Hypertext Transfer Protocol (HTTP)

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- HTTP and Client-Server model
- DNS and URL
- HTTP Request and response
- Character encoding
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HTTP

- **HTTP = Hypertext Transfer Protocol**
  - Application-level protocol for distributed, collaborative, hypermedia information systems.
  - Used for retrieving inter-linked resources led to the establishment of the World Wide Web.
  - HTTP is a request/response standard of a client and a server.
  - Client is the end-user using web browser
  - Server is the web site.
- Between client and server there may be several intermediaries: proxies, gateways, and tunnels.
- Typically, an HTTP client initiates a request to server over TCP
- An HTTP server listens at a particular port (80 by default) waits for the request messages from clients.
- Standardization: RFC2616 (HTTP 1.1):

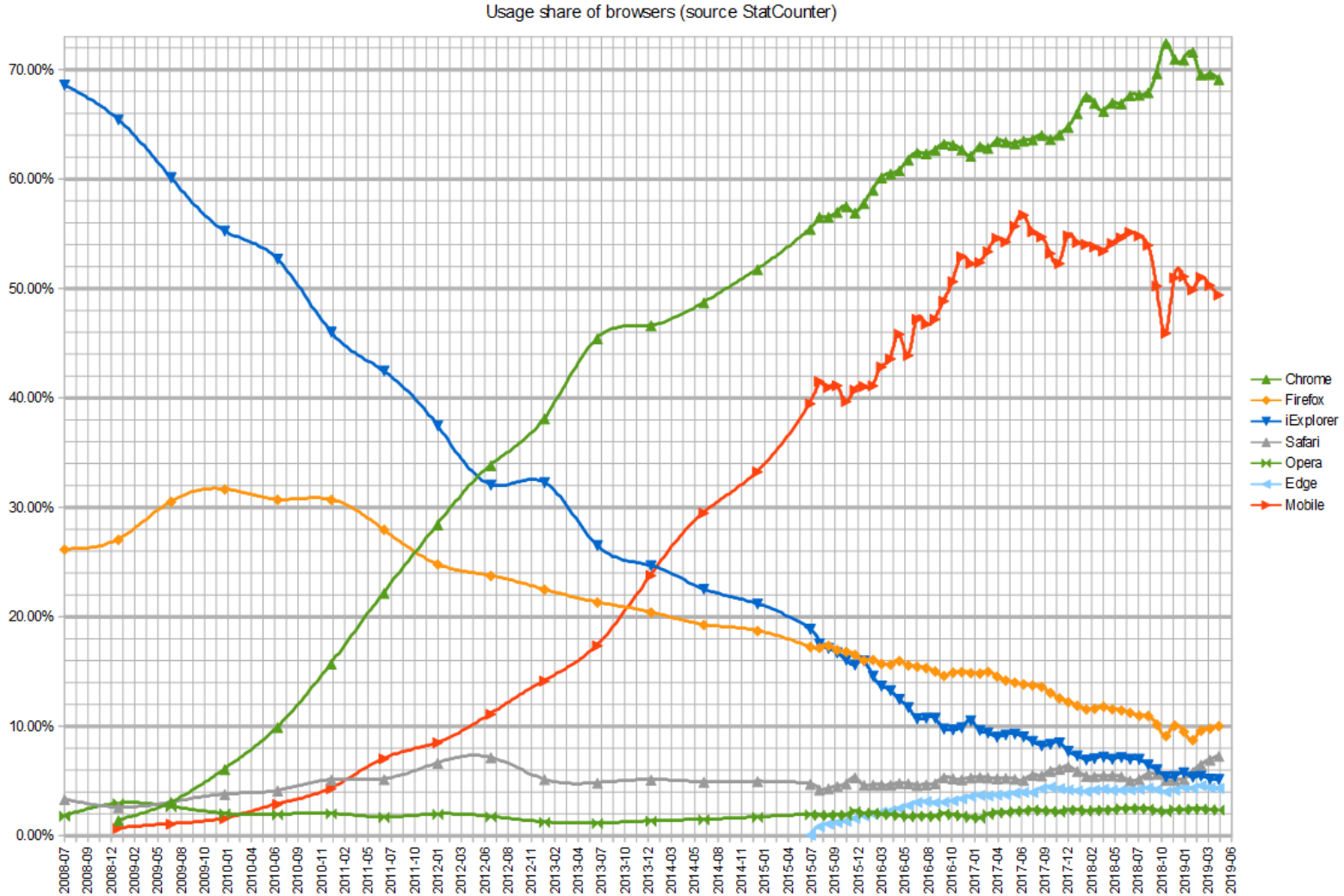
  http://www.w3.org/Protocols/rfc2616/rfc2616.html

Examples of Web server and client

- Web server
  - IIS: windows
  - Apache HTTP server (Apache): windows, linux
- Web client (Browser)
  - Internet Explorer:
    - Free with Windows license, started in 1995
    - Support Windows
  - Mozilla Firefox from Mozilla Corporation
    - free browser,
    - Support: Linux, Mac OS X, Microsoft Windows, and many other Unix-like operating system
  - **Safari:** developed by Apple Inc.
    - Support Mac OS, Windows, iPhone OS
  - Chrome: from Google
    - Free
    - Support

