

COMPUTER NETWORKS AND INTERNET PROTOCOLS

Application Layer – IV [HTTP, HTML, TELNET]

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HyperText Transfer Protocol (HTTP)

- HTTP is the protocol that supports communication between web browsers and web servers.
- A “Web Server” is a HTTP server
- A “Web Browser” is a HTTP client
- Most clients/servers run version 1.1, but 1.0 is also in use.
 - RFC 1945 (HTTP 1.0)
 - RFC 2616 (HTTP 1.1)
- HTTP version 1.1 specifies a persistent connection by default.

HTTP – Overview

- “HTTP is an application-level protocol with the lightness and speed necessary for distributed, hypermedia information systems.”
- Transport Independence
 - HTTP protocol generally takes place over a TCP connection,
 - However, the protocol itself is not dependent on a specific transport layer.



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Request - Response

- HTTP has a simple structure:
 - client sends a request
 - server returns a reply.
- HTTP can support multiple request-reply exchanges over a single TCP connection.
- The “well known” TCP port for HTTP servers is port 80.
 - Other ports also can be used



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ARCHITECTURE

WWW is a distributed client/server service, in which a HTTP client (browser) can access a service from a HTTP server.

- Client (Browser)
- Server
- Uniform Resource Locator
- Cookies

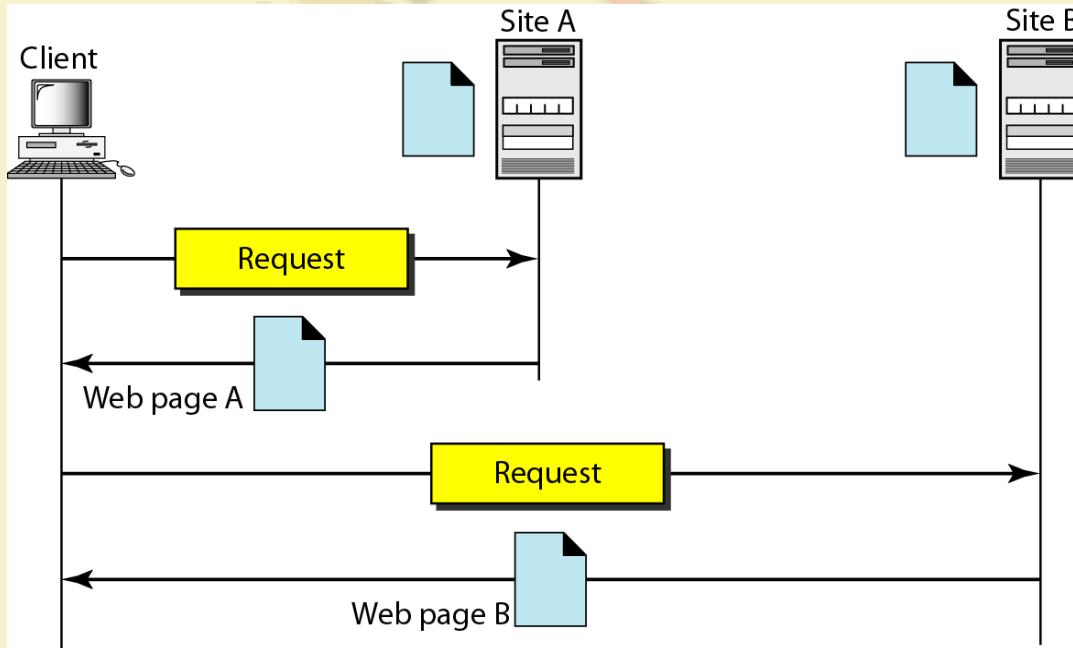


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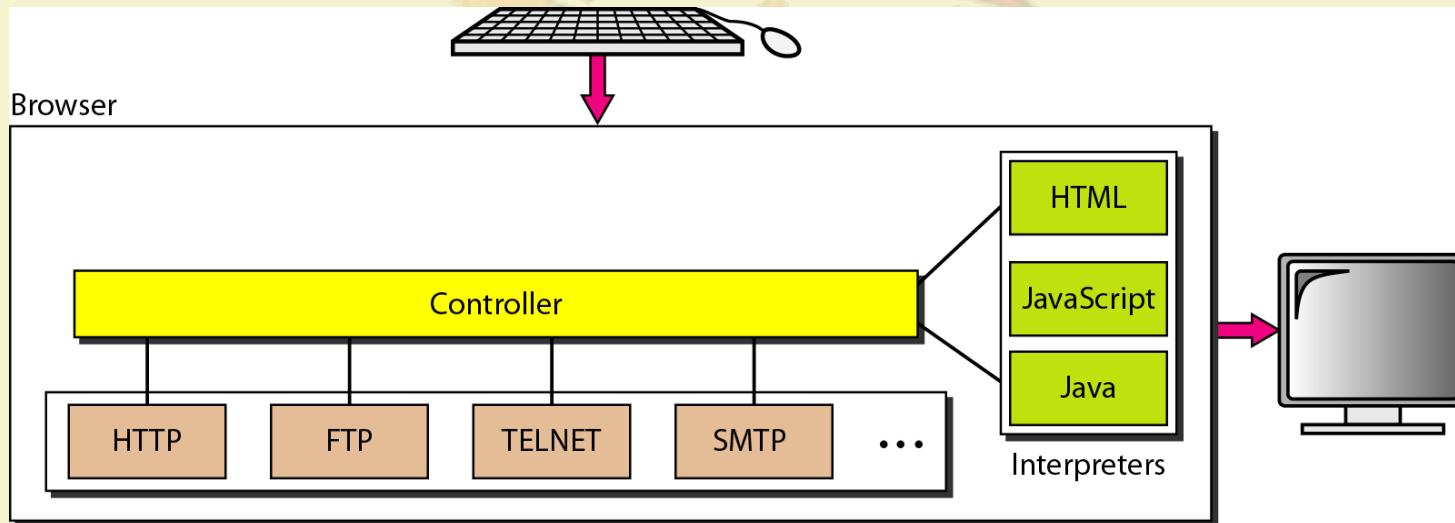
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Operation



Ref: Data Communication and Networking, Forouzan

HTTP Client (Browser)



Ref: Data Communication and Networking, Forouzan

URL



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WEB DOCUMENTS

Web documents can be grouped into three broad categories:

- Static
- Dynamic
- Active

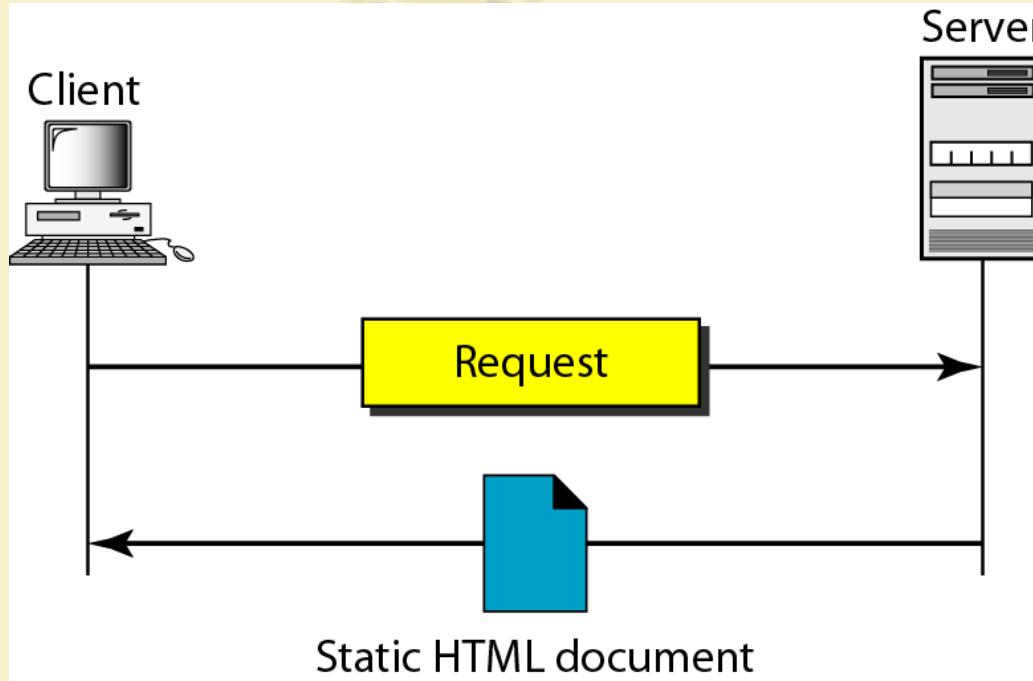


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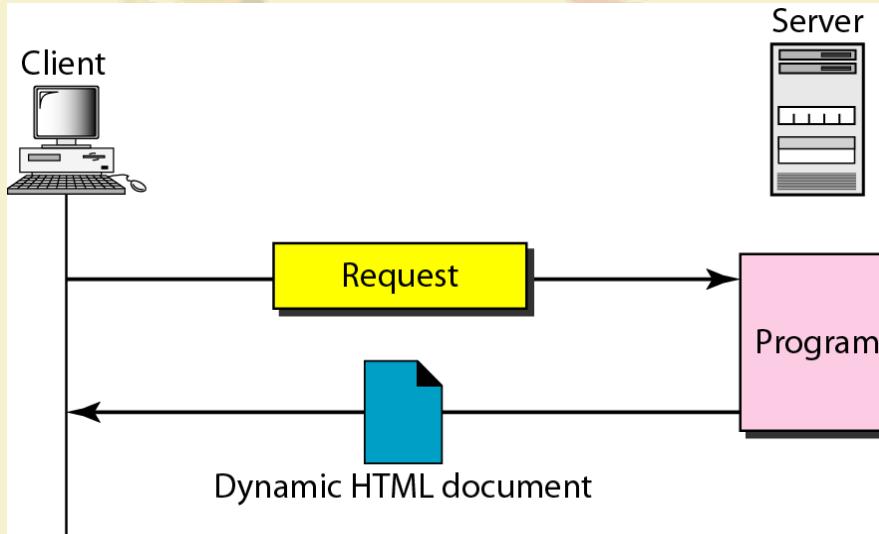
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Static document

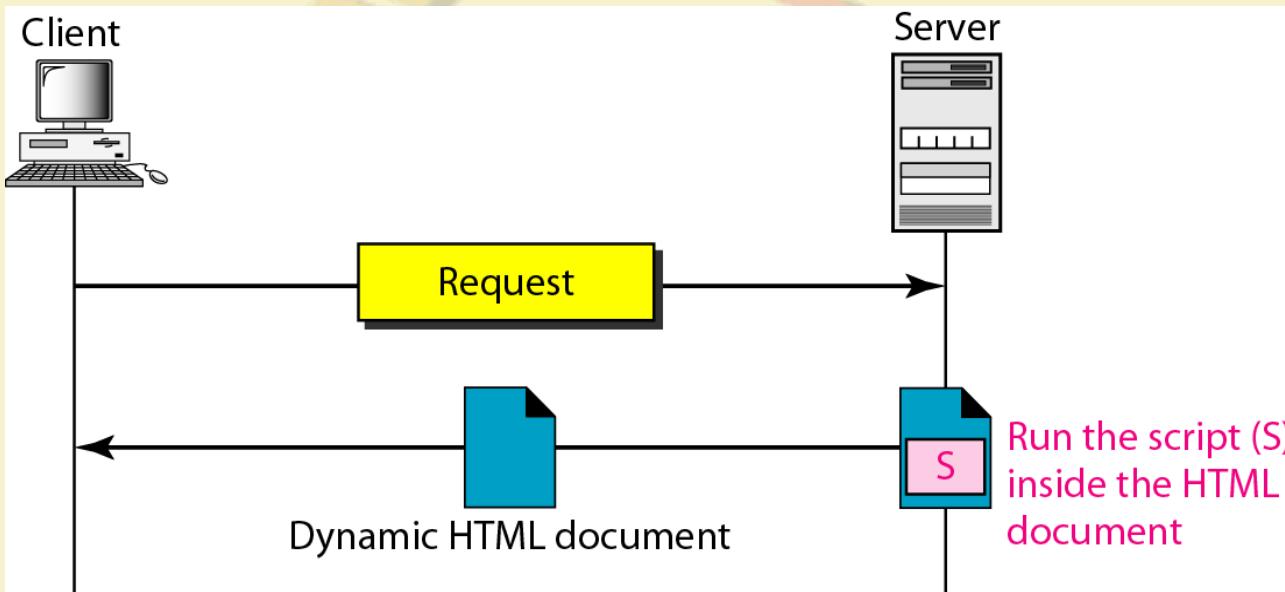


Ref: Data Communication and Networking, Forouzan

Dynamic document using CGI (Common Gateway Interface)

