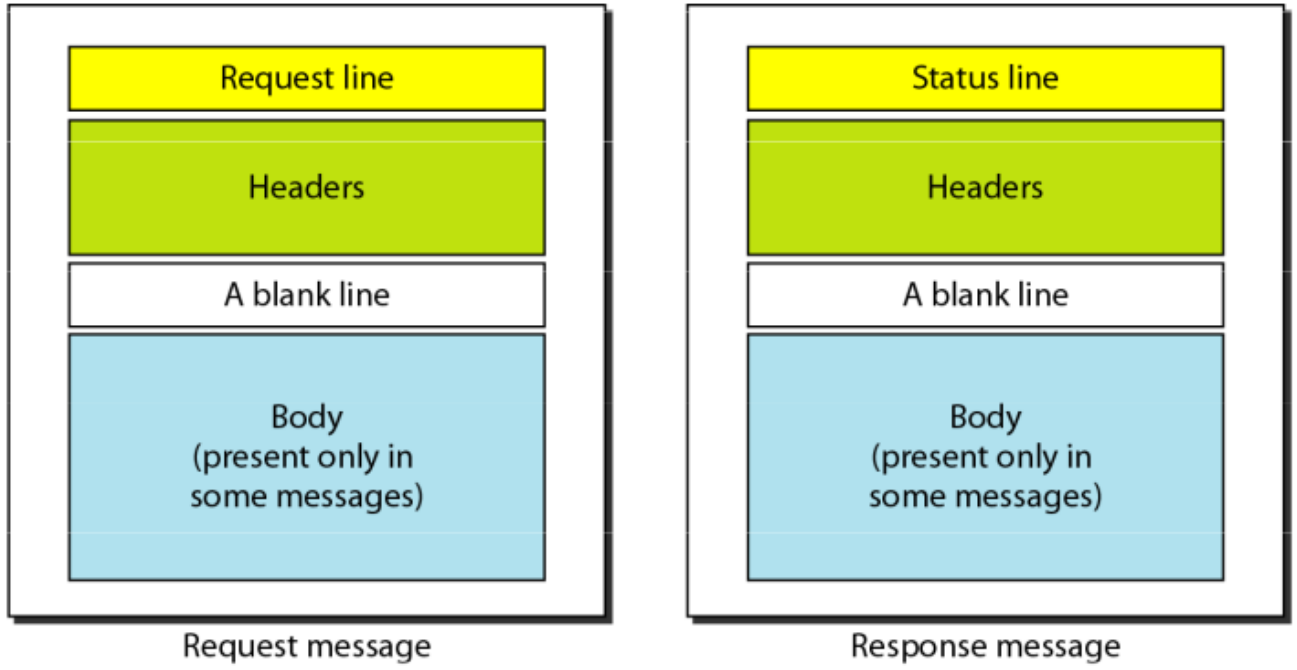
- HTTP: Hyper Text Transfer Protocol
- It is a protocol used mainly to access data on the World Wide Web. HTTP functions as combination of FTP and SMTP.
- HTTP uses services of TCP on well-known port 80.



3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- It is a protocol used mainly to access data on the World Wide Web. HTTP functions as combination of FTP and SMTP.
- HTTP uses services of TCP on well-known port 80.
- **Request and Response message**





3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- It is a protocol used mainly to access data on the World Wide Web. HTTP functions as combination of FTP and SMTP.
- HTTP uses services of TCP on well-known port 80.
- **Methods:**

Method	*Action*
GET	Requests a document from the server
HEAD	Requests information about a document but not the document itself
POST	Sends some information from the client to the server
PUT	Sends a document from the server to the client
TRACE	Echoes the incoming request
CONNECT	Reserved
OPTION	Inquires about available options

3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- It is a protocol used mainly to access data on the World Wide Web. HTTP functions as combination of FTP and SMTP.
- HTTP uses services of TCP on well-known port 80.
- **Status Codes:**

Code	*Phrase*	*Description*
	Informational	
100	Continue	The initial part of the request has been received, and the client may continue with its request.
101	Switching	The server is complying with a client request to switch protocols defined in the upgrade header.
	Success	
200	OK	The request is successful.
201	Created	A new URL is created.
202	Accepted	The request is accepted, but it is not immediately acted upon.
204	No content	There is no content in the body.