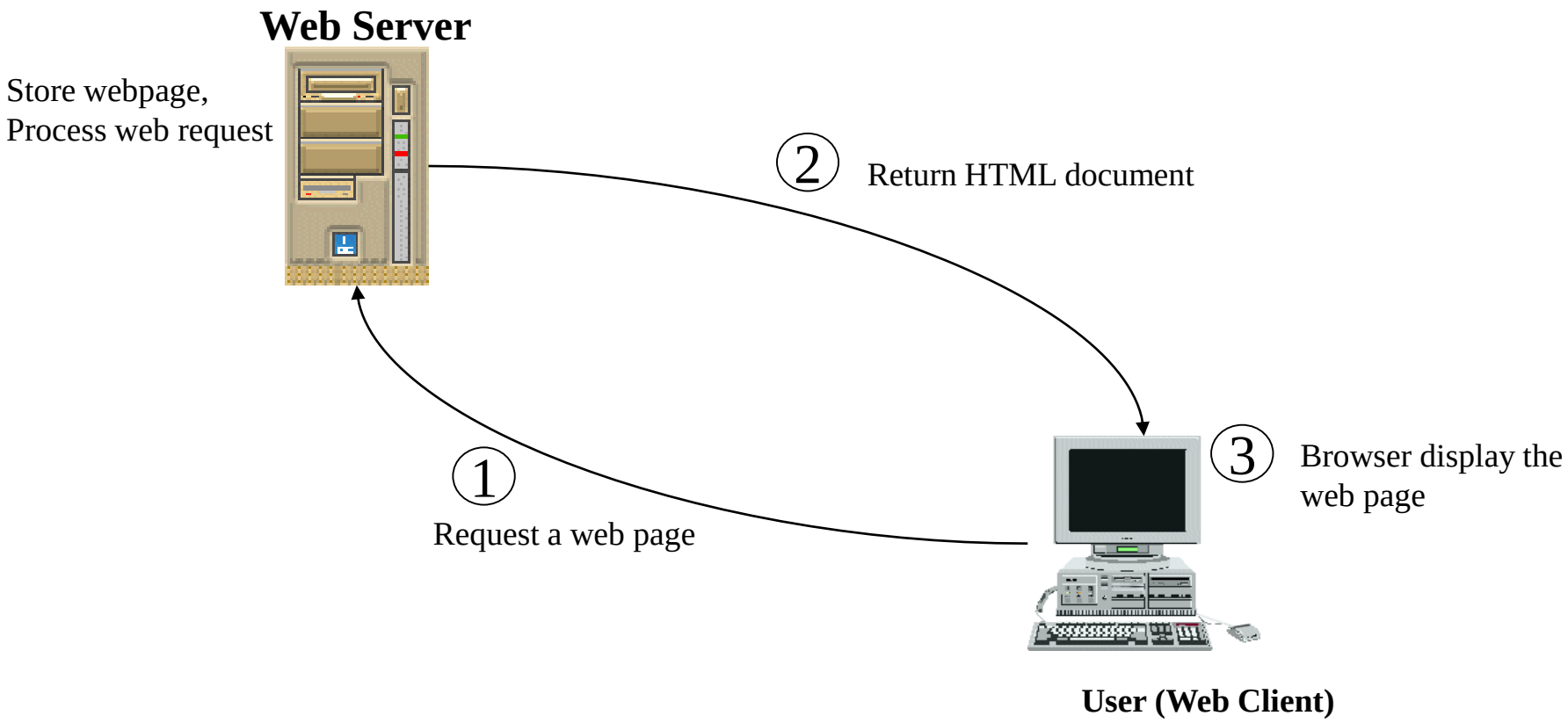
Usage share of web browsers

- Wikipedia: http://en.wikipedia.org/wiki/Usage_share_of_web_browsers

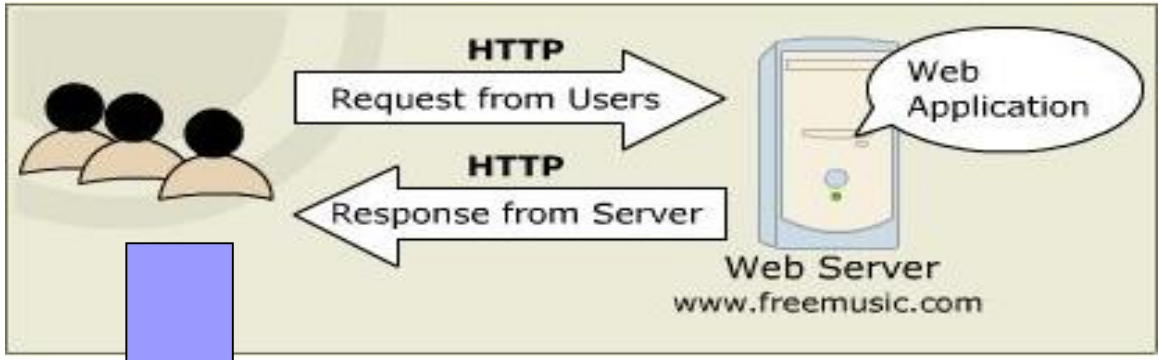


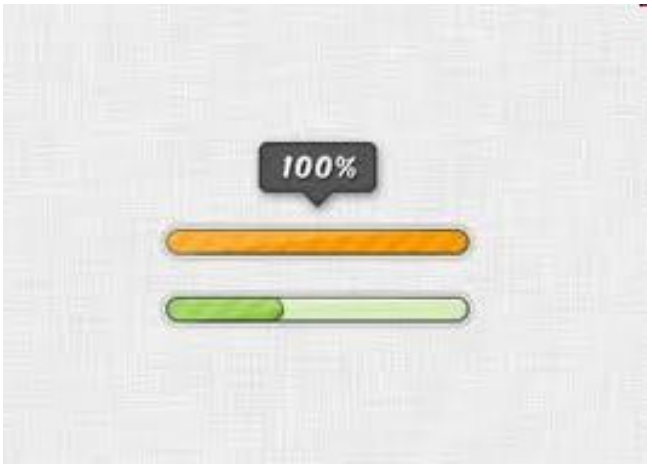
Server Client model