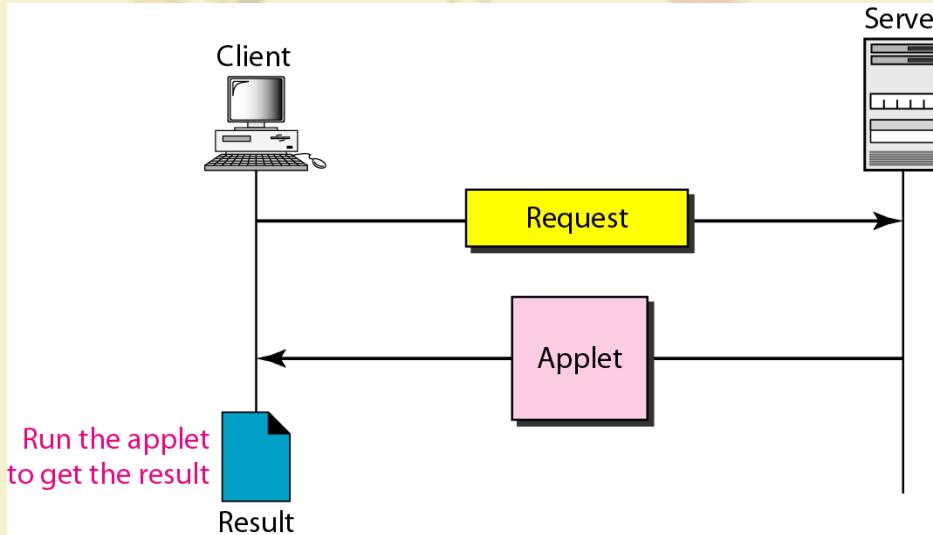


Dynamic document using Server-site script

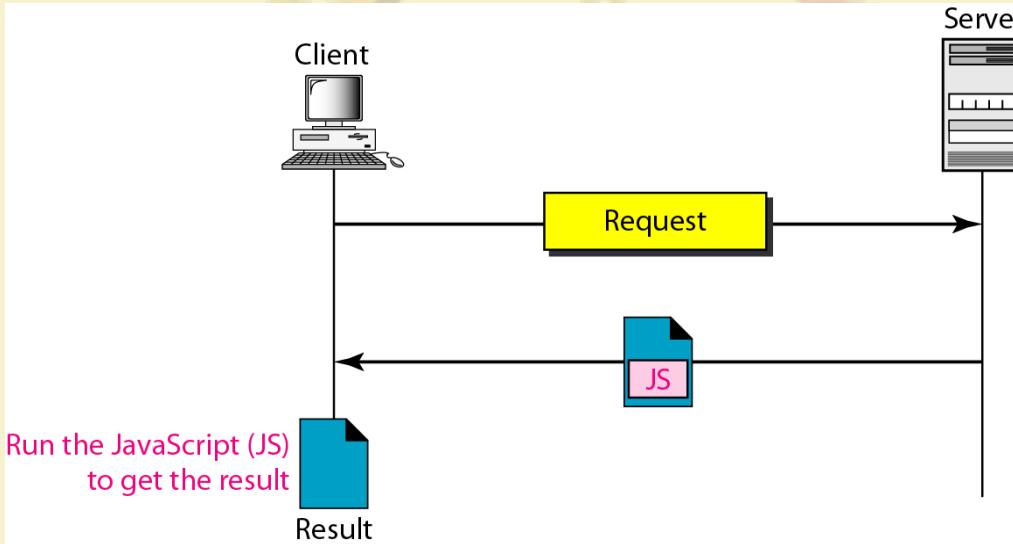


Ref: Data Communication and Networking, Forouzan

Active document using Java applet



Active document using Client-site script

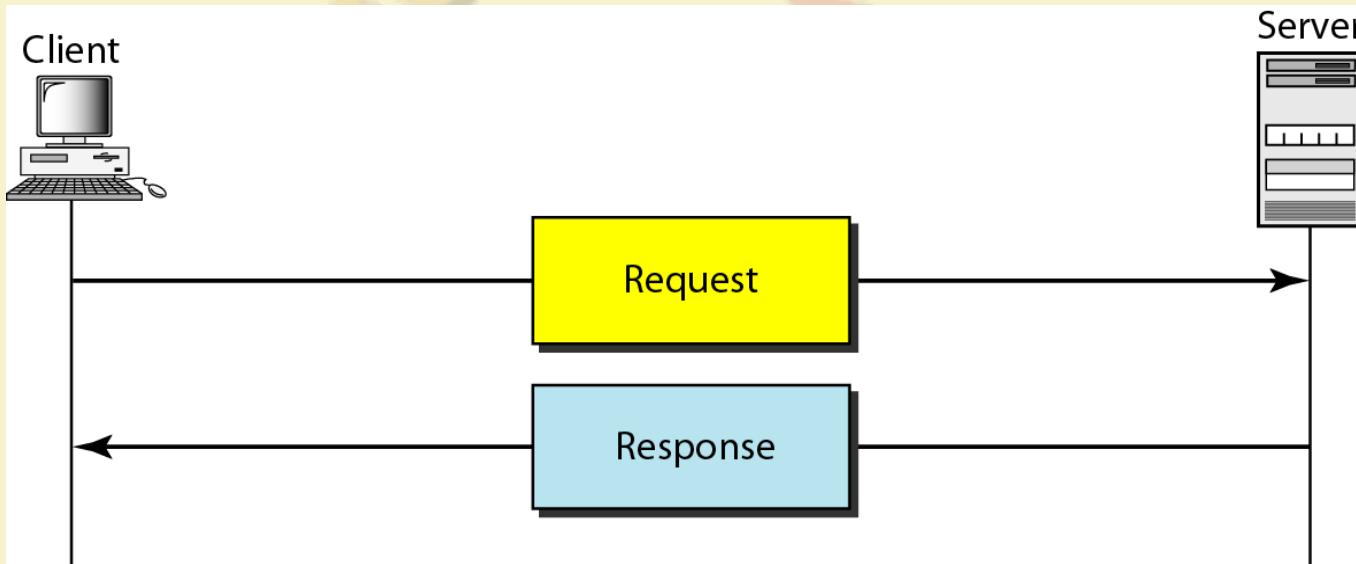


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HTTP transaction

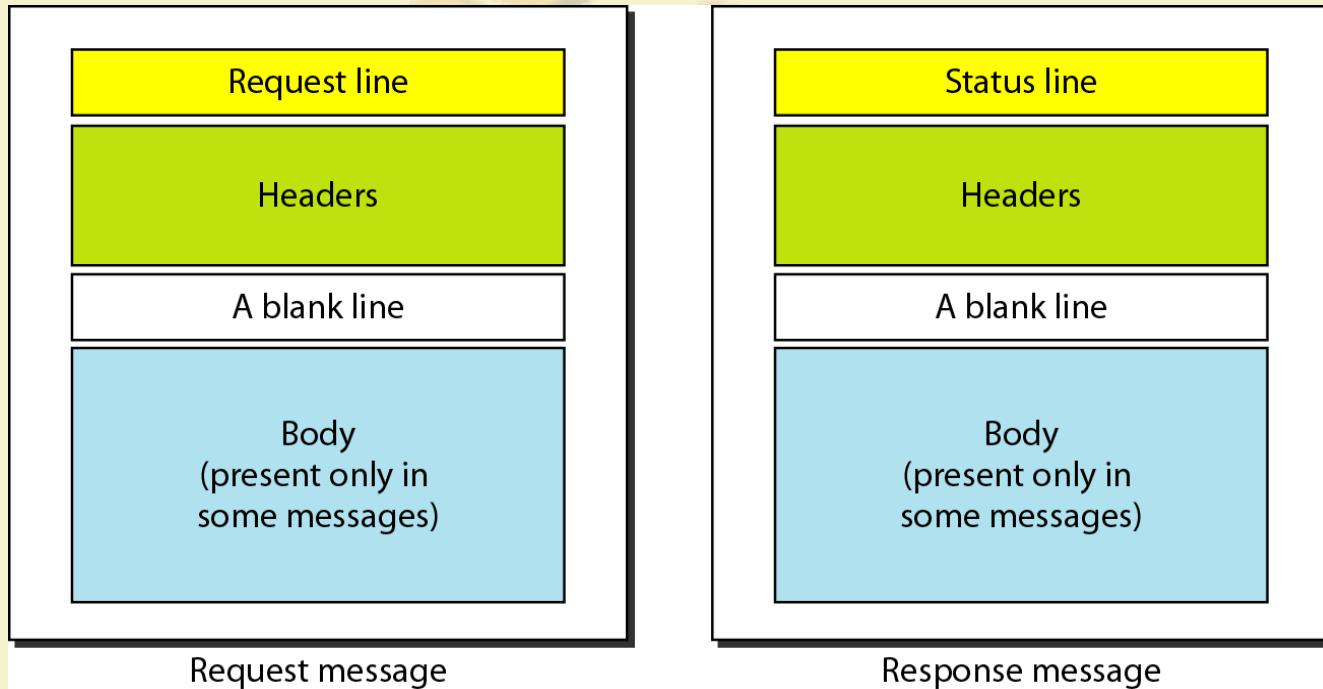


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HTTP: Request and Response messages