3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- **Status Codes ...**

Code	*Phrase*	*Description*
	Redirection	
301	Moved permanently	The requested URL is no longer used by the server.
302	Moved temporarily	The requested URL has moved temporarily.
304	Not modified	The document has not been modified.
	Client Error	
400	Bad request	There is a syntax error in the request.
401	Unauthorized	The request lacks proper authorization.
403	Forbidden	Service is denied.
404	Not found	The document is not found.
405	Method not allowed	The method is not supported in this URL.
406	Not acceptable	The format requested is not acceptable.
	Server Error	
500	Internal server error	There is an error, such as a crash, at the server site.
501	Not implemented	The action requested cannot be performed.
503	Service unavailable	The service is temporarily unavailable, but may be requested in the future.

3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- **Header Format**

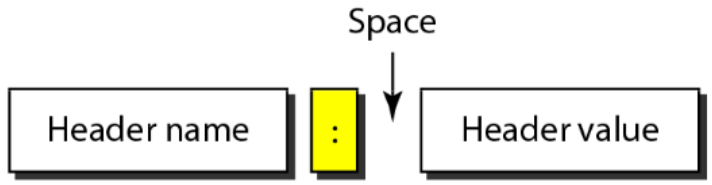


Table 27.3 ***General headers***

Header	*Description*
Cache-control	Specifies information about caching
Connection	Shows whether the connection should be closed or not
Date	Shows the current date
MIME-version	Shows the MIME version used
Upgrade	Specifies the preferred communication protocol

Table 27.4 ***Request headers***

Header	*Description*
Accept	Shows the medium format the client can accept
Accept-charset	Shows the character set the client can handle
Accept-encoding	Shows the encoding scheme the client can handle
Accept-language	Shows the language the client can accept
Authorization	Shows what permissions the client has
From	Shows the e-mail address of the user
Host	Shows the host and port number of the server
If-modified-since	Sends the document if newer than specified date
If-match	Sends the document only if it matches given tag
If-non-match	Sends the document only if it does not match given tag
If-range	Sends only the portion of the document that is missing
If-unmodified-since	Sends the document if not changed since specified date
Referrer	Specifies the URL of the linked document
User-agent	Identifies the client program