- Server client model of Web system
- HTTP protocol between Client, Server



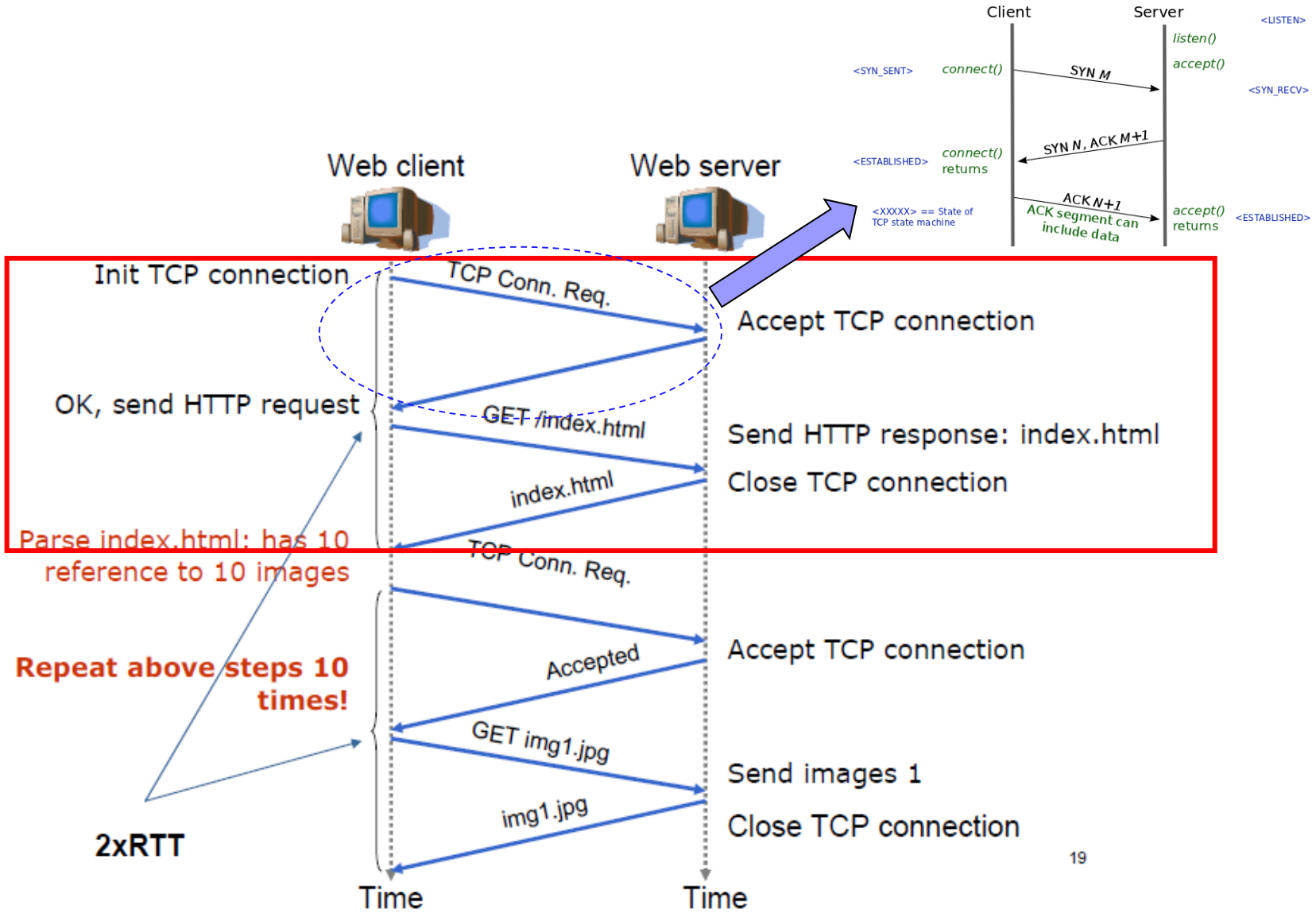
HTTP request and response





How browser know to display download progress bar for 1 HTTP request/response?