Ref: Data Communication and Networking, Forouzan

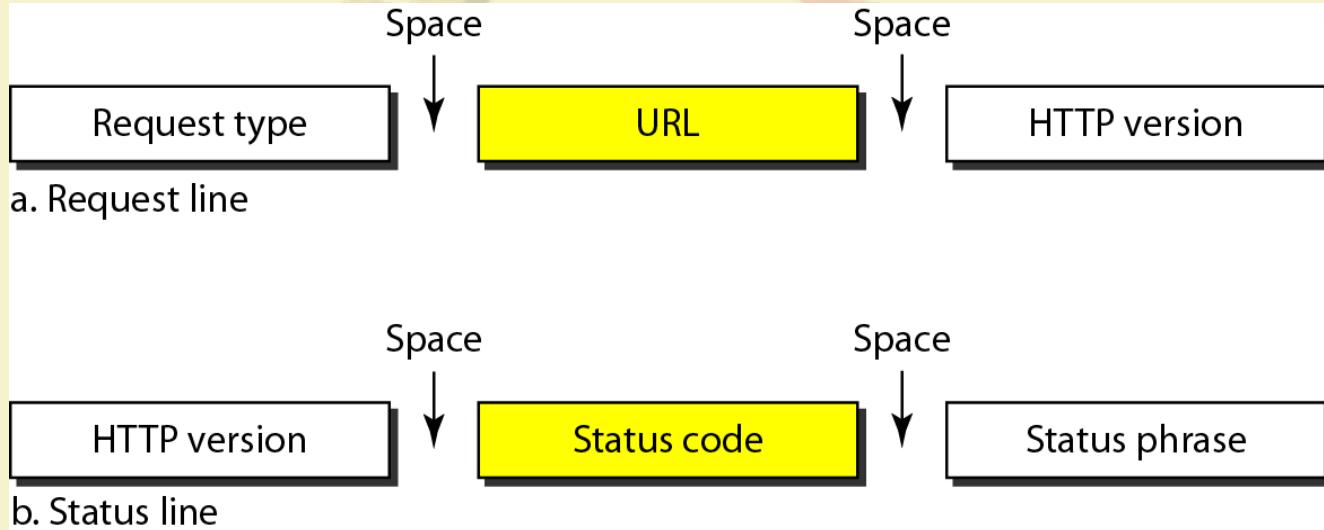


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HTTP Request and Status lines



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HTTP Methods

<i>Method</i>	<i>Action</i>
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

Ref: Data Communication and Networking, Forouzan

HTTP Status Codes

<i>Code</i>	<i>Phrase</i>	<i>Description</i>
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.



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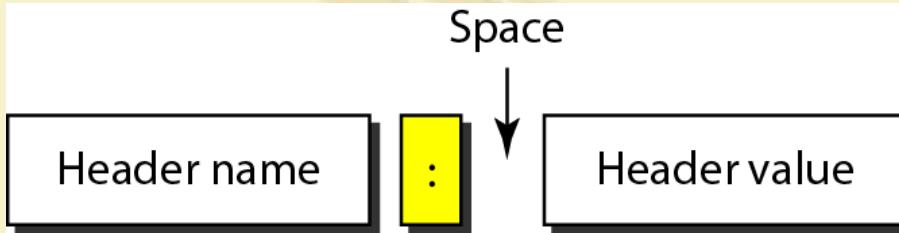


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HTTP Status Codes (contd...)

<i>Code</i>	<i>Phrase</i>	<i>Description</i>
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.

HTTP Header



<i>Header</i>	<i>Description</i>
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



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Request Headers

<i>Header</i>	<i>Description</i>
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

Response Headers

<i>Header</i>	<i>Description</i>
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



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HTTP: Entity headers

<i>Header</i>	<i>Description</i>
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

Example 1

This example retrieves a document. We use the GET method to retrieve an image with the path /usr/bin/image1. The request line shows the method (GET), the URL, and the HTTP version (1.1).

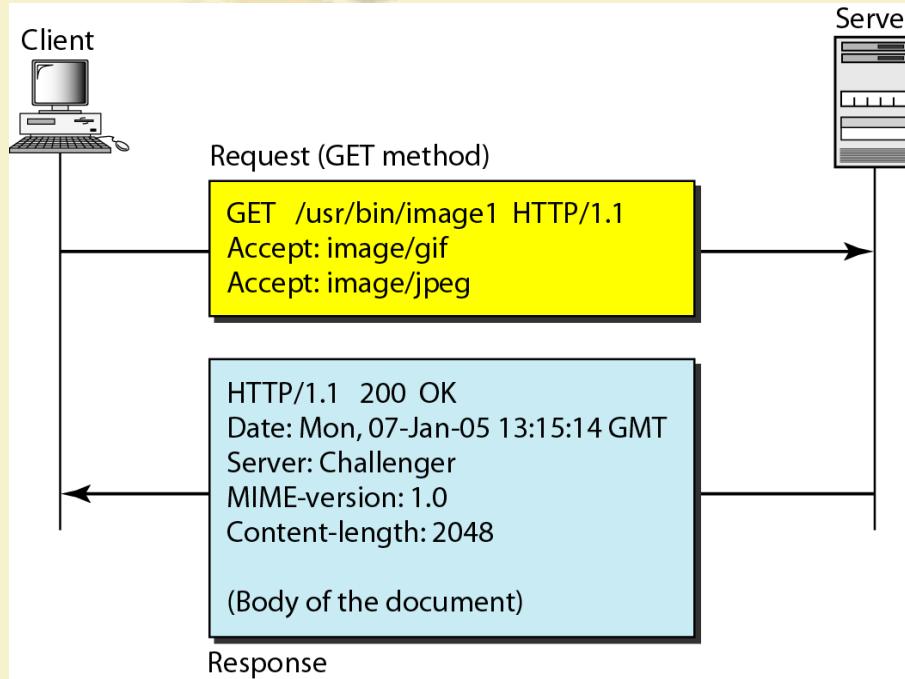
The header has two lines that show that the client can accept images in the GIF or JPEG format. The request does not have a body. The response message contains the status line and four lines of header. The header lines define the date, server, MIME version, and length of the document. The body of the document follows the header.



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Example 2

In this example, the client wants to send data to the server. Use the POST method. The request line shows the method (POST), URL, and HTTP version (1.1). There are four lines of headers. The request body contains the input information. The response message contains the status line and four lines of headers. The created document, which is a CGI document, is included as the body