3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- **Header Format**

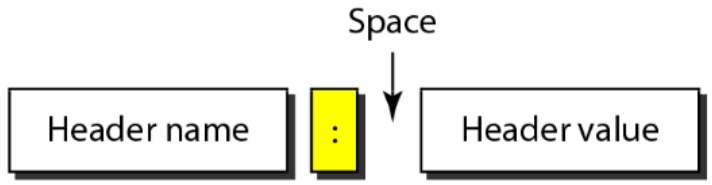


Table 27.5 ***Response headers***

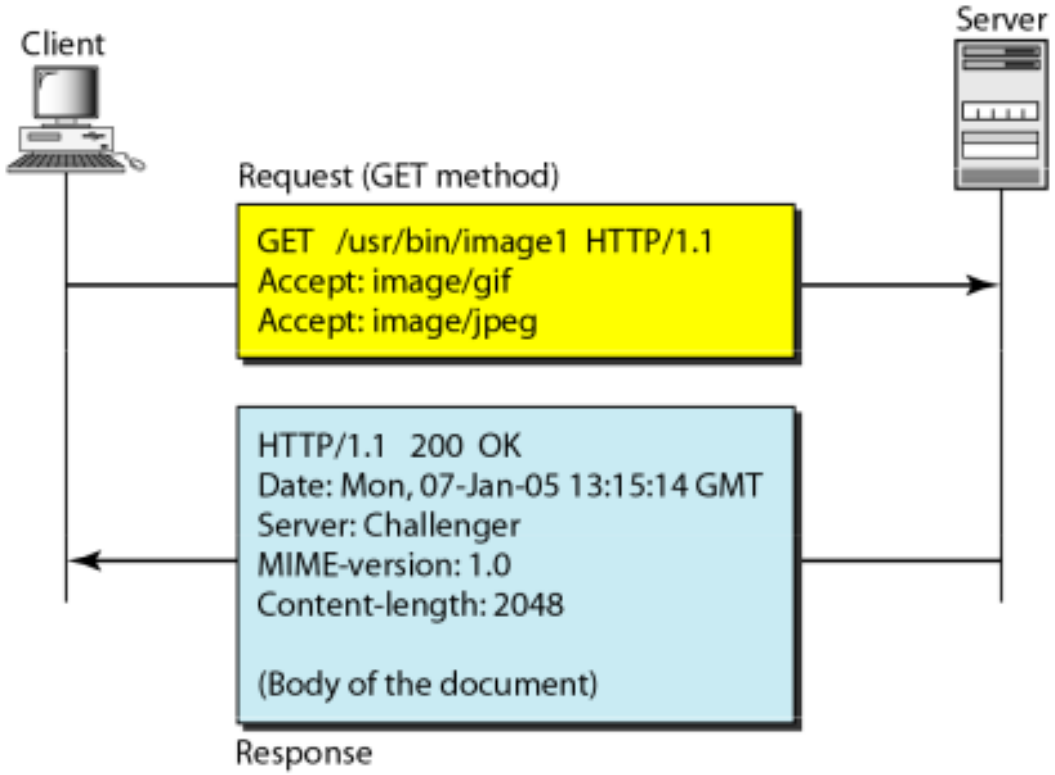
Header	*Description*
Accept-range	Shows if server accepts the range requested by client
Age	Shows the age of the document
Public	Shows the supported list of methods
Retry-after	Specifies the date after which the server is available
Server	Shows the server name and version number