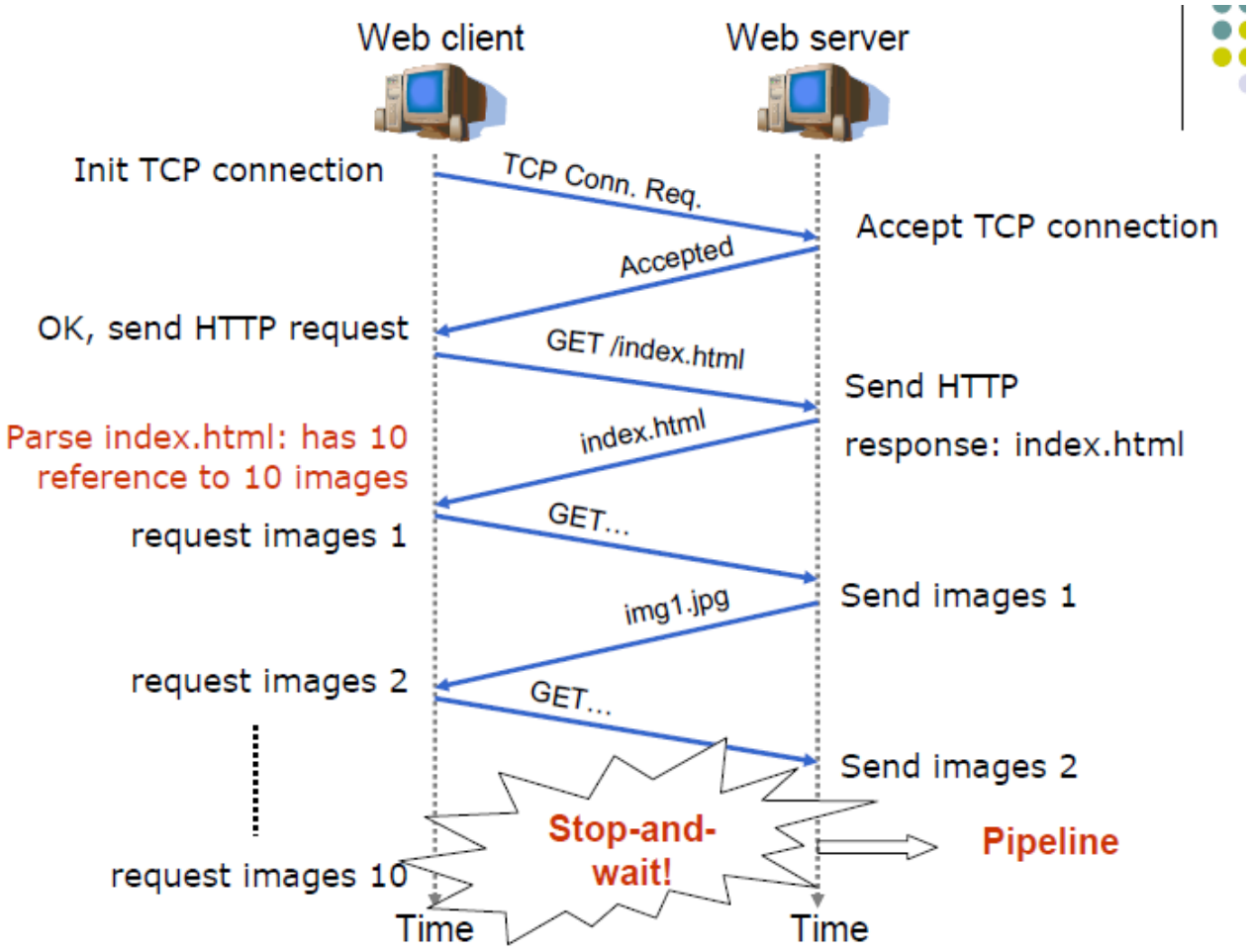
HTTP request and response v.1.0



HTTP request and response

- Procedure:
  - HTTP Client (Web Browsers) opens the connection
  - HTTP Client sends the request message to an HTTP server asking for resource.
  - The server returns the response message with the request resource.
  - Once the resource is delivered, Server closes the connection.
- HTTP doesn't store any connection information and ➔ stateless protocol.
- In HTTP Connection last for only one transaction. A transaction consists a of several request-response pairs.
- The default port is 80.

HTTP request and response v.1.1

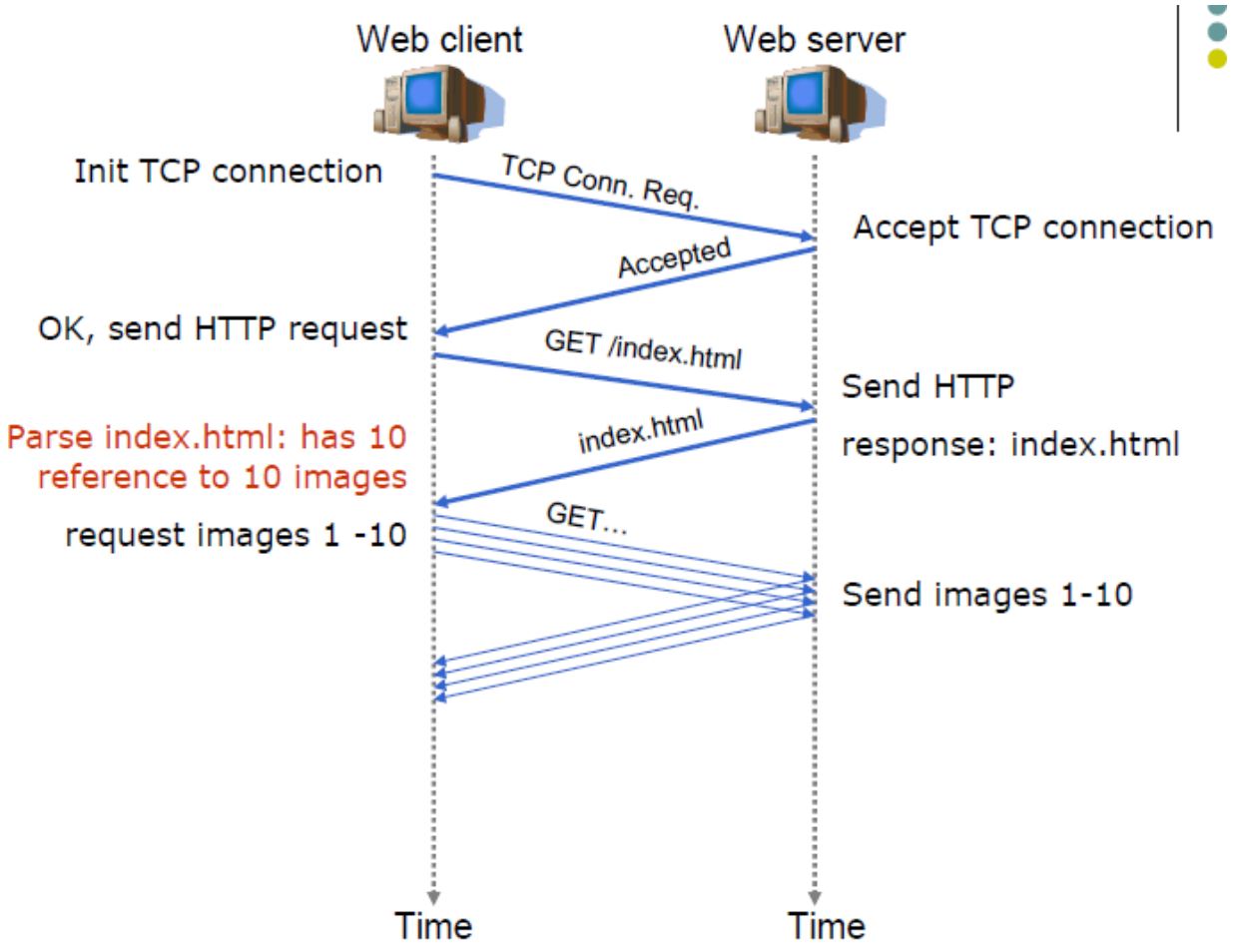


RFC2616: HTTP/1.1 servers SHOULD maintain persistent connections and use TCP's flow control mechanisms to resolve temporary overloads, rather than terminating connections with the expectation that clients will retry