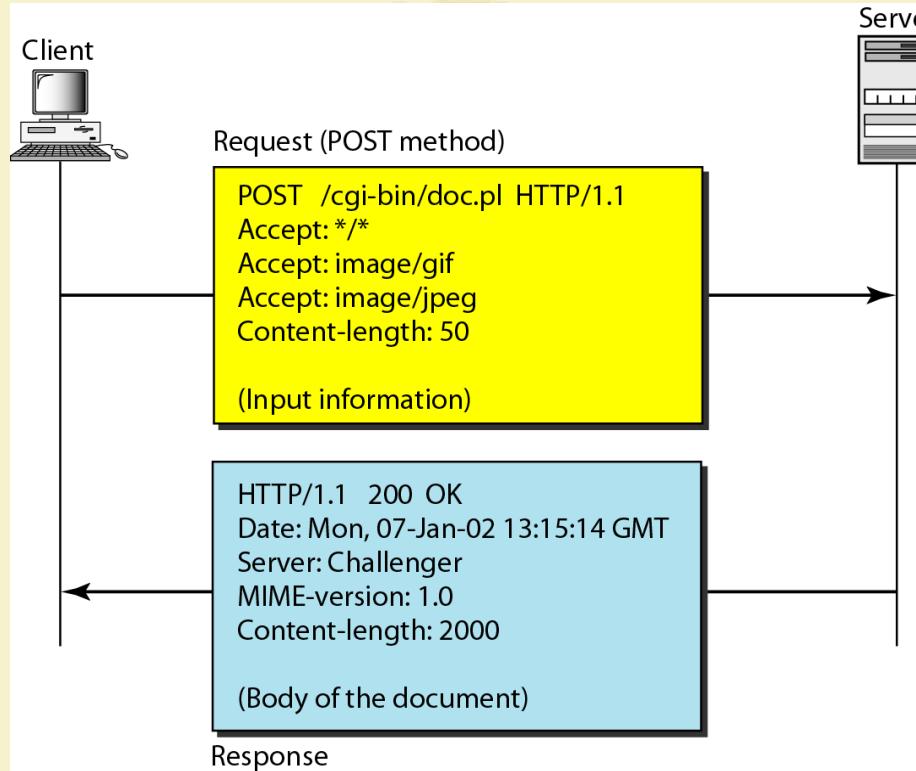


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Example 2



Connecting HTTP server using TELNET

```
$ telnet www.mhhe.com 80
```

```
Trying 198.45.24.104 ...
```

```
Connected to www.mhhe.com (198.45.24.104).
```

```
Escape character is '^]'.  
GET /engcs/compsci/forouzan HTTP/1.1
```

```
From: forouzanbehrouz@fhda.edu
```

HTTP/1.1 200 OK

Date: Thu, 28 Oct 2004 16:27:46 GMT

Server: Apache/1.3.9 (Unix) ApacheJServ/1.1.2 PHP/4.1.2 PHP/3.0.18

MIME-version:1.0

Content-Type: text/html

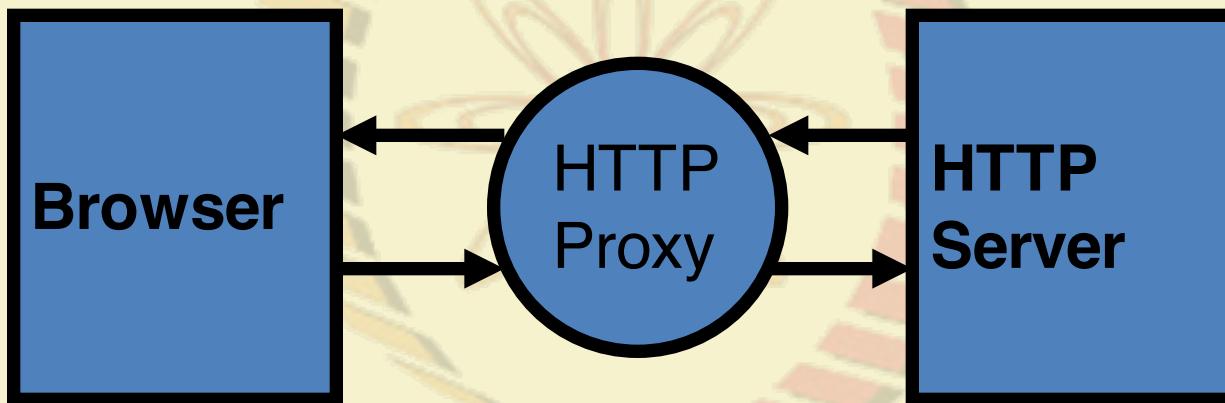


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HTTP Proxy Server



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HTML



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What is HTML?

- Stands for Hyper Text Markup Language
- Computer language used to create web pages
- HTML file = text file containing markup tags such <p>
- Tags tell Web browser how to display a page
- Can have either *.htm or *.html file extension



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HTML Elements

- Tags are the elements that create the components of a page
- Tags surrounded by angle brackets < >
- Usually come in pairs
 - Example: Start tag <p> and end tag </p>
- Stuff between is called “element content”
- Tags are not case sensitive
 - New standard is to use lower case



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Your created HTML document

```
<html>  
  <head>  
    <title> ...document title... </title>  
  </head>  
  <body>  
    ...your page content...  
  </body>  
</html>
```



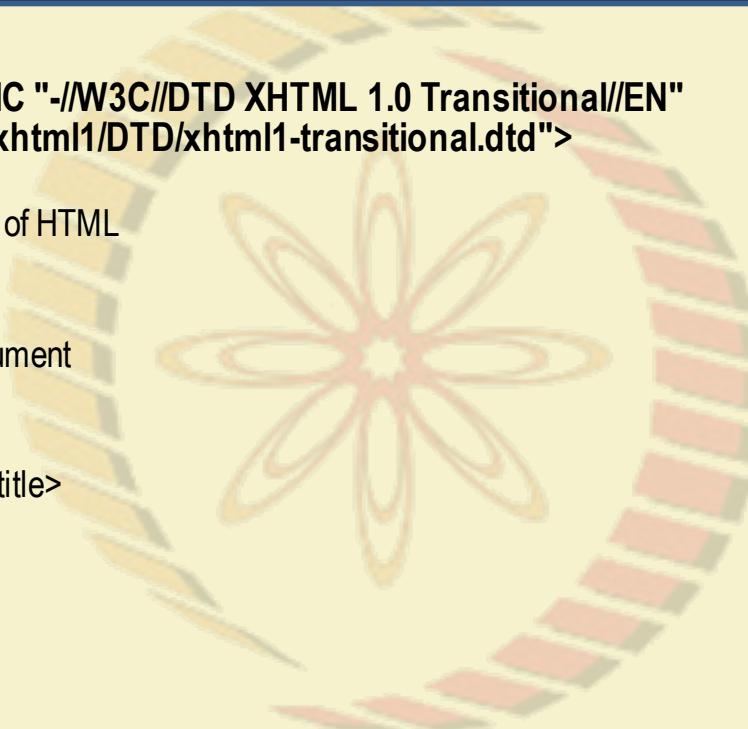
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Page Components

- <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
 - First line of code
 - Declaration of version of HTML
- <html>...</html>
 - Container for the document
- <head>...</head>
 - <title> Title of page </title>
- <body>...</body>
 - Content of page



```
<html>
  <head>
    <title>...document  
title... </title>
  </head>
  <body>
    ...your page content...
  </body>
</html>
```

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Type here to search

8:16 AM
28-Jun-18

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Basic Tags

- Headings
 - `<h1>...</h1>` to `<h6>...</h6>`
 - Like in Word
- Paragraph
 - `<p>... </p>`
 - Inserts a line space before and after a paragraph



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Example of use of Heading

UNIVERSITY OF HAWAII AT MĀNOA LIBRARY

Home | Research Tools | Personal Services | About the Library

Ask Us | Find Books & Media | Your Account | Site Search

Library Exhibits

Exhibits on themes or events of interest to the community are regularly displayed at Hamilton and Sinclair Libraries with the goal of informing our users about the resources at the University of Hawai'i at Manoa libraries. The Exhibits Committee coordinates and facilitates displays in Hamilton and Sinclair Libraries according to the [Exhibits Policy](#). Exhibits are accepted on well-thought out themes, preferably scholarly in nature. Anyone interested in providing an exhibit may complete the [Request to Display in Library](#) form. Floor plans for the [Phase II Gallery](#) and the [Bridge Gallery](#) display the layout and dimensions for each gallery.

