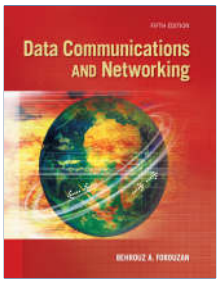

Computer Networks

Lecturer: Dr. A.O. Aldhaibani

HTTP

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World Wide Web

– (abbreviated WWW or Web).

– **Visualizations** of the **14 billion** pages that make up the network of the web.
  - Image via **Opte** Project.
  - Source: www.pinterest.ca

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World Wide Web

– The idea of the Web was first **proposed** by **Tim Berners-Lee** in **1989** for research.

– The **commercial** Web started in the early 1990s.

– The Web **today** is a **repository** of **information** in which the documents, called ***web pages.***

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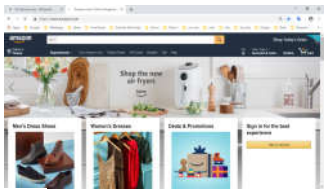
World Wide Web

Today, the **Web** is used to provide **electronic shopping** and **gaming**.



One can use the Web to **listen** to **radio** programs or view **television** programs

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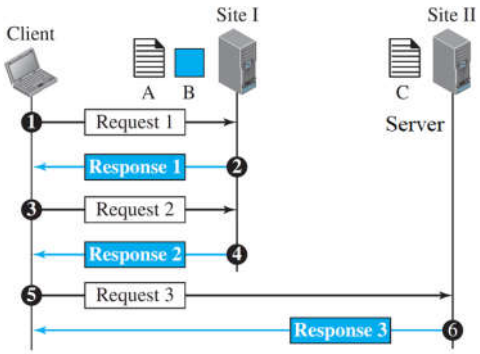
Web Architecture



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Uniform Resource Locator (URL)

- URL is an identifier to distinguish web pages. uniform resource locator (URL) is the address of a resource on the Internet. A URL indicates the location of a resource as well as the protocol used to access it

protocol://host/path	Used most of the time
protocol://host:port/path	Used when port number is needed

- Ex: http://www.mhhe.com/compsci/forouzan/

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Web Documents

Web categories are:

- **Static page**: is **fixed-content** documents that are **created** and **stored** in a **server**.
- **Dynamic page**: is **created** by a web server **whenever** a browser **requests** the document.
  - **example** of a **dynamic** document is the **retrieval** of the **time** and **date** from a server.
- **Active page**: a **page** with a **program** or a **script** to be **run** at the **client** site. For example, suppose we want to run a program that creates animated graphics on the screen or a program that interacts with the user. The program definitely needs to be run at the client site where the animation or interaction takes place.

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HyperText Transfer Protocol (HTTP)

- HTTP is used to **retrieve** web **pages** from the a Web **server**.
- HTTP client **sends** a **request**;
- an HTTP server returns a **response**.
- HTTP server uses **port number 80**; the client uses a **temporary** port number.
- HTTP uses the services of **TCP**.
  - This means that, **before** any transaction between the **client** and the **server** can take place, a **connection** needs to be **established** between them.

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HTTP Connections

- ***Non-persistent Connections:***
  - TCP connection is made for each request/response.
- ***Persistent Connections:***
  - the server **leaves** the **connection open** for more requests after sending a response.

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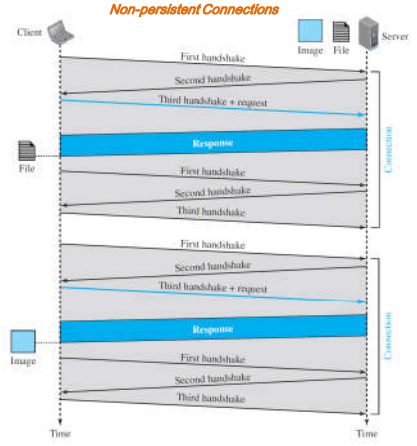
Non-persistent Connections



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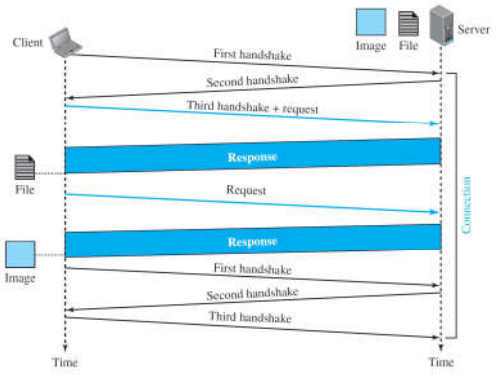
persistent Connections