HTTP 1.1

- This is the HTTP version currently in common use.
- Introduced critical performance optimizations and feature enhancements
  - persistent and pipelined connections
  - compression/decompression
  - content negotiations
  - virtual hosting (a server with a single IP Address hosting multiple domains)
  - faster response and great bandwidth savings by adding cache support.
- Many performance optimization in “black art”
  - Connection management - particularly knowing when and how to close connections - is one of the practical point of HTTP

HTTP request and response v.1.1 pipeline



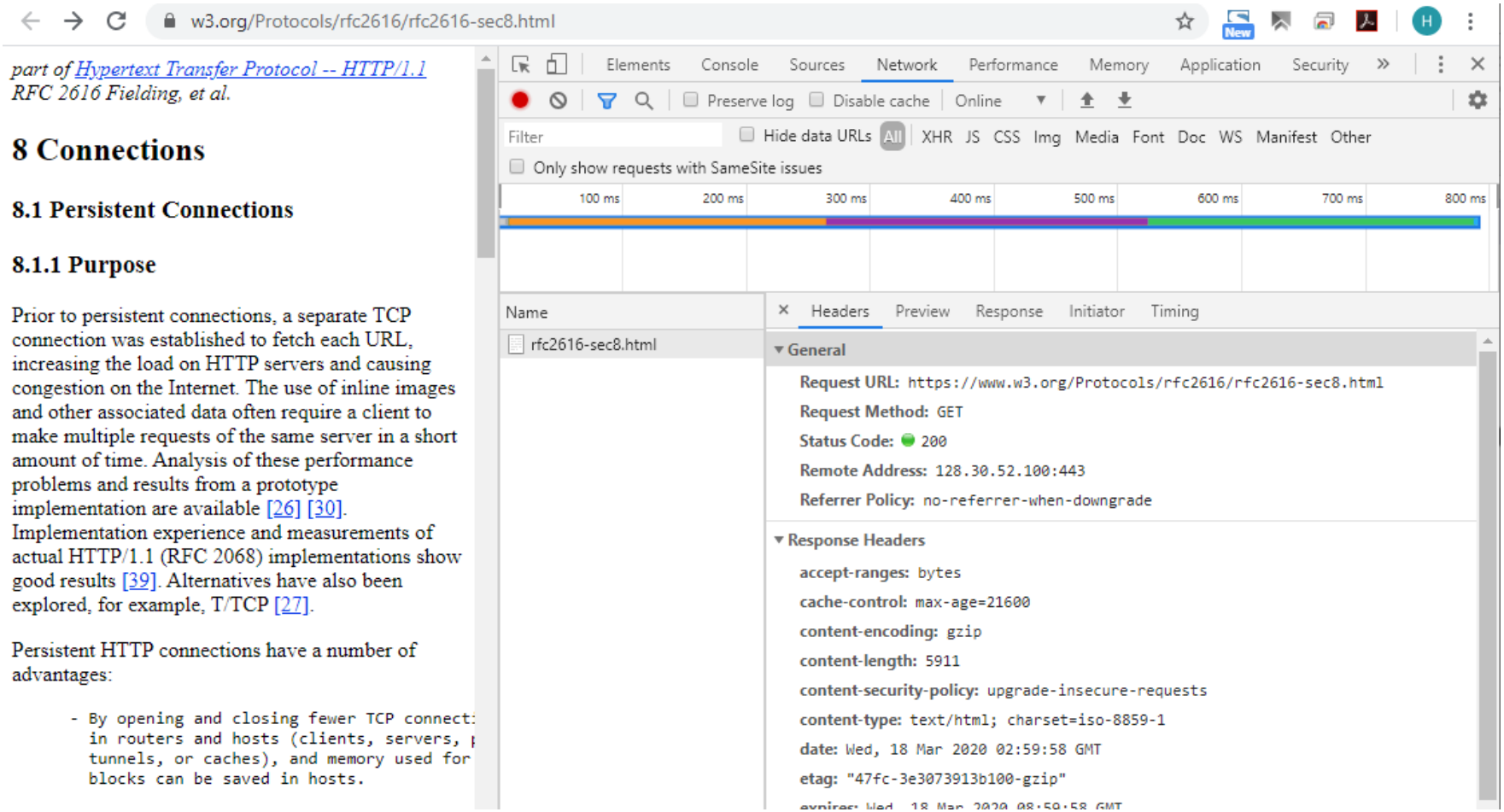
RFC2616: A client that supports persistent connections MAY "pipeline" its requests (i.e., send multiple requests without waiting for each response). A server MUST send its responses to those requests in the same order that the requests were received.