For upcoming exhibits at Hamilton Library please view the [Main Exhibits Calendar](#). In addition to the main exhibits, visit the department display cases in Asia Collection, Science and Technology, and Special Collections.

Featured Current Exhibits

February 2007


Ross Togashi Photo Exhibit


Special Collections:
Postcard Exhibit


Bridge Exhibit: Paradise Lost and
Saved



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Link Tag

- Link
 - Anchor tag <a>...
 - 3 kinds
 - Link to page in same folder
 - Link to page in different folder
 - Link to outside webpage on the Internet.



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Example of Anchor Tag

```
<a href="http://www.iitkgp.ac.in">Go to the IITKgp home page</a>
```

address

text in page

- Two components
 - Address
 - Text or description – this is what you see on the page

Image Source Tag

- Empty tag – no closing tag
- Components of Img tag

```

```

- **url** = points to location of the image file
- **alt** = describes image for screen readers



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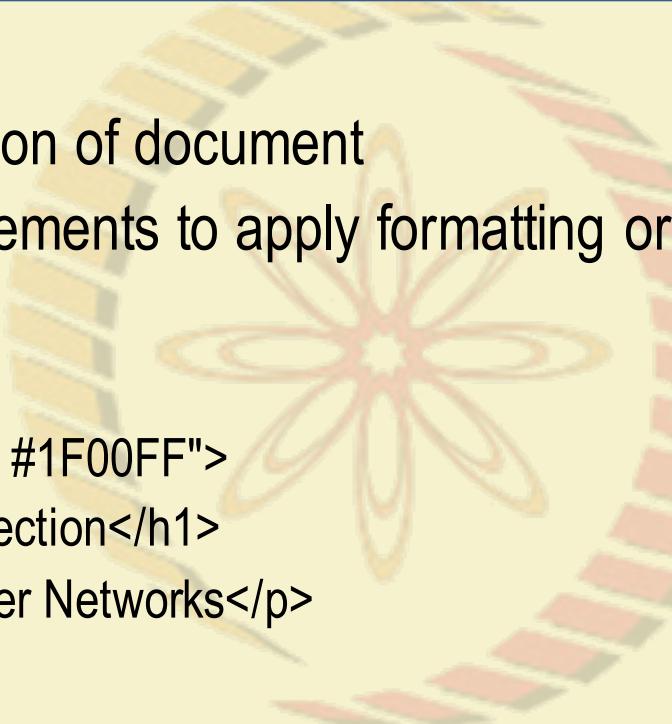
File location

- Same folder: “samplePic.gif”
 - Document-relative link
 - Look for image in same folder
- Different folder named images: “/images/samplePic.gif”

Division Tag

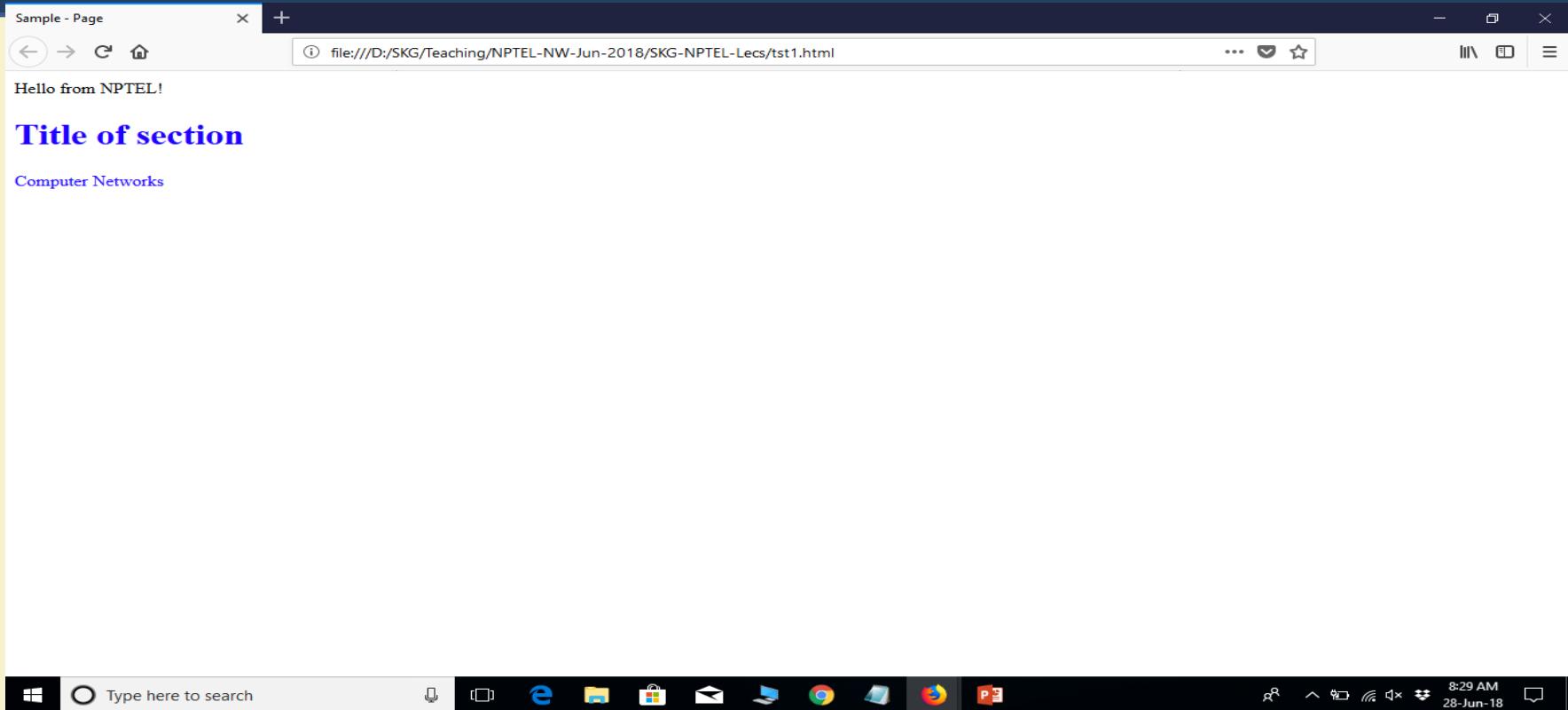
- <div>...</div>
 - Division or section of document
 - Use to group elements to apply formatting or style
 - Example:

```
<div style="color: #1F00FF">
  <h1> Title of section</h1>
  <p> Computer Networks</p>
</div>
```



```
<html>
<head>
<title> Sample - Page</title>
</head>
<body>
Hello from NPTEL!
<div style="color: #1F00FF">
  <h1> Title of section</h1>
  <p> Computer Networks </p>
</div>

</body>
</html>
```



Examples of use of Links

The screenshot shows a library website with a header navigation bar: Home | Research Tools | Personal Services | About the Library. Below the header is a large photograph of a library interior with people at desks. The page is divided into several sections:

- Ask Us**: Includes a Site Search input field and a "Site Search" button.
- Quick Links**:
 - Hours
 - Staff Directory
 - Departments
 - UH Libraries
 - Other Libraries
 - Work @ the Library
 - Donations
 - FAQ
- News & Events**:
 - Touring Paradise: War & South Pacific
 - Karen Peacock PIALA award
 - Faculty Lecture Series
 - Workshops That Matter
- Find Books & Media**: Includes a search input field, a "Search" button, and a link to "[Basic Search]".
- Research Tools**:
 - UH Catalog (Find Books & Media)
 - E-Resources & Databases
 - Electronic Journals
 - Browse by Subject
 - Quick Facts
 - Digital Collections
 - More Tools...
- About the Library**:
 - Hours
 - Directions
 - Maps (Floorplans)
 - Study Rooms
 - Staff Directory
 - Departments
 - Computing
 - Library Calculator
 - Library Exhibits
 - More About the Library...
- Featured Resources**: Includes a dropdown menu labeled "Choose one" and a "Go" button.
- Personal Services**:
 - Your Account/Renew Books
 - Course Reserves
 - Accessibility
 - Purchase Suggestions
 - Loans from Other Libraries
 - LILO
 - Instruction
 - More Services...
- New @Your Library**: A thumbnail image showing a tax form with the text "1040 U.S." and "Tax forms Available In Hamilton Near the Reference Desk".