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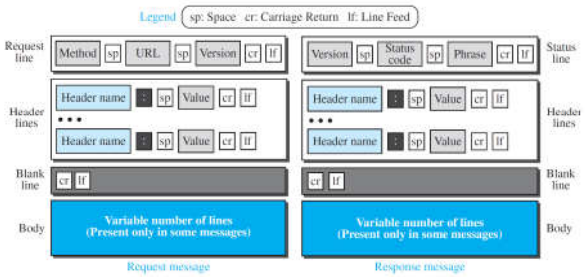
HTTP Message Formats

Figure 26.5 *Formats of the request and response messages*

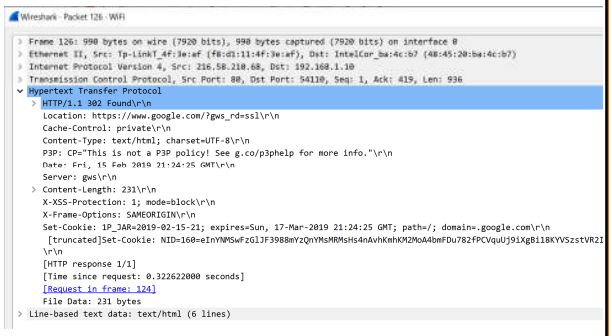


- method :GET method to send a request
- The HEAD method is used when the client needs only some information about the web page from the server, such as the last time it was modified. It can also be used to test the validity of a URL.
- version :gives the version of the protocol; the most current version of HTTP is 1.1.
- header line sends additional information from the client to the server. For example, the client can request that the document be sent in a special format. Each header line has a header name, a colon, a space, and a header value.
- The value field defines the values associated with each header name(length IP)
- The body can be present in a request message. Usually, it contains the comment to be sent or the file to be published on the website when the method is PUT or POST.
- The status code field defines the status of the request.(include error or not).
- Header: For example, the sender can send extra information about the document. Each header line has a header name, a colon, a space, and a header value.
- The status code field in response massage defines the status of the request. It consists of three digits. Whereas the codes in the 100 range are only informational, the codes in the 200 range indicate a successful request. The codes in the 300 range redirect the client to another URL, and the codesin the 400 range indicate an error at the client site. Finally, the codes in the 500 range indicate an error at the server site. The status phrase explains the status code in text form

- The body contains the document to be sent from the server to the client. The body
- is present unless the response is an error message.

Wireshark HTTP Request

Wireshark HTTP Reply



Methods

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

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Request header names

Header	*Description*
User-agent	Identifies the client program
Accept	Shows the media 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
Host	Shows the host and port number of the client
Date	Shows the current date
Upgrade	Specifies the preferred communication protocol
Cookie	Returns the cookie to the server (explained later)
If-Modified-Since	If the file is modified since a specific date

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Response header names

Header	*Description*
Date	Shows the current date
Upgrade	Specifies the preferred communication protocol
Server	Gives information about the server
Set-Cookie	The server asks the client to save a cookie
Content-Encoding	Specifies the encoding scheme
Content-Language	Specifies the language
Content-Length	Shows the length of the document
Content-Type	Specifies the media type
Location	To ask the client to send the request to another site
Accept-Ranges	The server will accept the requested byte-ranges
Last-modified	Gives the date and time of the last change

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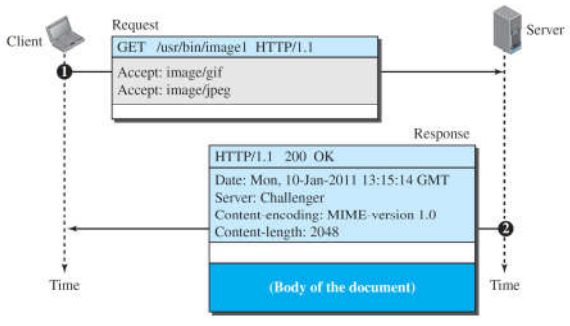
GET Request Example



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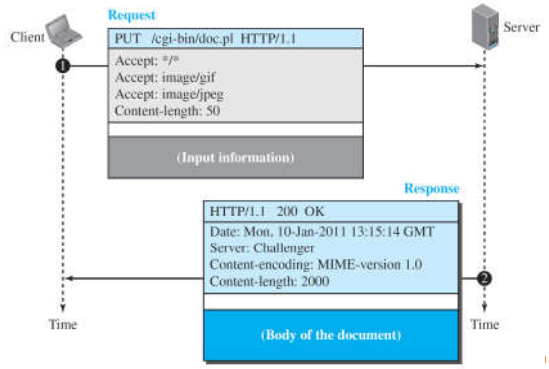
PUT Request Example



Conditional Request

- A client can add a **condition** in its **request**.
- In this case, the server will **send** the **requested** web page **if the condition is met** or inform the client otherwise.
- One of the most **common conditions** imposed by the client is the **time and date** the web page is **modified**.