HTTP Message Structure

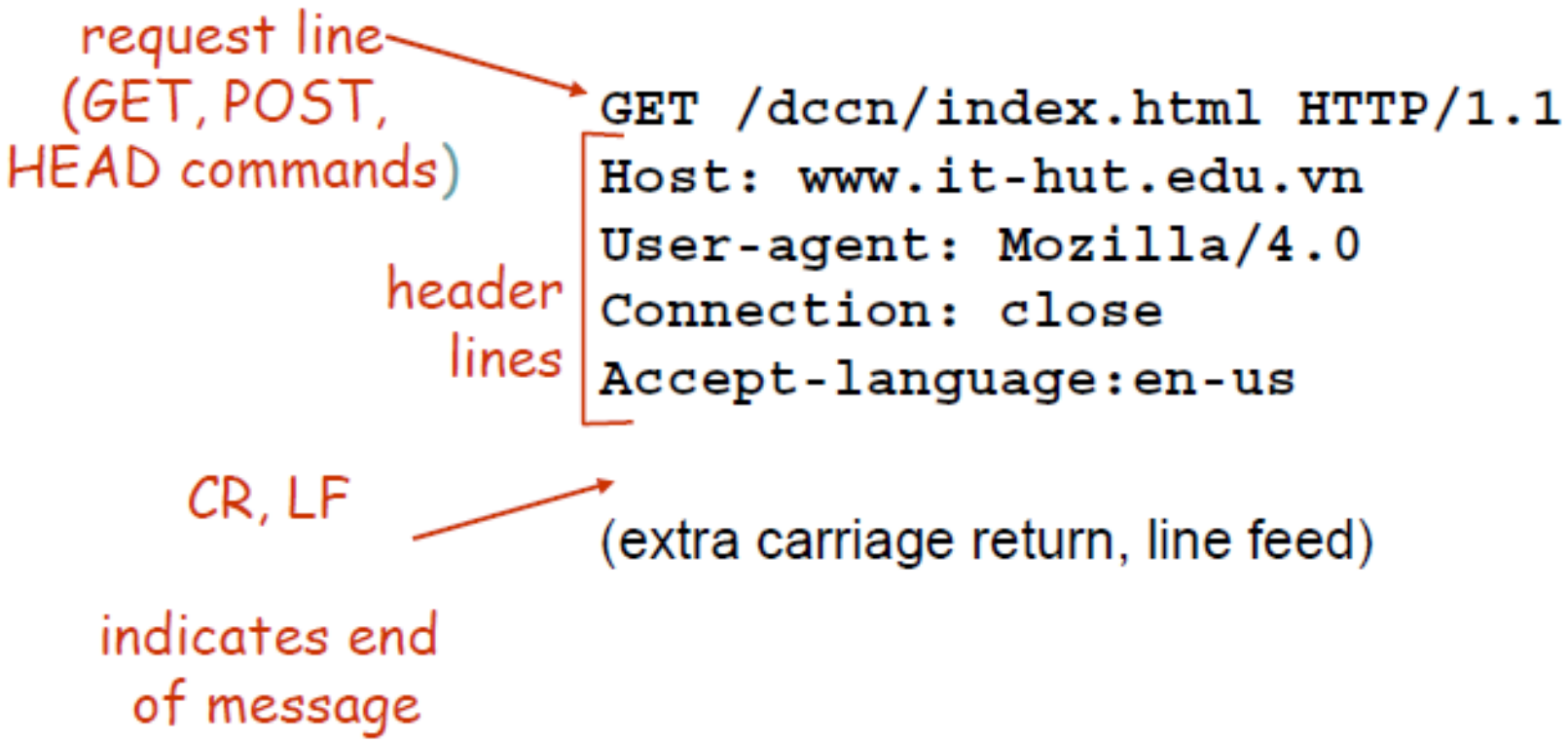
- By free text as many application level procotols
- Fields by keywork, separated by line – CRLF (Carriage Return & Line Feed)
- Zero or more header lines CRLF
- A blank line ie. a CRLF
- An optional message body like file, query data or query output.

➔ Chrome development tool to debug HTTP messages sent & received within browser

Chrome development tool

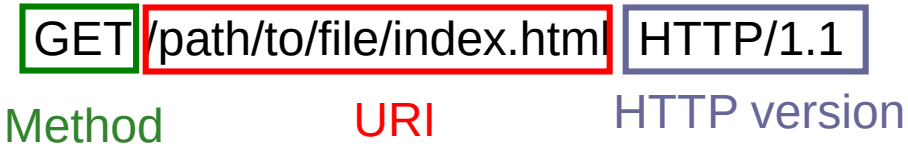


HTTP Request Message



HTTP Request Message: initial line

- Initial line has three parts, separated by spaces:
  - An HTTP Method Name (HTTP keyword)
  - The local path of the requested resource.
  - The version of HTTP being used.
- Example of initial line:



- Methods: GET, POST
- The HTTP version always takes the form **"HTTP/x.x"**, uppercase.