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Typical HTML document

```
<html>  
  <head>  
    <title> ...document title... </title>  
  </head>  
  <body>  
    ...your page content...  
  </body>  
</html>
```



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End Product

- <html>
- <head>
- <title>Author's Page</title>
- </head>
- <body>
- <div>
- Home

- Courses

- Personal

- </div>
- <p>Hello my name is XYZ and I am writing about myself. Contact info:
- Web Team
- <div>
-
- </div>
- </div>
- </body>
- </html>



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Next Mission

- Choose colors for your page
 - Text color
 - Link color
 - Background color
- Choose font size
 - Type of font
 - Font size



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TELNET

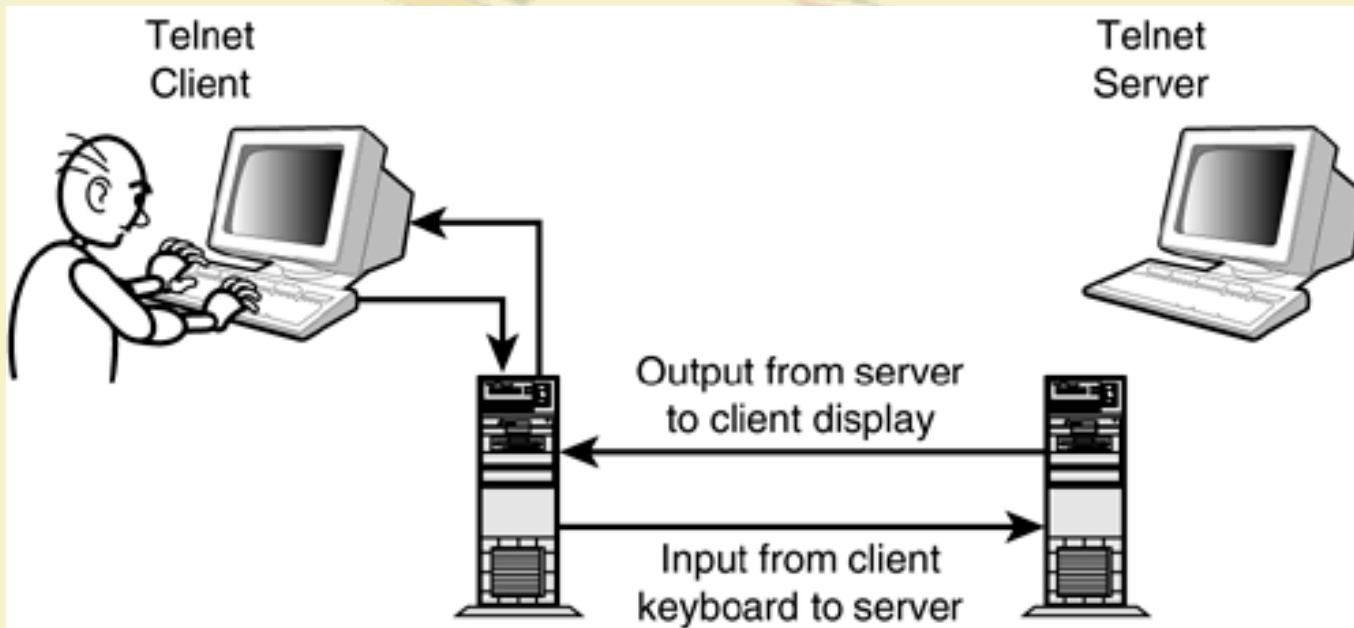


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TELNET



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TELNET vs. telnet

- TELNET is a *protocol* that provides “a general, bi-directional, eight-bit byte oriented communications facility”.
- **telnet** is a *program* that supports the TELNET protocol over TCP.
- Many application protocols are built upon the TELNET protocol.



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The TELNET Protocol

❑ Reference: RFC 854

- TCP connection (Popular port: 23)
- Data and control over the same connection.
- Network Virtual Terminal
 - intermediate representation of a generic terminal.
 - provides a standard language for communication of terminal control functions.

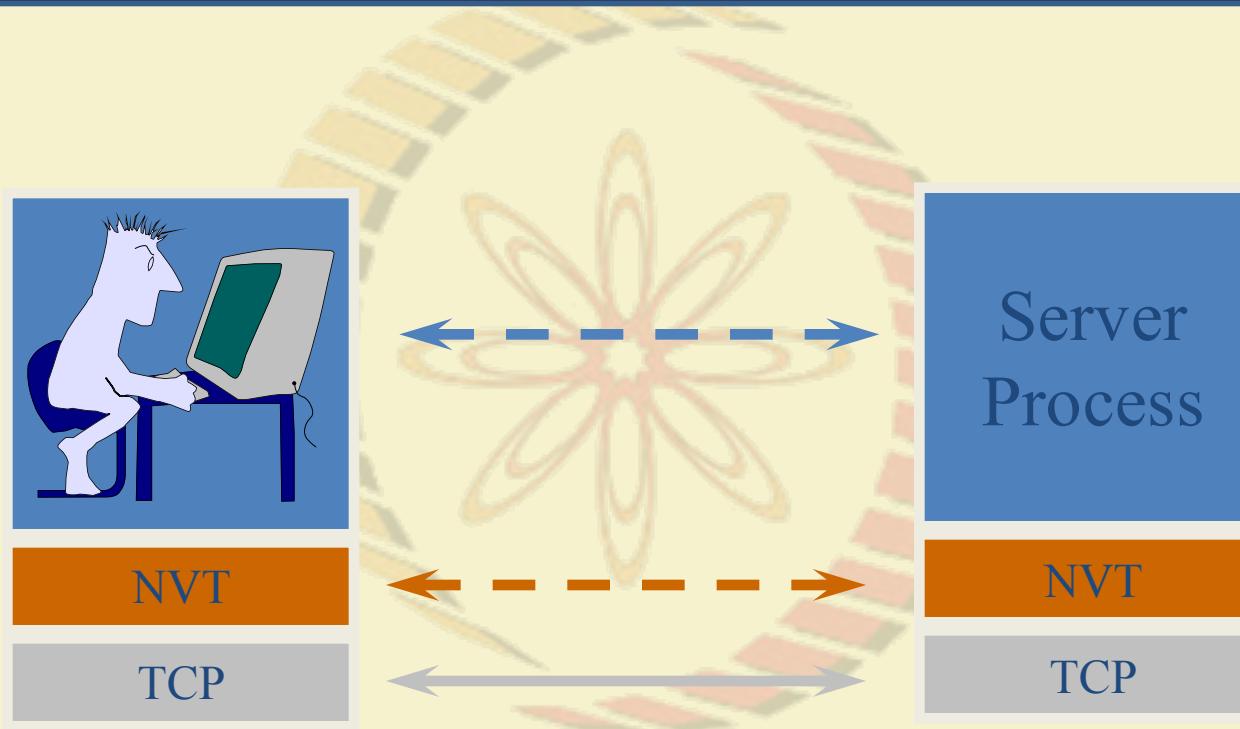


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Network Virtual Terminal (NVT)

