



H T T P : //

hypertext transfer protocol

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About the Tutorial

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. This is the foundation for data communication for the World Wide Web (i.e. internet) since 1990. HTTP is a generic and stateless protocol which can be used for other purposes as well using extensions of its request methods, error codes, and headers.

This tutorial is based on RFC-2616 specification, which defines the protocol referred to as HTTP/1.1. HTTP/1.1 is a revision of the original HTTP (HTTP/1.0). A major difference between HTTP/1.0 and HTTP/1.1 is that HTTP/1.0 uses a new connection for each request/response exchange, whereas HTTP/1.1 connection may be used for one or more request/response exchanges.

Audience

This tutorial has been prepared for computer science graduates and web developers to help them understand the basic-to-advanced level concepts related to Hypertext Transfer Protocol (HTTP).

Prerequisites

Before proceeding with this tutorial, it is good to have a basic understanding of web concepts, web browsers, web servers, client and server architecture based softwares.

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1. OVERVIEW

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. This is the foundation for data communication for the World Wide Web (i.e. internet) since 1990. HTTP is a generic and stateless protocol which can be used for other purposes as well using extensions of its request methods, error codes, and headers.

Basically, HTTP is a TCP/IP based communication protocol that is used to deliver data (HTML files, image files, query results, etc.) on the World Wide Web. The default port is TCP 80, but other ports can be used as well. It provides a standardized way for computers to communicate with each other. HTTP specification specifies how clients' request data will be constructed and sent to the server, and how the servers respond to these requests.

Basic Features

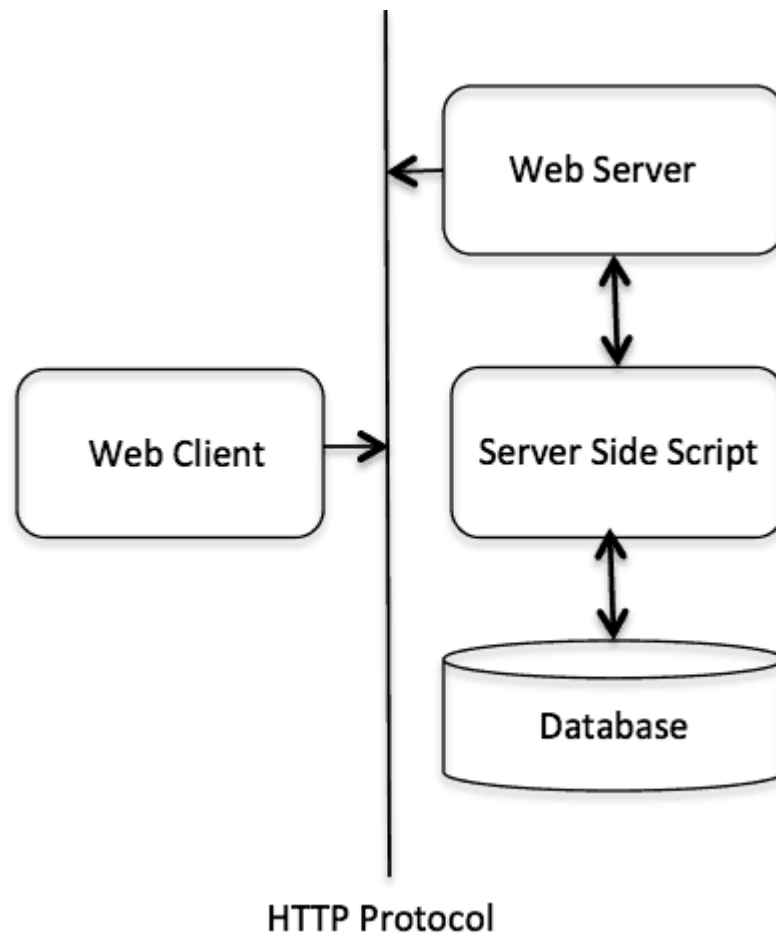
There are three basic features that make HTTP a simple but powerful protocol:

- **HTTP is connectionless:** The HTTP client, i.e., a browser initiates an HTTP request and after a request is made, the client disconnects from the server and waits for a response. The server processes the request and re-establishes the connection with the client to send a response back.
- **HTTP is media independent:** It means, any type of data can be sent by HTTP as long as both the client and the server know how to handle the data content. It is required for the client as well as the server to specify the content type using appropriate MIME-type.
- **HTTP is stateless:** As mentioned above, HTTP is connectionless and it is a direct result of HTTP being a stateless protocol. The server and client are aware of each other only during a current request. Afterwards, both of them forget about each other. Due to this nature of the protocol, neither the client nor the browser can retain information between different requests across the web pages.

HTTP/1.0 uses a new connection for each request/response exchange, whereas HTTP/1.1 connection may be used for one or more request/response exchanges.

Basic Architecture

The following diagram shows a very basic architecture of a web application and depicts where HTTP sits:



The HTTP protocol is a request/response protocol based on the client/server based architecture where web browsers, robots and search engines, etc. act like HTTP clients, and the Web server acts as a server.

Client

The HTTP client sends a request to the server in the form of a request method, URI, and protocol version, followed by a MIME-like message containing request modifiers, client information, and possible body content over a TCP/IP connection.

Server

The HTTP server responds with a status line, including the message's protocol version and a success or error code, followed by a MIME-like message containing server information, entity meta-information, and possible entity-body content.

2. PARAMETERS

This chapter is going to list down few of the important HTTP Protocol Parameters and their syntax the way they are used in the communication. For example, format for date, format of URL, etc. This will help you in constructing your request and response messages while writing HTTP client or server programs. You will see the complete usage of these parameters in subsequent chapters while learning the message structure for HTTP requests and responses.

HTTP Version

HTTP uses a **<major>.<minor>** numbering scheme to indicate versions of the protocol. The version of an HTTP message is indicated by an HTTP-Version field in the first line. Here is the general syntax of specifying HTTP version number:

```
HTTP-Version = "HTTP" "/" 1*DIGIT "." 1*DIGIT
```

Example

```
HTTP/1.0
```

or

```
HTTP/1.1
```

Uniform Resource Identifiers

Uniform Resource Identifiers (URI) are simply formatted, case-insensitive string containing name, location, etc. to identify a resource, for example, a website, a web service, etc. A general syntax of URI used for HTTP is as follows:

```
URI = "http:" "://" host [ ":" port ] [ abs_path [ "?" query ] ]
```

Here if the **port** is empty or not given, port 80 is assumed for HTTP and an empty **abs_path** is equivalent to an **abs_path** of "/". The characters other than those in the **reserved** and **unsafe** sets are equivalent to their ""%" HEX HEX" encoding.

Example

The following three URIs are equivalent:

```
http://abc.com:80/~smith/home.html
http://ABC.com/%7Esmith/home.html
http://ABC.com:/%7esmith/home.html
```

Date/Time Formats

All HTTP date/time stamps MUST be represented in Greenwich Mean Time (GMT), without exception. HTTP applications are allowed to use any of the following three representations of date/time stamps:

```
Sun, 06 Nov 1994 08:49:37 GMT ; RFC 822, updated by RFC 1123
Sunday, 06-Nov-94 08:49:37 GMT ; RFC 850, obsoleted by RFC 1036
Sun Nov 6 08:49:37 1994 ; ANSI C's asctime() format
```

Character Sets

We use character sets to specify the character sets that the client prefers. Multiple character sets can be listed separated by commas. If a value is not specified, the default is the US-ASCII.

Example

Following are the valid character sets:

```
US-ASCII

or

ISO-8859-1

or

ISO-8859-7
```

Content Encodings

A content encoding value indicates that an encoding algorithm has been used to encode the content before passing it over the network. Content coding are

primarily used to allow a document to be compressed or otherwise usefully transformed without losing the identity.