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Conditional Request Example

Request

GET http://www.commonServer.com/information/file1 HTTP/1.1	Request line
If-Modified-Since: Thu, Sept 04 00:00:00 GMT	Header line
	Blank line

Response

HTTP/1.1 304 Not Modified	Status line
Date: Sat, Sept 06 08 16:22:46 GMT	First header line
Server: commonServer.com	Second header line
	Blank line
(Empty Body)	Empty body

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Cookies

- The HTTP was originally **designed** as a **stateless** protocol.
- **Today** the HTTP has other functions that need to **remember** some **information** about the **clients**:

Using Cookies

– An ***electronic*** *store* (**e-commerce**) can use a cookie for its client shoppers.
  • When the client **finishes** shopping and wants to check out, the last cookie is **retrieved** and the **total** charge is calculated.

– The site that **restricts** access to ***registered*** *clients* only **sends** a **cookie** to the client when the client **registers** for the first time.

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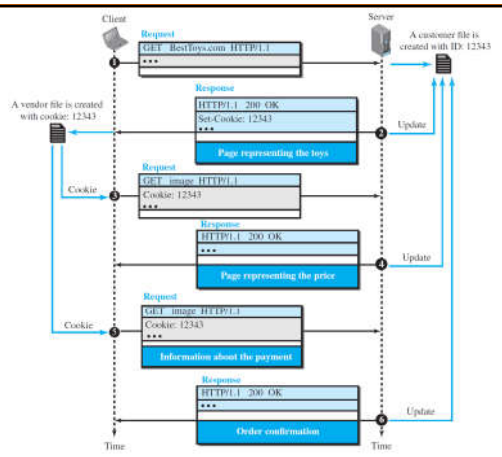

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Using Cookies

– A web ***portal*** uses the cookie in a similar way of registered users.

– A cookie is also used by ***advertising*** agencies.

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Web Caching: Proxy Servers

– A **proxy** server is a **computer** that **keeps copies** of **responses** to **recent** requests.

– The proxy server **reduces** the **load** on the **original server**, **decreases traffic**, and **improves latency**.

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Proxy Server Location

– We can have a **hierarchy** of **proxy** servers, as shown below:

- A **client computer** can also be used as a **proxy** server.
- In a company, a **proxy** server may be installed on a **computer** in the company LAN.
- An **ISP** with many customers can install a **proxy** server.

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Usage of Proxy Server

– To use the proxy server, the **client** must be **configured** to **access** the proxy **instead** of the target server.

– When an HTTP **request** is created by any of the clients the request **is first directed** to the proxy server.

– If the proxy server **already** has the corresponding web page, it sends the **response** to the client.

– **Otherwise**, the proxy server **acts as a client** and sends the request to the web server in the Internet.

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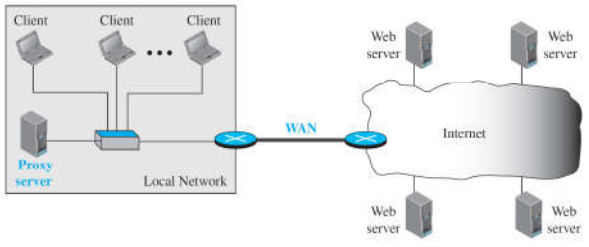
Example of a Proxy Server



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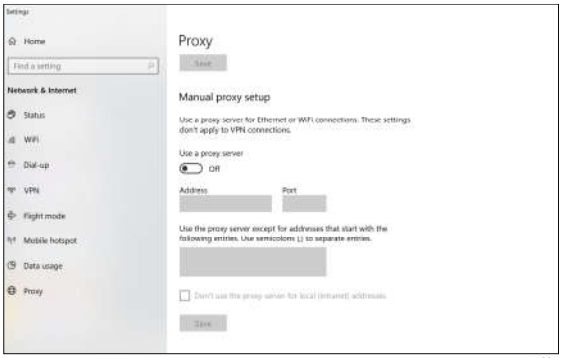
Proxy configuration in Windows 10



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Cache Update

- A very **important question** is **how long** a **response** should **remain** in the proxy server before being **deleted** and **replaced**?
- One **solution** is to **store** the **list of sites** whose information **remains** the **same** for a while.
- Another **solution** is to **keep** in the cache the **most visited sites** and then **delete** the **least** visited sites.

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HTTP Security

- HTTP **does** not **provide** security.
- HTTP can be **run over** the Secure Socket Layer (**SSL**).
- In this case, HTTP is **referred** to as **HTTPS**.

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Discussion

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