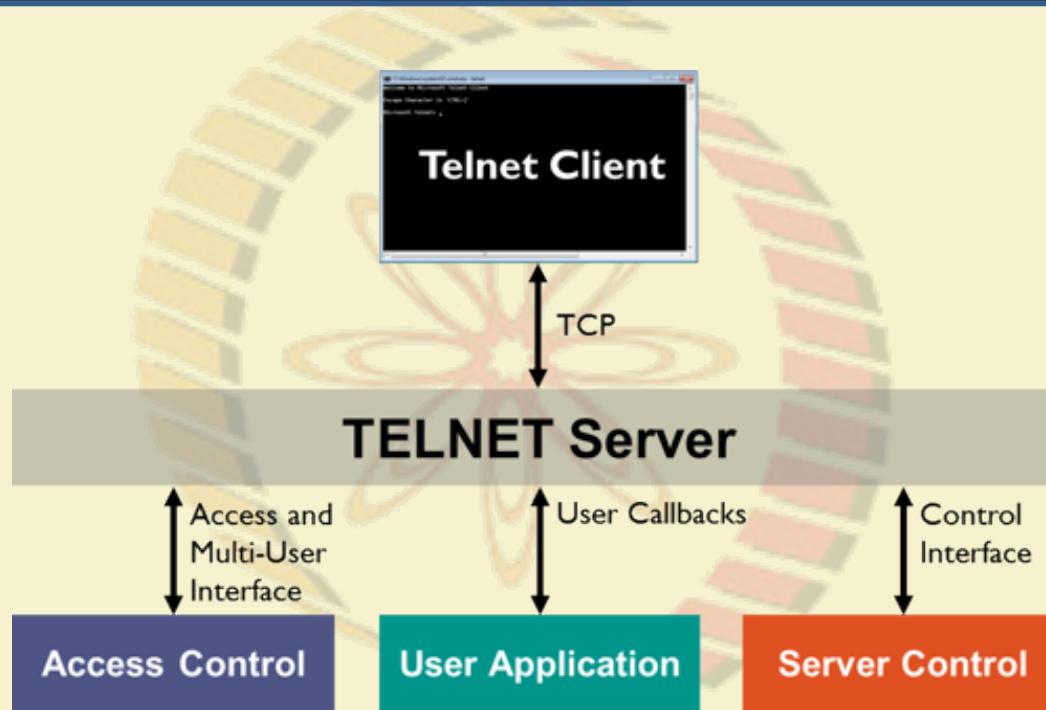


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TELNET



Negotiated Options

- All NVTs support a minimal set of capabilities.
 - Some terminals have more capabilities than the minimal set.
- The set of options is not part of the TELNET protocol,
 - so that new terminal features can be incorporated without changing the TELNET protocol.
- Two endpoints negotiate a set of mutually acceptable options
 - Line mode vs. character mode
 - echo modes
 - character set (EBCDIC vs. ASCII)



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Control Functions

- TELNET includes support for a series of control functions commonly supported by servers.
- This provides a uniform mechanism for communication of (the supported) control functions.



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Control Functions

- Interrupt Process (IP)
 - suspend/abort process.
- Abort Output (AO)
 - send no more output to user's terminal.
- Are You There (AYT)
 - check to see if system is still running.
- Erase Character (EC)
 - delete last character sent
- Erase Line (EL)
 - delete all input in current line.



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Command Structure

- All TELNET commands and data flow through the same TCP connection.
- Commands start with a special character called the Interpret as Command escape character
 - The IAC code is 255.
 - If a 255 is sent as data - it must be followed by another 255.
- If IAC is found and the next byte is IAC
 - a single byte is presented to application/terminal
- If IAC is followed by any other code
 - the TELNET layer interprets this as a command.



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TELNET Operations

- You can use the **telnet** program to play with the TELNET protocol.
- **telnet** is a *generic* TCP client.
 - Sends whatever you type to the TCP socket.
 - Prints whatever comes back through the TCP socket
 - Useful for testing TCP servers (ASCII based protocols).
- Many Unix systems have these servers running (by default):
 - **echo** port 7 **discard** port 9
 - **daytime** port 13 **chargen** port 19



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telnet hostname port

```
> telnet skg.cse.edu 7
Trying 234.197.140.246...
Connected to skg.cse.edu
(234.197.140.246).
Escape character is '^]'.
Hi SKG
Hi SKG
Testing telnet
Testing telnet
^]
telnet> quit
Connection closed.
```

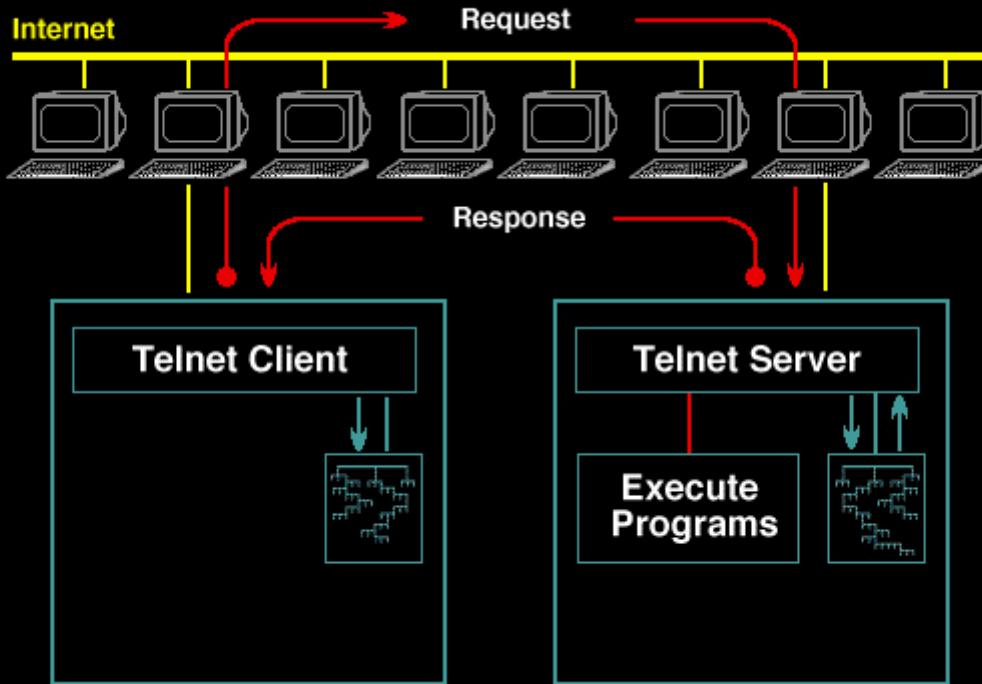


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TELNET



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thank you!



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