All content-coding values are case-insensitive. HTTP/1.1 uses content-coding values in the Accept-Encoding and Content-Encoding header fields which we will see in the subsequent chapters.

Example

Following are the valid encoding schemes:

```
Accept-encoding: gzip
```

or

```
Accept-encoding: compress
```

or

```
Accept-encoding: deflate
```

Media Types

HTTP uses Internet Media Types in the **Content-Type** and **Accept** header fields in order to provide open and extensible data typing and type negotiation. All the Media-type values are registered with the Internet Assigned Number Authority (IANA). The general syntax to specify media type is as follows:

```
media-type = type "/" subtype *( ";" parameter )
```

The type, subtype, and parameter attribute names are case-insensitive.

Example

```
Accept: image/gif
```

Language Tags

HTTP uses language tags within the **Accept-Language** and **Content-Language** fields. A language tag is composed of one or more parts: a primary language tag and a possibly empty series of subtags:

```
language-tag = primary-tag *( "-" subtag )
```

Whitespaces are not allowed within the tags and all tags are case-insensitive.

Example

Example tags include:

en, en-US, en-cockney, i-cherokee, x-pig-latin
--

where any two-letter primary-tag is an ISO-639 language abbreviation and any two-letter initial subtag is an ISO-3166 country code.

3. MESSAGES

HTTP is based on the client-server architecture model and a stateless request/response protocol that operates by exchanging messages across a reliable TCP/IP connection.

An HTTP "client" is a program (Web browser or any other client) that establishes a connection to a server for the purpose of sending one or more HTTP request messages. An HTTP "server" is a program (generally a web server like Apache Web Server or Internet Information Services IIS, etc.) that accepts connections in order to serve HTTP requests by sending HTTP response messages.

HTTP makes use of the Uniform Resource Identifier (URI) to identify a given resource and to establish a connection. Once the connection is established, **HTTP messages** are passed in a format similar to that used by the Internet mail [RFC5322] and the Multipurpose Internet Mail Extensions (MIME) [RFC2045]. These messages include **requests** from client to server and **responses** from server to client which will have the following format:

```
HTTP-message = <Request> | <Response> ; HTTP/1.1 messages
```

HTTP requests and HTTP responses use a generic message format of RFC 822 for transferring the required data. This generic message format consists of the following four items.

A Start-line

Zero or more header fields followed by CRLF

An empty line (i.e., a line with nothing preceding the CRLF) indicating the end of the header fields

Optionally a message-body

In the following sections, we will explain each of the entities used in an HTTP message.

Message Start-Line

A start-line will have the following generic syntax:

```
start-line = Request-Line | Status-Line
```

We will discuss Request-Line and Status-Line while discussing HTTP Request and HTTP Response messages respectively. For now, let's see the examples of start line in case of request and response:

```
GET /hello.htm HTTP/1.1      (This is Request-Line sent by the client)
```

```
HTTP/1.1 200 OK             (This is Status-Line sent by the server)
```

Header Fields

HTTP header fields provide required information about the request or response, or about the object sent in the message body. There are four types of HTTP message headers:

- **General-header:** These header fields have general applicability for both request and response messages.
- **Request-header:** These header fields have applicability only for request messages.
- **Response-header:** These header fields have applicability only for response messages.
- **Entity-header:** These header fields define meta-information about the entity-body or, if no body is present, about the resource identified by the request.

All the above-mentioned headers follow the same generic format and each of the header field consists of a name followed by a colon (:) and the field value as follows:

```
message-header = field-name ":" [ field-value ]
```

Following are the examples of various header fields:

```
User-Agent: curl/7.16.3 libcurl/7.16.3 OpenSSL/0.9.71 zlib/1.2.3
```

```
Host: www.example.com
```

```
Accept-Language: en, mi
```

```
Date: Mon, 27 Jul 2009 12:28:53 GMT
```

```
Server: Apache
```

```
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
ETag: "34aa387-d-1568eb00"
Accept-Ranges: bytes
Content-Length: 51
Vary: Accept-Encoding
Content-Type: text/plain
```

Message Body

The message body part is optional for an HTTP message but if it is available, then it is used to carry the entity-body associated with the request or response. If entity body is associated, then usually **Content-Type** and **Content-Length** headers lines specify the nature of the body associated.

A message body is the one which carries the actual HTTP request data (including form data and uploaded, etc.) and HTTP response data from the server (including files, images, etc.). Shown below is the simple content of a message body:

```
<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

4. REQUESTS

An HTTP client sends an HTTP request to a server in the form of a request message which includes the following format:

A Request-line

Zero or more header (General|Request|Entity) fields followed by CRLF

An empty line (i.e., a line with nothing preceding the CRLF) indicating the end of the header fields

Optionally a message-body

The following sections explain each of the entities used in an HTTP request message.

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 space SP characters.

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

Let's discuss each of the parts mentioned in the Request-Line.

Request Method

The **request method** indicates the method to be performed on the resource identified by the given **Request-URI**. The method is case-sensitive and should always be mentioned in uppercase. The following table lists all the supported methods in HTTP/1.1.

S.N.	Method and Description
1	GET The GET method is used to retrieve information from the given server using a given URI. Requests using GET should only retrieve data and should have no other effect on the data.
2	HEAD Same as GET, but it transfers the status line and the header section only.
3	POST A POST request is used to send data to the server, for example, customer information, file upload, etc. using HTML forms.
4	PUT Replaces all the current representations of the target resource with the uploaded content.
5	DELETE Removes all the current representations of the target resource given by URI.
6	CONNECT Establishes a tunnel to the server identified by a given URI.
7	OPTIONS Describes the communication options for the target resource.
8	TRACE Performs a message loopback test along with the path to the target resource.

Request-URI

The Request-URI is a Uniform Resource Identifier and identifies the resource upon which to apply the request. Following are the most commonly used forms to specify an URI:

Request-URI = "*" absoluteURI abs_path authority
--

S.N.	Method and Description
1	<p>The asterisk * is used when an HTTP request does not apply to a particular resource, but to the server itself, and is only allowed when the method used does not necessarily apply to a resource. For example:</p> <p>OPTIONS * HTTP/1.1</p>
2	<p>The absoluteURI is used when an HTTP request is being made to a proxy. The proxy is requested to forward the request or service from a valid cache, and return the response. For example:</p> <p>GET http://www.w3.org/pub/WWW/TheProject.html HTTP/1.1</p>
3	<p>The most common form of Request-URI is that used to identify a resource on an origin server or gateway. For example, a client wishing to retrieve a resource directly from the origin server would create a TCP connection to port 80 of the host "www.w3.org" and send the following lines:</p> <p>GET /pub/WWW/TheProject.html HTTP/1.1 Host: www.w3.org</p> <p>Note that the absolute path cannot be empty; if none is present in the original URI, it MUST be given as "/" (the server root).</p>

Request Header Fields

We will study General-header and Entity-header in a separate chapter when we will learn HTTP header fields. For now, let's check what Request header fields are.

The request-header fields allow the client to pass additional information about the request, and about the client itself, to the server. These fields act as request modifiers. Here is a list of some important Request-header fields that can be used based on the requirement:

- Accept-Charset
- Accept-Encoding
- Accept-Language
- Authorization

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

You can introduce your custom fields in case you are going to write your own custom Client and Web Server.

Examples of Request Message

Now let's put it all together to form an HTTP request to fetch **hello.htm** page from the web server running on tutorialspoint.com

```
GET /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

Here we are not sending any request data to the server because we are fetching a plain HTML page from the server. Connection is a general-header, and the rest of the headers are request headers.