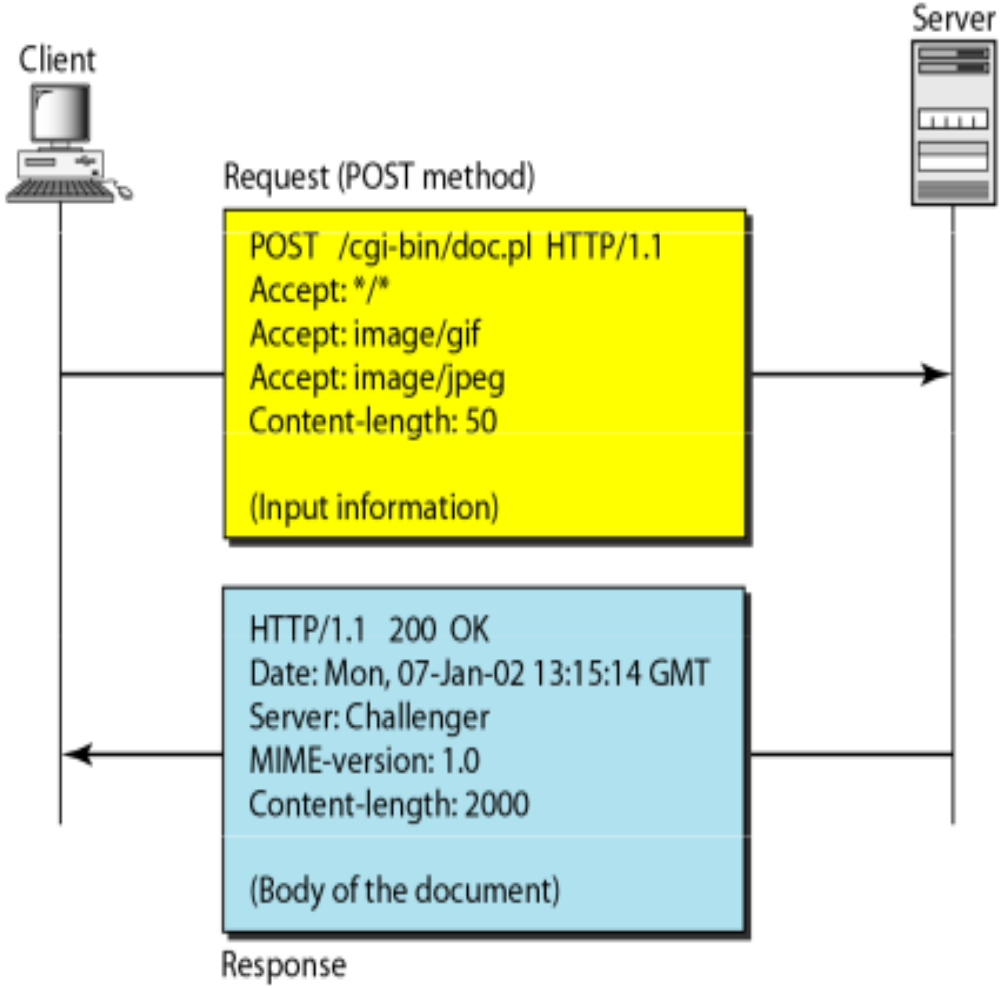
Table 27.6 ***Entity headers***

Header	*Description*
Allow	Lists valid methods that can be used with a URL
Content-encoding	Specifies the encoding scheme
Content-language	Specifies the language
Content-length	Shows the length of the document
Content-range	Specifies the range of the document
Content-type	Specifies the medium type
Etag	Gives an entity tag
Expires	Gives the date and time when contents may change
Last-modified	Gives the date and time of the last change
Location	Specifies the location of the created or moved document

3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- **Example1 and Example 2**





3.1 WWW and HTTP

- HTTP: Hyper Text Transfer Protocol
- **Pcap files :** https://www.cloudshark.org/captures/4a3b7c2a3230