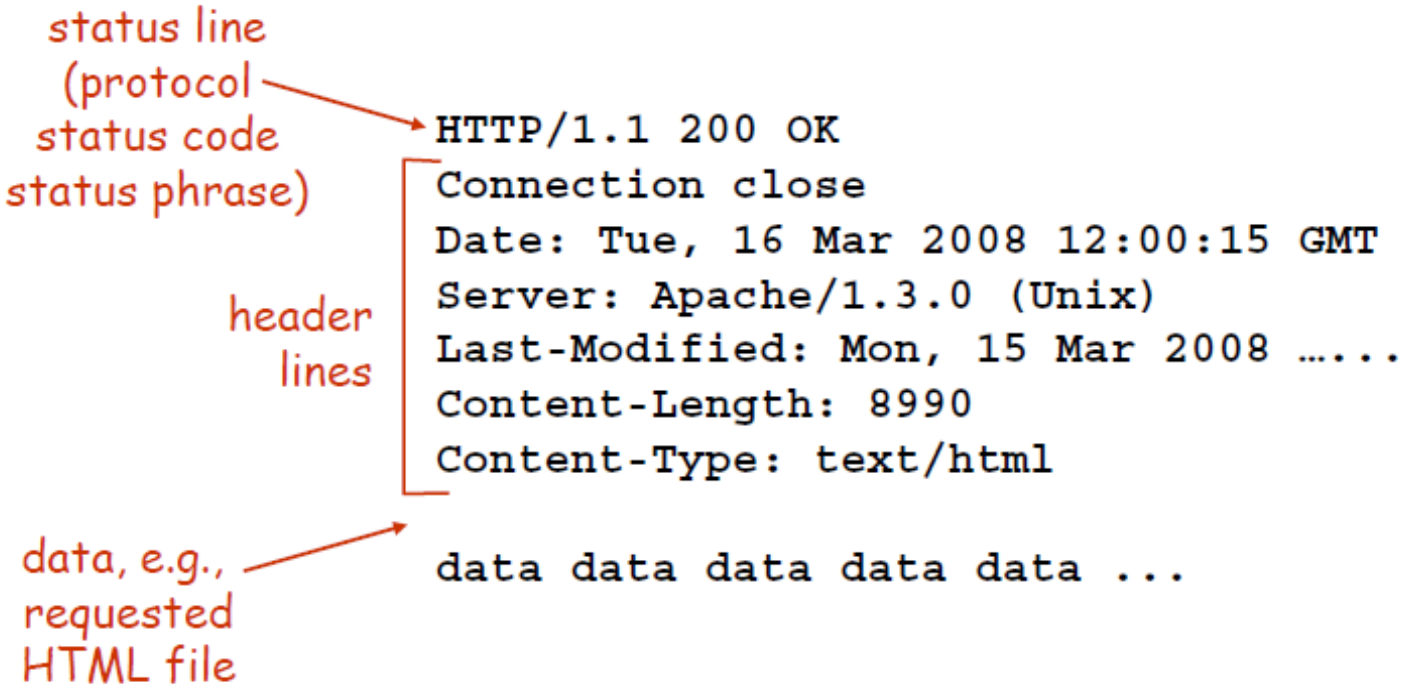
GET and POST methods

- GET method used for getting information:
  - document,
  - a simple database query
- Parameter of GET is seen in the URL
  - Ex: http://www.google.co.uk/search?hl=en&q=java&meta=
- POST method is used when submitting information
  - credit card number,
  - information to be saved in the database.
  - Data is included in the body of the request
- Data send using POST is not visible to the client and there is not limit on amount of data being sent.

HTTP Response Message: initial line

- The initial response line, called the status line, has three parts separated by spaces:
  - The version of HTTP being used.
  - A response status code that gives the result of the request.
  - An English reason phrase describing the status code.
- Examples:
  - HTTP/1.0 200 OK
  - HTTP/1.0 404 Not Found

HTTP Response Message



HTTP Response codes

200 OK

- request succeeded, requested object later in this message

301 Moved Permanently

- requested object moved, new location specified later in this message (Location:)

400 Bad Request

- request message not understood by server

404 Not Found

- requested document not found on this server

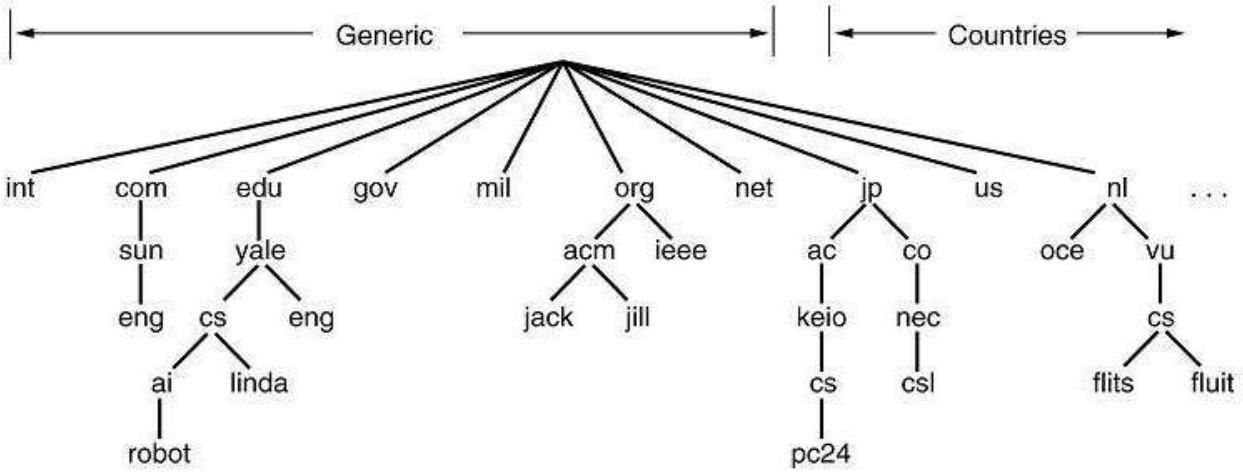
505 HTTP Version Not Supported

Other methods

- https://www.w3.org/Protocols/rfc2616/rfc2616-sec9.html#sec9 - 9 Method Definitions
  - GET
  - POST
  - HEAD: identical to GET except that the server MUST NOT return a message-body in the response
  - PUT: requests that the enclosed entity be stored under the supplied Request-URI
  - DELETE: requests that the origin server delete the resource identified by the Request-URI
  - TRACE: (mostly for debugging) to invoke a remote, application-layer loop-back of the request message
  - CONNECT: use with a proxy that can dynamically switch to being a tunnel (e.g. SSL tunneling)

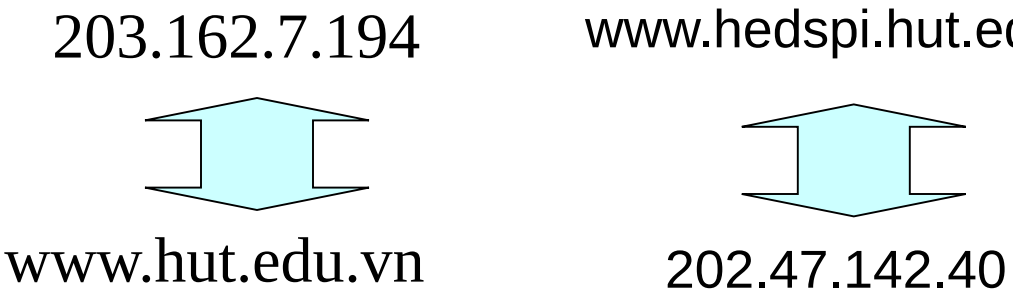
Domain name

- The Domain Name System is a hierarchical naming system for computers, services, or any resource participating in the Internet
- Example of domain name
  - www.keio.ac.jp
  - www.hedspi.hut.edu.vn
  - .hut.edu.vn