The following example shows how to send form data to the server using request message body:

```
POST /cgi-bin/process.cgi HTTP/1.1
```

```
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Content-Type: application/x-www-form-urlencoded
Content-Length: length
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive

licenseID=string&content=string&/paramsXML=string
```

Here the given URL `/cgi-bin/process.cgi` will be used to process the passed data and accordingly, a response will be returned. Here **content-type** tells the server that the passed data is a simple web form data and **length** will be the actual length of the data put in the message body. The following example shows how you can pass plain XML to your web server:

```
POST /cgi-bin/process.cgi HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Content-Type: text/xml; charset=utf-8
Content-Length: length
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive

<?xml version="1.0" encoding="utf-8"?>
<string xmlns="http://clearforest.com/">string</string>
```

5. RESPONSES

After receiving and interpreting a request message, a server responds with an HTTP response message:

A Status-line

Zero or more header (General|Response|Entity) fields followed by CRLF

An empty line (i.e., a line with nothing preceding the CRLF) indicating the end of the header fields

Optionally a message-body

The following sections explain each of the entities used in an HTTP response message.

Message Status-Line

A Status-Line consists of the protocol version followed by a numeric status code and its associated textual phrase. The elements are separated by space SP characters.

```
Status-Line = HTTP-Version SP Status-Code SP Reason-Phrase CRLF
```

HTTP Version

A server supporting HTTP version 1.1 will return the following version information:

```
HTTP-Version = HTTP/1.1
```

Status Code

The Status-Code element is a 3-digit integer where first digit of the Status-Code defines the class of response and the last two digits do not have any categorization role. There are 5 values for the first digit:

S.N.	Code and Description
1	1xx: Informational It means the request was received and the process is continuing.
2	2xx: Success It means the action was successfully received, understood, and accepted.
3	3xx: Redirection It means further action must be taken in order to complete the request.
4	4xx: Client Error It means the request contains incorrect syntax or cannot be fulfilled.
5	5xx: Server Error It means the server failed to fulfill an apparently valid request.

HTTP status codes are extensible and HTTP applications are not required to understand the meaning of all registered status codes. A list of all the status codes has been given in a separate chapter for your reference.

Response Header Fields

We will study General-header and Entity-header in a separate chapter when we will learn HTTP header fields. For now, let's check what Response header fields are.

The response-header fields allow the server to pass additional information about the response which cannot be placed in the Status-Line. These header fields give information about the server and about further access to the resource identified by the Request-URI.

- Accept-Ranges
- Age
- ETag

- Location
- Proxy-Authenticate
- Retry-After
- Server
- Vary
- WWW-Authenticate

You can introduce your custom fields in case you are going to write your own custom Web Client and Server.

Examples of Response Message

Now let's put it all together to form an HTTP response for a request to fetch the **hello.htm** page from the web server running on tutorialspoint.com

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

The following example shows an HTTP response message displaying error condition when the web server could not find the requested page:

```
HTTP/1.1 404 Not Found
Date: Sun, 18 Oct 2012 10:36:20 GMT
Server: Apache/2.2.14 (Win32)
Content-Length: 230
Connection: Closed
```

```

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

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html>
<head>
  <title>404 Not Found</title>
</head>
<body>
  <h1>Not Found</h1>
  <p>The requested URL /t.html was not found on this server.</p>
</body>
</html>

```

Following is an example of HTTP response message showing error condition when the web server encountered a wrong HTTP version in the given HTTP request:

```

HTTP/1.1 400 Bad Request
Date: Sun, 18 Oct 2012 10:36:20 GMT
Server: Apache/2.2.14 (Win32)
Content-Length: 230
Content-Type: text/html; charset=iso-8859-1
Connection: Closed

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html>
<head>
  <title>400 Bad Request</title>
</head>
<body>
  <h1>Bad Request</h1>
  <p>Your browser sent a request that this server could not understand.<p>
  <p>The request line contained invalid characters following the
  protocol string.<p>
</body>

```



```
</html>
```

6. METHODS

The set of common methods for HTTP/1.1 is defined below and this set can be expanded based on requirements. These method names are case-sensitive and they must be used in uppercase.

S.N.	Method and Description
1	GET The GET method is used to retrieve information from the given server using a given URI. Requests using GET should only retrieve data and should have no other effect on the data.
2	HEAD Same as GET, but transfers the status line and header section only.
3	POST A POST request is used to send data to the server, for example, customer information, file upload, etc. using HTML forms.
4	PUT Replaces all current representations of the target resource with the uploaded content.
5	DELETE Removes all current representations of the target resource given by a URI.
6	CONNECT Establishes a tunnel to the server identified by a given URI.
7	OPTIONS Describes the communication options for the target resource.
8	TRACE Performs a message loopback test along the path to the target resource.

GET Method

A GET request retrieves data from a web server by specifying parameters in the URL portion of the request. This is the main method used for document retrieval. The following example makes use of GET method to fetch hello.htm:

```
GET /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

The server response against the above GET request will be as follows:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
ETag: "34aa387-d-1568eb00"
Vary: Authorization,Accept
Accept-Ranges: bytes
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

HEAD Method

The HEAD method is functionally similar to GET, except that the server replies with a response line and headers, but no entity-body. The following example makes use of HEAD method to fetch header information about hello.htm:

```
HEAD /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

The server response against the above GET request will be as follows:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
ETag: "34aa387-d-1568eb00"
Vary: Authorization,Accept
Accept-Ranges: bytes
Content-Length: 88
Content-Type: text/html
Connection: Closed
```

You can notice that here the server does not send any data after header.

POST Method

The POST method is used when you want to send some data to the server, for example, file update, form data, etc. The following example makes use of POST method to send a form data to the server, which will be processed by a process.cgi and finally a response will be returned:

```
POST /cgi-bin/process.cgi HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Content-Type: text/xml; charset=utf-8
Content-Length: 88
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

```
<?xml version="1.0" encoding="utf-8"?>
<string xmlns="http://clearforest.com/">string</string>
```

The server-side script process.cgi processes the passed data and sends the following response:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
ETag: "34aa387-d-1568eb00"
Vary: Authorization,Accept
Accept-Ranges: bytes
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Request Processed Successfully</h1>
</body>
</html>
```

PUT Method

The PUT method is used to request the server to store the included entity-body at a location specified by the given URL. The following example requests the server to save the given entity-boy in **hello.htm** at the root of the server:

```
PUT /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Connection: Keep-Alive
Content-type: text/html
```

```
Content-Length: 182
```

```
<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

The server will store the given entity-body in **hello.htm** file and will send the following response back to the client:

```
HTTP/1.1 201 Created
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Content-type: text/html
Content-length: 30
Connection: Closed
```

```
<html>
<body>
<h1>The file was created.</h1>
</body>
</html>
```

DELETE Method

The DELETE method is used to request the server to delete a file at a location specified by the given URL. The following example requests the server to delete the given file **hello.htm** at the root of the server:

```
DELETE /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Connection: Keep-Alive
```

The server will delete the mentioned file **hello.htm** and will send the following response back to the client:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Content-type: text/html
Content-length: 30
Connection: Closed
```

```
<html>
<body>
<h1>URL deleted.</h1>
</body>
</html>
```

CONNECT Method

The CONNECT method is used by the client to establish a network connection to a web server over HTTP. The following example requests a connection with a web server running on the host tutorialspoint.com:

```
CONNECT www.tutorialspoint.com HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
```

The connection is established with the server and the following response is sent back to the client:

```
HTTP/1.1 200 Connection established
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
```

OPTIONS Method

The OPTIONS method is used by the client to find out the HTTP methods and other options supported by a web server. The client can specify a URL for the OPTIONS method, or an asterisk (*) to refer to the entire server. The following example requests a list of methods supported by a web server running on tutorialspoint.com:

```
OPTIONS * HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
```

The server will send an information based on the current configuration of the server, for example:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Allow: GET,HEAD,POST,OPTIONS,TRACE
Content-Type: httpd/unix-directory
```

TRACE Method

The TRACE method is used to echo the contents of an HTTP Request back to the requester which can be used for debugging purpose at the time of development. The following example shows the usage of TRACE method:

```
TRACE / HTTP/1.1
Host: www.tutorialspoint.com
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
```

The server will send the following message in response to the above request:

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Content-Type: message/http
Content-Length: 39
Connection: Closed

TRACE / HTTP/1.1
Host: www.tutorialspoint.com
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
```


7. STATUS CODES

The Status-Code element in a server response is a 3-digit integer where the first digit of the Status-Code defines the class of response and the last two digits do not have any categorization role. There are 5 values for the first digit:

S.N.	Code and Description
1	1xx: Informational It means the request has been received and the process is continuing.
2	2xx: Success It means the action was successfully received, understood, and accepted.
3	3xx: Redirection It means further action must be taken in order to complete the request.
4	4xx: Client Error It means the request contains incorrect syntax or cannot be fulfilled.
5	5xx: Server Error It means the server failed to fulfill an apparently valid request.

HTTP status codes are extensible and HTTP applications are not required to understand the meaning of all the registered status codes. Given below is a list of all the status codes.

1xx: Information

Message	Description
100 Continue	Only a part of the request has been received by the server, but as long as it has not been rejected, the client should continue with the request.

101 Switching Protocols	The server switches protocol.
-------------------------	-------------------------------

2xx: Successful

Message	Description
200 OK	The request is OK.
201 Created	The request is complete, and a new resource is created.
202 Accepted	The request is accepted for processing, but the processing is not complete.
203 Non-authoritative Information	The information in the entity header is from a local or third-party copy, not from the original server.
204 No Content	A status code and a header are given in the response, but there is no entity-body in the reply.
205 Reset Content	The browser should clear the form used for this transaction for additional input.
206 Partial Content	The server is returning partial data of the size requested. Used in response to a request specifying a <i>Range</i> header. The server must specify the range included in the response with the <i>Content-Range</i> header.

3xx: Redirection

Message	Description
300 Multiple Choices	A link list. The user can select a link and go to that location. Maximum five addresses.
301 Moved Permanently	The requested page has moved to a new url.
302 Found	The requested page has moved temporarily to

	a new url.
303 See Other	The requested page can be found under a different url.
304 Not Modified	This is the response code to an <i>If-Modified-Since</i> or <i>If-None-Match</i> header, where the URL has not been modified since the specified date.
305 Use Proxy	The requested URL must be accessed through the proxy mentioned in the <i>Location</i> header.
306 <i>Unused</i>	This code was used in a previous version. It is no longer used, but the code is reserved
307 Temporary Redirect	The requested page has moved temporarily to a new url.

4xx: Client Error

Message	Description
400 Bad Request	The server did not understand the request.
401 Unauthorized	The requested page needs a username and a password.
402 Payment Required	<i>You cannot use this code yet.</i>
403 Forbidden	Access is forbidden to the requested page.
404 Not Found	The server cannot find the requested page.
405 Method Not Allowed	The method specified in the request is not allowed.
406 Not Acceptable	The server can only generate a response that is not accepted by the client.
407 Proxy Authentication Required	You must authenticate with a proxy server before this request can be served.

408 Request Timeout	The request took longer than the server was prepared to wait.
409 Conflict	The request could not be completed because of a conflict.
410 Gone	The requested page is no longer available.
411 Length Required	The "Content-Length" is not defined. The server will not accept the request without it.
412 Precondition Failed	The pre-condition given in the request evaluated to false by the server.
413 Request Entity Too Large	The server will not accept the request, because the request entity is too large.
414 Request-url Too Long	The server will not accept the request, because the url is too long. Occurs when you convert a "post" request to a "get" request with a long query information.
415 Unsupported Media Type	The server will not accept the request, because the media type is not supported.
416 Requested Range Not Satisfiable	The requested byte range is not available and is out of bounds.
417 Expectation Failed	The expectation given in an Expect request-header field could not be met by this server.

5xx: Server Error

Message	Description
500 Internal Server Error	The request was not completed. The server met an unexpected condition.
501 Not Implemented	The request was not completed. The server did not support the functionality required.
502 Bad Gateway	The request was not completed. The server received an invalid response from the

	upstream server.
503 Service Unavailable	The request was not completed. The server is temporarily overloading or down.
504 Gateway Timeout	The gateway has timed out.
505 HTTP Version Not Supported	The server does not support the "http protocol" version.

8. HEADER FIELDS

HTTP header fields provide required information about the request or response, or about the object sent in the message body. There are four types of HTTP message headers:

- **General-header:** These header fields have general applicability for both request and response messages.
- **Client Request-header:** These header fields have applicability only for request messages.
- **Server Response-header:** These header fields have applicability only for response messages.
- **Entity-header:** These header fields define meta-information about the entity-body or, if no body is present, about the resource identified by the request

General Headers

Cache-Control

The Cache-Control general-header field is used to specify directives that MUST be obeyed by all the caching system. The syntax is as follows:

```
Cache-Control : cache-request-directive|cache-response-directive
```

An HTTP client or server can use the **Cache-control** general header to specify parameters for the cache or to request certain kinds of documents from the cache. The caching directives are specified in a comma-separated list. For example:

```
Cache-control: no-cache
```

The following table lists the important cache request directives that can be used by the client in its HTTP request:

S.N.	Cache Request Directive and Description
1	no-cache A cache must not use the response to satisfy a subsequent request without successful revalidation with the origin server.

2	no-store The cache should not store anything about the client request or server response.
3	max-age = seconds Indicates that the client is willing to accept a response whose age is not greater than the specified time in seconds.
4	max-stale [= seconds] Indicates that the client is willing to accept a response that has exceeded its expiration time. If seconds are given, it must not be expired by more than that time.
5	min-fresh = seconds Indicates that the client is willing to accept a response whose freshness lifetime is not less than its current age plus the specified time in seconds.
6	no-transform Does not convert the entity-body.
7	only-if-cached Does not retrieve new data. The cache can send a document only if it is in the cache, and should not contact the origin-server to see if a newer copy exists.

The following important cache response directives can be used by the server in its HTTP response:

S.N.	Cache Request Directive and Description
1	public Indicates that the response may be cached by any cache.
2	private Indicates that all or part of the response message is intended for a single user and must not be cached by a shared cache.
3	no-cache A cache must not use the response to satisfy a subsequent request

	without successful re-validation with the origin server.
4	no-store The cache should not store anything about the client request or server response.
5	no-transform Does not convert the entity-body.
6	must-revalidate The cache must verify the status of the stale documents before using it and expired ones should not be used.
7	proxy-revalidate The proxy-revalidate directive has the same meaning as the must-revalidate directive, except that it does not apply to non-shared user agent caches.
8	max-age = seconds Indicates that the client is willing to accept a response whose age is not greater than the specified time in seconds.
9	s-maxage = seconds The maximum age specified by this directive overrides the maximum age specified by either the max-age directive or the Expires header. The s-maxage directive is always ignored by a private cache.

Connection

The Connection general-header field allows the sender to specify options that are desired for that particular connection and must not be communicated by proxies over further connections. Following is the simple syntax for using connection header:

```
Connection : "Connection"
```

HTTP/1.1 defines the "closed" connection option for the sender to signal that the connection will be closed after completion of the response. For example:

```
Connection: Closed
```

By default, HTTP 1.1 uses persistent connections, where the connection does not automatically close after a transaction. HTTP 1.0, on the other hand, does not

have persistent connections by default. If a 1.0 client wishes to use persistent connections, it uses the **keep-alive** parameter as follows:

```
Connection: keep-alive
```

Date

All HTTP date/time stamps MUST be represented in Greenwich Mean Time (GMT), without exception. HTTP applications are allowed to use any of the following three representations of date/time stamps:

```
Sun, 06 Nov 1994 08:49:37 GMT ; RFC 822, updated by RFC 1123
Sunday, 06-Nov-94 08:49:37 GMT ; RFC 850, obsoleted by RFC 1036
Sun Nov 6 08:49:37 1994 ; ANSI C's asctime() format
```

Here the first format is the most preferred one.

Pragma

The Pragma general-header field is used to include implementation-specific directives that might apply to any recipient along the request/response chain. For example:

```
Pragma: no-cache
```

The only directive defined in HTTP/1.0 is the no-cache directive and is maintained in HTTP 1.1 for backward compatibility. No new Pragma directives will be defined in the future.

Trailer

The Trailer general field value indicates that the given set of header fields is present in the trailer of a message encoded with chunked transfer-coding. Following is the syntax of Trailer header field:

```
Trailer : field-name
```

Message header fields listed in the Trailer header field must not include the following header fields:

- Transfer-Encoding
- Content-Length
- Trailer

Transfer-Encoding

The *Transfer-Encoding* general-header field indicates what type of transformation has been applied to the message body in order to safely transfer it between the sender and the recipient. This is not the same as content-encoding because transfer-encodings are a property of the message, not of the entity-body. The syntax of Transfer-Encoding header field is as follows:

```
Transfer-Encoding: chunked
```

All transfer-coding values are case-insensitive.

Upgrade

The *Upgrade* general-header allows the client to specify what additional communication protocols it supports and would like to use if the server finds it appropriate to switch protocols. For example:

```
Upgrade: HTTP/2.0, SHTTP/1.3, IRC/6.9, RTA/x11
```

The Upgrade header field is intended to provide a simple mechanism for transition from HTTP/1.1 to some other, incompatible protocol.

Via

The *Via* general-header must be used by gateways and proxies to indicate the intermediate protocols and recipients. For example, a request message could be sent from an HTTP/1.0 user agent to an internal proxy code-named "fred", which uses HTTP/1.1 to forward the request to a public proxy at nowhere.com, which completes the request by forwarding it to the origin server at www.ics.uci.edu. The request received by www.ics.uci.edu would then have the following Via header field:

```
Via: 1.0 fred, 1.1 nowhere.com (Apache/1.1)
```

The Upgrade header field is intended to provide a simple mechanism for transition from HTTP/1.1 to some other, incompatible protocol.

Warning

The *Warning* general-header is used to carry additional information about the status or transformation of a message which might not be reflected in the message. A response may carry more than one Warning header.

```
Warning : warn-code SP warn-agent SP warn-text SP warn-date
```

Client Request Headers

Accept

The *Accept* request-header field can be used to specify certain media types which are acceptable for the response. The general syntax is as follows:

```
Accept: type/subtype [q=qvalue]
```

Multiple media types can be listed separated by commas and the optional qvalue represents an acceptable quality level for accept types on a scale of 0 to 1. Following is an example:

```
Accept: text/plain; q=0.5, text/html, text/x-dvi; q=0.8, text/x-c
```

This would be interpreted as **text/html** and **text/x-c** and are the preferred media types, but if they do not exist, then send the **text/x-dvi** entity, and if that does not exist, send the **text/plain** entity.

Accept-Charset

The *Accept-Charset* request-header field can be used to indicate what character sets are acceptable for the response. Following is the general syntax:

```
Accept-Charset: character_set [q=qvalue]
```

Multiple character sets can be listed separated by commas and the optional qvalue represents an acceptable quality level for non-preferred character sets on a scale of 0 to 1. Following is an example:

```
Accept-Charset: iso-8859-5, unicode-1-1; q=0.8
```

The special value "*", if present in the **Accept-Charset** field, matches every character set and if no **Accept-Charset** header is present, the default is that any character set is acceptable.

Accept-Encoding

The *Accept-Encoding* request-header field is similar to *Accept*, but restricts the content-codings that are acceptable in the response. The general syntax is:

```
Accept-Encoding: encoding types
```

Examples are as follows:

```
Accept-Encoding: compress, gzip
Accept-Encoding:
Accept-Encoding: *
Accept-Encoding: compress;q=0.5, gzip;q=1.0
Accept-Encoding: gzip;q=1.0, identity; q=0.5, *;q=0
```

Accept-Language

The *Accept-Language* request-header field is similar to *Accept*, but restricts the set of natural languages that are preferred as a response to the request. The general syntax is:

```
Accept-Language: language [q=qvalue]
```

Multiple languages can be listed separated by commas and the optional *qvalue* represents an acceptable quality level for non-preferred languages on a scale of 0 to 1. Following is an example:

```
Accept-Language: da, en-gb;q=0.8, en;q=0.7
```

Authorization

The *Authorization* request-header field value consists of credentials containing the authentication information of the user agent for the realm of the resource being requested. The general syntax is:

```
Authorization : credentials
```

The HTTP/1.0 specification defines the BASIC authorization scheme, where the authorization parameter is the string of **username:password** encoded in base 64. Following is an example:

```
Authorization: BASIC Z3Vlc3Q6Z3Vlc3QxMjM=
```

The value decodes into is **guest:guest123** where **guest** is user ID and **guest123** is the password.

Cookie

The *Cookie* request-header field value contains a name/value pair of information stored for that URL. Following is the general syntax:

```
Cookie: name=value
```

Multiple cookies can be specified separated by semicolons as follows:

```
Cookie: name1=value1;name2=value2;name3=value3
```

Expect

The *Expect* request-header field is used to indicate that a particular set of server behaviors is required by the client. The general syntax is:

```
Expect : 100-continue | expectation-extension
```

If a server receives a request containing an *Expect* field that includes an expectation-extension that it does not support, it must respond with a 417 (Expectation Failed) status.

From

The *From* request-header field contains an Internet e-mail address for the human user who controls the requesting user agent. Following is a simple example:

```
From: webmaster@w3.org
```

This header field may be used for logging purposes and as a means for identifying the source of invalid or unwanted requests.

Host

The *Host* request-header field is used to specify the Internet host and the port number of the resource being requested. The general syntax is:

```
Host : "Host" ":" host [ ":" port ] ;
```

A **host** without any trailing port information implies the default port, which is 80. For example, a request on the origin server for *http://www.w3.org/pub/WWW/* would be:

```
GET /pub/WWW/ HTTP/1.1
Host: www.w3.org
```

If-Match

The *If-Match* request-header field is used with a method to make it conditional. This header requests the server to perform the requested method only if the given value in this tag matches the given entity tags represented by **Etag**. The general syntax is:

```
If-Match : entity-tag
```

An asterisk (*) matches any entity, and the transaction continues only if the entity exists. Following are possible examples:

```
If-Match: "xyzyz"
If-Match: "xyzyz", "r2d2xxxx", "c3piozzzz"
If-Match: *
```

If none of the entity tags match, or if "*" is given and no current entity exists, the server must not perform the requested method, and must return a 412 (Precondition Failed) response.

If-Modified-Since

The *If-Modified-Since* request-header field is used with a method to make it conditional. If the requested URL has not been modified since the time specified in this field, an entity will not be returned from the server; instead, a 304 (not modified) response will be returned without any message-body. The general syntax of if-modified-since is:

```
If-Modified-Since : HTTP-date
```

An example of the field is:

```
If-Modified-Since: Sat, 29 Oct 1994 19:43:31 GMT
```

If none of the entity tags match, or if "*" is given and no current entity exists, the server must not perform the requested method, and must return a 412 (Precondition Failed) response.

If-None-Match

The *If-None-Match* request-header field is used with a method to make it conditional. This header requests the server to perform the requested method only if one of the given value in this tag matches the given entity tags represented by **ETag**. The general syntax is:

```
If-None-Match : entity-tag
```

An asterisk (*) matches any entity, and the transaction continues only if the entity does not exist. Following are the possible examples:

```
If-None-Match: "xyzyz"
```

```
If-None-Match: "xyzy", "r2d2xxxx", "c3piozzzz"
```

```
If-None-Match: *
```

If-Range

The *If-Range* request-header field can be used with a conditional GET to request only the portion of the entity that is missing, if it has not been changed, and the entire entity if it has been changed. The general syntax is as follows:

```
If-Range : entity-tag | HTTP-date
```

Either an entity tag or a date can be used to identify the partial entity already received. For example:

```
If-Range: Sat, 29 Oct 1994 19:43:31 GMT
```

Here if the document has not been modified since the given date, the server returns the byte range given by the Range header, otherwise it returns all of the new document.

If-Unmodified-Since

The *If-Unmodified-Since* request-header field is used with a method to make it conditional. The general syntax is:

```
If-Unmodified-Since : HTTP-date
```

If the requested resource has not been modified since the time specified in this field, the server should perform the requested operation as if the *If-Unmodified-Since* header were not present. For example:

```
If-Unmodified-Since: Sat, 29 Oct 1994 19:43:31 GMT
```

If the request results in anything other than a 2xx or 412 status, the *If-Unmodified-Since* header should be ignored.

Max-Forwards

The *Max-Forwards* request-header field provides a mechanism with the TRACE and OPTIONS methods to limit the number of proxies or gateways that can forward the request to the next inbound server. Here is the general syntax:

```
Max-Forwards : n
```

The Max-Forwards value is a decimal integer indicating the remaining number of times this request message may be forwarded. This is useful for debugging with the TRACE method, avoiding infinite loops. For example:

```
Max-Forwards : 5
```

The Max-Forwards header field may be ignored for all other methods defined in the HTTP specification.

Proxy-Authorization

The *Proxy-Authorization* request-header field allows the client to identify itself (or its user) to a proxy which requires authentication. Here is the general syntax:

```
Proxy-Authorization : credentials
```

The Proxy-Authorization field value consists of credentials containing the authentication information of the user agent for the proxy and/or realm of the resource being requested.

Range

The *Range* request-header field specifies the partial range(s) of the content requested from the document. The general syntax is:

```
Range: bytes-unit=first-byte-pos "-" [last-byte-pos]
```

The first-byte-pos value in a byte-range-spec gives the byte-offset of the first byte in a range. The last-byte-pos value gives the byte-offset of the last byte in the range; that is, the byte positions specified are inclusive. You can specify a byte-unit as bytes. Byte offsets start at zero. Some simple examples are as follows:

- The first 500 bytes

Range: bytes=0-499

- The second 500 bytes

Range: bytes=500-999

- The final 500 bytes

Range: bytes=-500

- The first and last bytes only

Range: bytes=0-0,-1

Multiple ranges can be listed, separated by commas. If the first digit in the comma-separated byte range(s) is missing, the range is assumed to count from the end of the document. If the second digit is missing, the range is byte **n** to the end of the document.

Referer

The *Referer* request-header field allows the client to specify the address (URI) of the resource from which the URL has been requested. The general syntax is as follows:

```
Referer : absoluteURI | relativeURI
```

Following is a simple example:

```
Referer: http://www.tutorialspoint.org/http/index.htm
```

If the field value is a relative URI, it should be interpreted relative to the *Request-URI*.

TE

The *TE* request-header field indicates what extension *transfer-coding* it is willing to accept in the response and whether or not it is willing to accept trailer fields in a chunked *transfer-coding*. Following is the general syntax:

```
TE : t-codings
```

The presence of the keyword "trailers" indicates that the client is willing to accept trailer fields in a chunked transfer-coding and it is specified either of the ways:

```
TE: deflate
TE:
TE: trailers, deflate;q=0.5
```

If the TE field-value is empty or if no TE field is present, then only transfer-coding is *chunked*. A message with no transfer-coding is always acceptable.

User-Agent

The *User-Agent* request-header field contains information about the user agent originating the request. Following is the general syntax:

```
User-Agent : product | comment
```

Example:

```
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
```

Server Response Headers

Accept-Ranges

The *Accept-Ranges* response-header field allows the server to indicate its acceptance of range requests for a resource. The general syntax is:

```
Accept-Ranges : range-unit | none
```

For example, a server that accepts byte-range requests may send:

```
Accept-Ranges: bytes
```

Servers that do not accept any kind of range request for a resource may send:

```
Accept-Ranges: none
```

This will advise the client not to attempt a range request.

Age

The *Age* response-header field conveys the sender's estimate of the amount of time since the response (or its revalidation) was generated at the origin server. The general syntax is:

```
Age : delta-seconds
```

Age values are non-negative decimal integers, representing time in seconds. Following is a simple example:

```
Age: 1030
```

An HTTP/1.1 server that includes a cache must include an Age header field in every response generated from its own cache.

ETag

The *ETag* response-header field provides the current value of the entity tag for the requested variant. The general syntax is:

```
ETag : entity-tag
```

Here are some simple examples:

```
ETag: "xyzyz"  
ETag: W/"xyzyz"  
ETag: ""
```

Location

The *Location* response-header field is used to redirect the recipient to a location other than the Request-URI for completion. The general syntax is:

```
Location : absoluteURI
```

Following is a simple example:

```
Location: http://www.tutorialspoint.org/http/index.htm
```

The Content-Location header field differs from Location in that the Content-Location identifies the original location of the entity enclosed in the request.

Proxy-Authenticate

The *Proxy-Authenticate* response-header field must be included as a part of a 407 (Proxy Authentication Required) response. The general syntax is:

```
Proxy-Authenticate : challenge
```

Retry-After

The *Retry-After* response-header field can be used with a 503 (Service Unavailable) response to indicate how long the service is expected to be unavailable to the requesting client. The general syntax is:

```
Retry-After : HTTP-date | delta-seconds
```

Examples:

```
Retry-After: Fri, 31 Dec 1999 23:59:59 GMT  
Retry-After: 120
```

In the latter example, the delay is 2 minutes.

Server

The *Server* response-header field contains information about the software used by the origin server to handle the request. The general syntax is:

```
Server : product | comment
```

Following is a simple example:

```
Server: Apache/2.2.14 (Win32)
```

If the response is being forwarded through a proxy, the proxy application must not modify the *Server* response-header.

Set-Cookie

The *Set-Cookie* response-header field contains a name/value pair of information to retain for this URL. The general syntax is:

```
Set-Cookie: NAME=VALUE; OPTIONS
```

Set-Cookie response header comprises the token *Set-Cookie*, followed by a comma-separated list of one or more cookies. Here are the possible values you can specify as options:

S.N.	Options and Description
1	Comment=comment This option can be used to specify any comment associated with the cookie.
2	Domain=domain The Domain attribute specifies the domain for which the cookie is valid.
3	Expires=Date-time The date the cookie will expire. If it is blank, the cookie will expire when the visitor quits the browser.
4	Path=path The Path attribute specifies the subset of URLs to which this cookie applies.

5	Secure It instructs the user agent to return the cookie only under a secure connection.
---	---

Following is an example of a simple cookie header generated by the server:

```
Set-Cookie: name1=value1,name2=value2; Expires=Wed, 09 Jun 2021 10:18:14 GMT
```

Vary

The *Vary* response-header field specifies that the entity has multiple sources and may therefore vary according to the specified list of request header(s). Following is the general syntax:

```
Vary : field-name
```

You can specify multiple headers separated by commas and a value of asterisk "*" signals that unspecified parameters are not limited to the request-headers. Following is a simple example:

```
Vary: Accept-Language, Accept-Encoding
```

Here field names are case-insensitive.

WWW-Authenticate

The *WWW-Authenticate* response-header field must be included in 401 (Unauthorized) response messages. The field value consists of at least one challenge that indicates the authentication scheme(s) and parameters applicable to the Request-URI. The general syntax is:

```
WWW-Authenticate : challenge
```

WWW-Authenticate field value might contain more than one challenge, or if more than one WWW-Authenticate header field is provided, the contents of a challenge itself can contain a comma-separated list of authentication parameters. Following is a simple example:

```
WWW-Authenticate: BASIC realm="Admin"
```

Entity Headers

Allow

The *Allow* entity-header field lists the set of methods supported by the resource identified by the Request-URI. The general syntax is:

```
Allow : Method
```

You can specify multiple methods separated by commas. Following is a simple example:

```
Allow: GET, HEAD, PUT
```

This field cannot prevent a client from trying other methods.

Content-Encoding

The *Content-Encoding* entity-header field is used as a modifier to the media-type. The general syntax is:

```
Content-Encoding : content-coding
```

The content-coding is a characteristic of the entity identified by the Request-URI. Following is a simple example:

```
Content-Encoding: gzip
```

If the content-coding of an entity in a request message is not acceptable to the origin server, the server should respond with a status code of 415 (Unsupported Media Type).

Content-Language

The *Content-Language* entity-header field describes the natural language(s) of the intended audience for the enclosed entity. Following is the general syntax:

```
Content-Language : language-tag
```

Multiple languages may be listed for content that is intended for multiple audiences. Following is a simple example:

```
Content-Language: mi, en
```

The primary purpose of Content-Language is to allow a user to identify and differentiate entities according to the user's own preferred language.

Content-Length

The *Content-Length* entity-header field indicates the size of the entity-body, in decimal number of OCTETs, sent to the recipient or, in the case of the HEAD method, the size of the entity-body that would have been sent, had the request been a GET. The general syntax is:

```
Content-Length : DIGITS
```

Following is a simple example:

```
Content-Length: 3495
```

Any Content-Length greater than or equal to zero is a valid value.

Content-Location

The *Content-Location* entity-header field may be used to supply the resource location for the entity enclosed in the message when that entity is accessible from a location separate from the requested resource's URI. The general syntax is:

```
Content-Location: absoluteURI | relativeURI
```

Following is a simple example:

```
Content-Location: http://www.tutorialspoint.org/http/index.htm
```

The value of Content-Location also defines the base URI for the entity.

Content-MD5

The *Content-MD5* entity-header field may be used to supply an MD5 digest of the entity for checking the integrity of the message upon receipt. The general syntax is:

```
Content-MD5 : md5-digest using base64 of 128 bit MD5 digest as per RFC 1864
```

Following is a simple example:

```
Content-MD5 : 8c2d46911f3f5a326455f0ed7a8ed3b3
```

The MD5 digest is computed based on the content of the entity-body, including any content-coding that has been applied, but not including any transfer-encoding applied to the message-body.

Content-Range

The *Content-Range* entity-header field is sent with a partial entity-body to specify where in the full entity-body the partial body should be applied. The general syntax is:

```
Content-Range : bytes-unit SP first-byte-pos "-" last-byte-pos
```

Examples of byte-content-range-spec values, assuming that the entity contains a total of 1234 bytes:

```
- The first 500 bytes:
Content-Range : bytes 0-499/1234

- The second 500 bytes:
Content-Range : bytes 500-999/1234

- All except for the first 500 bytes:
Content-Range : bytes 500-1233/1234

- The last 500 bytes:
Content-Range : bytes 734-1233/1234
```

When an HTTP message includes the content of a single range, this content is transmitted with a Content-Range header, and a Content-Length header showing the number of bytes actually transferred. For example,

```
HTTP/1.1 206 Partial content
Date: Wed, 15 Nov 1995 06:25:24 GMT
Last-Modified: Wed, 15 Nov 1995 04:58:08 GMT
Content-Range: bytes 21010-47021/47022
Content-Length: 26012
Content-Type: image/gif
```

Content-Type

The *Content-Type* entity-header field indicates the media type of the entity-body sent to the recipient or, in the case of the HEAD method, the media type that would have been sent, had the request been a GET. The general syntax is:


```
Content-Type : media-type
```

Following is an example:

```
Content-Type: text/html; charset=ISO-8859-4
```

Expires

The *Expires* entity-header field gives the date/time after which the response is considered stale. The general syntax is:

```
Expires : HTTP-date
```

Following is an example:

```
Expires: Thu, 01 Dec 1994 16:00:00 GMT
```

Last-Modified

The *Last-Modified* entity-header field indicates the date and time at which the origin server believes the variant was last modified. The general syntax is:

```
Last-Modified: HTTP-date
```

Following is an example:

```
Last-Modified: Tue, 15 Nov 1994 12:45:26 GMT
```

9. CACHING

HTTP is typically used for distributed information systems, where performance can be improved by the use of response caches. The HTTP/1.1 protocol includes a number of elements intended to make caching work.

The goal of caching in HTTP/1.1 is to eliminate the need to send requests in many cases, and to eliminate the need to send full responses in many other cases.

The basic cache mechanisms in HTTP/1.1 are implicit directives to caches where server-specifies expiration times and validators. We use the **Cache-Control** header for this purpose.

The **Cache-Control** header allows a client or server to transmit a variety of directives in either requests or responses. These directives typically override the default caching algorithms. The caching directives are specified in a comma-separated list. For example:

```
Cache-control: no-cache
```

The following cache request directives can be used by the client in its HTTP request:

S.N.	Cache Request Directive and Description
1	no-cache A cache must not use the response to satisfy a subsequent request without successful re-validation with the origin server.
2	no-store The cache should not store anything about the client request or server response.
3	max-age = seconds Indicates that the client is willing to accept a response whose age is not greater than the specified time in seconds.
4	max-stale [= seconds] Indicates that the client is willing to accept a response that has exceeded its expiration time. If seconds are given, it must not be expired by more than that time.

5	min-fresh = seconds Indicates that the client is willing to accept a response whose freshness lifetime is not less than its current age plus the specified time in seconds.
6	no-transform Does not convert the entity-body.
7	only-if-cached Does not retrieve new data. The cache can send a document only if it is in the cache, and should not contact the origin-server to see if a newer copy exists.

The following cache response directives can be used by the server in its HTTP response:

S.N.	Cache Request Directive and Description
1	public Indicates that the response may be cached by any cache.
2	private Indicates that all or part of the response message is intended for a single user and must not be cached by a shared cache.
3	no-cache A cache must not use the response to satisfy a subsequent request without successful re-validation with the origin server.
4	no-store The cache should not store anything about the client request or server response.
5	no-transform Does not convert the entity-body.
6	must-revalidate The cache must verify the status of stale documents before using it and expired ones should not be used.

7	proxy-revalidate The proxy-revalidate directive has the same meaning as the must-revalidate directive, except that it does not apply to non-shared user agent caches.
8	max-age = seconds Indicates that the client is willing to accept a response whose age is not greater than the specified time in seconds.
9	s-maxage = seconds The maximum age specified by this directive overrides the maximum age specified by either the max-age directive or the Expires header. The s-maxage directive is always ignored by a private cache.

10. URL ENCODING

HTTP URLs can only be sent over the Internet using the ASCII *character-set*, which often contain characters outside the ASCII set. So these unsafe characters must be replaced with a **%** followed by two hexadecimal digits.

The following table shows the ASCII symbols of the characters and their replacements which can be used in the URL before passing it to the server:

ASCII	Symbol	Replacement
< 32		Encode with %xx where xx is the hexadecimal representation of the character.
32	space	+ or %20
33	!	%21
34	"	%22
35	#	%23
36	\$	%24
37	%	%25
38	&	%26
39	'	%27
40	(%28
41)	%29
42	*	*
43	+	%2B

44	,	%2C
45	-	-
46	.	.
47	/	%2F
48	0	0
49	1	1
50	2	2
51	3	3
52	4	4
53	5	5
54	6	6
55	7	7
56	8	8
57	9	9
58	:	%3A
59	;	%3B
60	<	%3C
61	=	%3D
62	>	%3E

63	?	%3F
64	@	%40
65	A	A
66	B	B
67	C	C
68	D	D
69	E	E
70	F	F
71	G	G
72	H	H
73	I	I
74	J	J
75	K	K
76	L	L
77	M	M
78	N	N
79	O	O
80	P	P
81	Q	Q

82	R	R
83	S	S
84	T	T
85	U	U
86	V	V
87	W	W
88	X	X
89	Y	Y
90	Z	Z
91	[%5B
92	\	%5C
93]	%5D
94	^	%5E
95	_	_
96	`	%60
97	a	a
98	b	b
99	c	c
100	d	d

101	e	e
102	f	f
103	g	g
104	h	h
105	i	i
106	j	j
107	k	k
108	l	l
109	m	m
110	n	n
111	o	o
112	p	p
113	q	q
114	r	r
115	s	s
116	t	t
117	u	u
118	v	v
119	w	w

120	x	x
121	y	y
122	z	z
123	{	%7B
124		%7C
125	}	%7D
126	~	%7E
127		%7F
> 127		Encode with %xx where xx is the hexadecimal representation of the character.

11. SECURITY

HTTP is used for communications over the internet, so application developers, information providers, and users should be aware of the security limitations in HTTP/1.1. This discussion does not include definitive solutions to the problems mentioned here, but it does make some suggestions for reducing security risks.

Personal Information Leakage

HTTP clients are often privy to large amount of personal information such as the user's name, location, mail address, passwords, encryption keys, etc. So you should be very careful to prevent unintentional leakage of this information via the HTTP protocol to other sources.

- All the confidential information should be stored at the server in encrypted form.
- Revealing the specific software version of the server might allow the server machine to become more vulnerable to attacks against software that is known to contain security holes.
- Proxies that serve as a portal through a network firewall should take special precautions regarding the transfer of header information that identifies the hosts behind the firewall.
- The information sent in the 'From' field might conflict with the user's privacy interests or their site's security policy, and hence, it should not be transmitted without the user being able to disable, enable, and modify the contents of the field.
- Clients should not include a Referer header field in a (non-secure) HTTP request, if the referring page was transferred with a secure protocol.
- Authors of services that use the HTTP protocol should not use GET based forms for the submission of sensitive data, because it will cause the data to be encoded in the Request-URI.

File and Path Names Based Attack

The document should be restricted to the documents returned by HTTP requests to be only those that were intended by the server administrators.

For example, UNIX, Microsoft Windows, and other operating systems use '..' as a path component to indicate a directory level above the current one. On such a system, an HTTP server MUST disallow any such construct in the Request-URI, if

it would otherwise allow access to a resource outside those intended to be accessible via the HTTP server.

DNS Spoofing

Clients using HTTP rely heavily on the Domain Name Service, and are thus generally prone to security attacks based on the deliberate mis-association of IP addresses and DNS names. So clients need to be cautious in assuming the continuing validity of an IP number/DNS name association.

If HTTP clients cache the results of host name lookups in order to achieve a performance improvement, they must observe the TTL information reported by the DNS. If HTTP clients do not observe this rule, they could be spoofed when a previously-accessed server's IP address changes.

Location Headers and Spoofing

If a single server supports multiple organizations that do not trust one another, then it **MUST** check the values of Location and Content-Location headers in the responses that are generated under the control of said organizations to make sure that they do not attempt to invalidate resources over which they have no authority.

Authentication Credentials

Existing HTTP clients and user agents typically retain authentication information indefinitely. HTTP/1.1 does not provide a method for a server to direct clients to discard these cached credentials which is a big security risk.

There are a number of workarounds to the parts of this problem, and so it is recommended to make the use of password protection in screensavers, idle time-outs, and other methods that mitigate the security problems inherent in this problem.

Proxies and Caching

HTTP proxies are men-in-the-middle, and represent an opportunity for man-in-the-middle attacks. Proxies have access to security-related information, personal information about individual users and organizations, and proprietary information belonging to users and content providers.

Proxy operators should protect the systems on which proxies run, as they would protect any system that contains or transports sensitive information.

Caching proxies provide additional potential vulnerabilities, since the contents of the cache represent an attractive target for malicious exploitation. Therefore, cache contents should be protected as sensitive information.

12. MESSAGE EXAMPLES

Example 1

HTTP request to fetch **hello.htm** page from the web server running on *tutorialspoint.com*.

Client request

```
GET /hello.htm HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

Server response

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

Example 2

HTTP request to fetch **t.html** page that does not exist on the web server running on *tutorialspoint.com*.

Client request

```
GET /t.html HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

Server response

```
HTTP/1.1 404 Not Found
Date: Sun, 18 Oct 2012 10:36:20 GMT
Server: Apache/2.2.14 (Win32)
Content-Length: 230
Content-Type: text/html; charset=iso-8859-1
Connection: close

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html>
<head>
  <title>404 Not Found</title>
</head>
<body>
  <h1>Not Found</h1>
  <p>The requested URL /t.html was not found on this server.</p>
</body>
</html>
```

Example 3

HTTP request to fetch **hello.htm** page from the web server running on *tutorialspoint.com*, but the request goes with an incorrect HTTP version:

Client request

```
GET /hello.htm HTTP1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive
```

Server response

```
HTTP/1.1 400 Bad Request
Date: Sun, 18 Oct 2012 10:36:20 GMT
Server: Apache/2.2.14 (Win32)
Content-Length: 230
Content-Type: text/html; charset=iso-8859-1
Connection: close

<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html>
<head>
  <title>400 Bad Request</title>
</head>
<body>
  <h1>Bad Request</h1>
  <p>Your browser sent a request that this server could not understand.<p>
  <p>The request line contained invalid characters following the
  protocol string.<p>
</body>
</html>
```

Example 4

HTTP request to post form data to **process.cgi** CGI page on a web server running on *tutorialspoint.com*. The server returns the passed name after setting them as cookies:

Client request

```
POST /cgi-bin/process.cgi HTTP/1.1
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Content-Type: text/xml; charset=utf-8
Content-Length: 60
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive

first=Zara&last=Ali
```

Server response

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Content-Length: 88
Set-Cookie: first=Zara,last=Ali;domain=tutorialspoint.com;Expires=Mon,
19-
Nov-2010 04:38:14 GMT;Path=/
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello Zara Ali</h1>
</body>
</html>
```