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.1	192.168.1.2	TCP	62	50863 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1260 SACK_PERM=1
2	0.000000	192.168.1.2	192.168.1.1	TCP	62	80 → 50863 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 SACK_PERM=1
3	0.032000	192.168.1.1	192.168.1.2	TCP	60	50863 → 80 [ACK] Seq=1 Ack=1 Win=65520 Len=0
4	0.033001	192.168.1.1	192.168.1.2	HTTP	365	GET http://www.ups.com/ HTTP/1.1
5	0.091000	192.168.1.2	192.168.1.1	TCP	1314	80 → 50863 [ACK] Seq=1 Ack=312 Win=65535 Len=1260 [TCP segment of a reassembled PDU]
6	0.091000	192.168.1.2	192.168.1.1	TCP	392	80 → 50863 [PSH, ACK] Seq=1261 Ack=312 Win=65535 Len=338 [TCP segment of a reassembled PDU]
7	0.106000	192.168.1.2	192.168.1.1	TCP	1314	80 → 50863 [ACK] Seq=1599 Ack=312 Win=65535 Len=1260 [TCP segment of a reassembled PDU]
8	0.106000	192.168.1.2	192.168.1.1	TCP	1314	80 → 50863 [ACK] Seq=2859 Ack=312 Win=65535 Len=1260 [TCP segment of a reassembled PDU]
9	0.122001	192.168.1.1	192.168.1.2	TCP	66	[TCP Dup ACK 3#1] 50863 → 80 [PSH, ACK] Seq=312 Ack=1 Win=65520 Len=0 SLE=1261 SRE=1599
10	0.122001	192.168.1.2	192.168.1.1	TCP	1314	80 → 50863 [ACK] Seq=4119 Ack=312 Win=65535 Len=1260 [TCP segment of a reassembled PDU]
11	0.333000	192.168.1.1	192.168.1.2	HTTP	365	[TCP Spurious Retransmission] GET http://www.ups.com/ HTTP/1.1
12	0.333000	192.168.1.2	192.168.1.1	TCP	1314	HTTP/1.1 200 OK [TCP segment of a reassembled PDU]
13	0.933001	192.168.1.1	192.168.1.2	HTTP	365	[TCP Spurious Retransmission] GET http://www.ups.com/ HTTP/1.1
14	0.933001	192.168.1.2	192.168.1.1	TCP	1314	[TCP Retransmission] 80 → 50863 [ACK] Seq=1 Ack=312 Win=65535 Len=1260
15	2.017001	192.168.1.2	192.168.1.1	TCP	1314	[TCP Retransmission] 80 → 50863 [ACK] Seq=1 Ack=312 Win=65535 Len=1260
16	2.133001	192.168.1.1	192.168.1.2	HTTP	365	[TCP Spurious Retransmission] GET http://www.ups.com/ HTTP/1.1
17	2.133001	192.168.1.2	192.168.1.1	TCP	1314	[TCP Retransmission] 80 → 50863 [ACK] Seq=1261 Ack=312 Win=65535 Len=1260
18	2.967001	192.168.1.2	192.168.1.1	TCP	1314	[TCP Retransmission] 80 → 50863 [ACK] Seq=1 Ack=312 Win=65535 Len=1260

```
▸ Frame 4: 365 bytes on wire (2920 bits), 365 bytes captured (2920 bits)
▸ Ethernet II, Src: Cisco_f9:1a:02 (00:01:64:f9:1a:02), Dst: Silicom_11:94:a5 (00:e0:ed:11:94:a
▸ Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.2
▸ Transmission Control Protocol, Src Port: 50863, Dst Port: 80, Seq: 1, Ack: 1, Len: 311
▾ Hypertext Transfer Protocol
  ▸ GET http://www.ups.com/ HTTP/1.1\r\n
    Host: www.ups.com\r\n
    User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64; rv:15.0) Gecko/20100101 Firefox/15.0.1\r\
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8\r\n
    Accept-Language: en-us,en;q=0.5\r\n
    Accept-Encoding: gzip, deflate\r\n
    Proxy-Connection: keep-alive\r\n
    \r\n
    Full request URI: http://www.ups.com/
    HTTP request 1/8
    Next request in frame: 11
```

```
0020  01 02 c6 af 00 50 a4 42  a3 75 33 05 f6 d0 50 18   .....P.B.u3...P.
0030  ff f0 24 f5 00 00 47 45  54 20 68 74 74 70 3a 2f   ..$...GET http:/
0040  2f 77 77 77 2e 75 70 73  2e 63 6f 6d 2f 20 48 54   /www.ups.com/ HT
0050  54 50 2f 31 2e 31 0d 0a  48 6f 73 74 3a 20 77 77   TP/1.1..Host: ww
0060  77 2e 75 70 73 2e 63 6f  6d 0d 0a 55 73 65 72 2d   w.ups.com..User-
0070  41 67 65 6e 74 3a 20 4d  6f 7a 69 6c 6c 61 2f 35   Agent: Mozilla/5
0080  2e 30 20 28 57 69 6e 64  6f 77 73 20 4e 54 20 36   .0 (Windows NT 6
0090  2e 31 3b 20 57 4f 57 36  34 3b 20 72 76 3a 31 35   .1; WOW64; rv:15
00a0  2e 30 29 20 47 65 63 6b  6f 2f 32 30 31 30 30 31   .0) Gecko/201001
00b0  30 31 20 46 69 72 65 66  6f 78 2f 31 35 2e 30 2e   01 Firefox/15.0.
00c0  31 0d 0a 41 63 63 65 70  74 3a 20 74 65 78 74 2f   1..Accept: text/
00d0  68 74 6d 6c 2c 61 70 70  6c 69 63 61 74 69 6f 6e   html,application
00e0  2f 78 68 74 6d 6c 2b 78  6d 6c 2c 61 70 70 6c 69   /xhtml+xml,appli
00f0  63 61 74 69 6f 6e 2f 78  6d 6c 3b 71 3d 30 2e 39   cation/xml;q=0.9
0100  2c 2a 2f 2a 3b 71 3d 30  2e 38 0d 0a 41 63 63 65   ,*/*;q=0.8..Acce
0110  70 74 2d 4c 61 6e 67 75  61 67 65 3a 20 65 6e 2d   pt-Language: en-
0120  75 73 2c 65 6e 3b 71 3d  30 2e 35 0d 0a 41 63 63   us,en;q=0.5..Acc
0130  65 70 74 2d 45 6e 63 6f  64 69 6e 67 3a 20 67 7a   ept-Encoding: gz
0140  69 70 2c 20 64 65 66 6c  61 74 65 0d 0a 50 72 6f   ip, deflate..Pro
0150  78 79 2d 43 6f 6e 6e 65  63 74 69 6f 6e 3a 20 6b   xy-Connection: k
0160  65 65 70 2d 61 6c 69 76  65 0d 0a 0d 0a            eep-alive....
```

Reference

- “Data Communications and Networking”, Behrouz A. Forouzan, 5th Edition, McGraw Hill, 2017.

Thank You