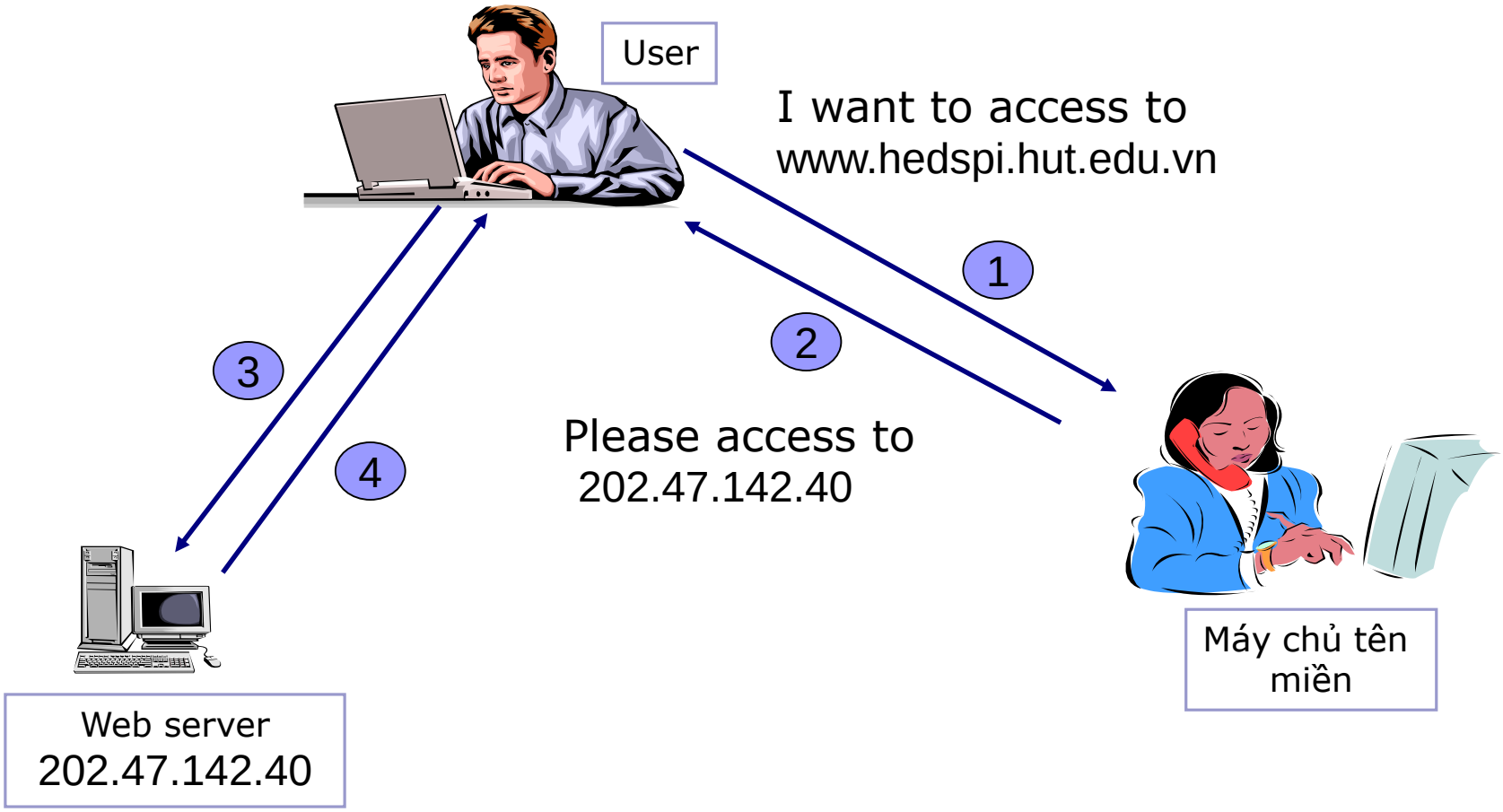


Domain name

- Domain Name Service (DNS) map a domain name with an IP address
- Domain name
  - Variable length
  - Easy to memory by human being
  - Independent of geographical location of a machine
- IP address
  - Fixed length
  - Easy to be processed by computer
  - Related to routing matter



Example of DNS in web system



URL

- Uniform Resource Locator (URL) is a type of Uniform Resource Identifier (URI) that specifies where an identified resource is available and the mechanism for retrieving it
- Format:
  - protocol: name of site/main document#fragment identifier
  - Ex: http://www.fit.hut.edu.vn/nhansu.htm
- Two types of URLs:
  - Absolute URL: full Internet address including the protocol, network location, and optional path and file name.
    - Ex: http://www.microsoft.com
  - Relative URL: URL with one or more of its parts missing. Browsers take the missing information from the page containing the URL.
    - Ex: index.htm.

Character encoding

- Character encoding
  - Mapping of sequence of characters and a with something else for facilitating the transmission of data or storage in computers
    - sequence of natural numbers, octets or electrical pulses
- Unicode
  - a computing industry standard allowing computers to consistently represent and manipulate text expressed in most of the world's writing systems.
  - More than 100,000 characters
- In Japan, 4 different encodings (Unicode, ISO-2022-JP, EUC-JP, Shift-JIS).
  - Some web pages do not have the encoding specification →web browsers must guess the right encoding for such pages.

Character encoding

- Unicode defines two mapping methods:
  - *Unicode Transformation Format* (UTF) encodings
    - UTF-8: 8 bits in one code value
    - UTF-16: 16 bit in one code value
    - UTF-32: 32 bit in one code value
  - *Universal Character Set* (UCS) encodings
    - UCS-2 is an obsolete subset of UTF-16;
    - UCS-4 and UTF-32 are functionally equivalent.

Character Encoding

- Many character encoding standards, such as ISO 8859 series, the encoding is straightforwardly related to the scalar position of the characters in the coded character set.
  - Ex: letter A in the ISO 8859-1 is 65th character in coded set → is encoded by 65.
- For Unicode,
  - there isn't a trivial, one-to-one mapping coded character set value ←→ encoded value.
  - There are a number of ways of encoding the same character.
  - For example, the letter à can be represented by two bytes in one encoding and four bytes in another.
- UTF-8 uses
  - 1 byte for characters in the ASCII set,
  - 2 bytes for characters in several more alphabetic blocks,
  - 3 bytes for the rest of the BMP.
  - 4 bytes for supplementary characters.
- UTF-16 uses
  - 2 bytes for any character in the BMP,
  - 4 bytes for supplementary characters.
- UTF-32 uses 4 bytes for all characters.

Media type

- Multimedia Internet MEdia : MIME
  - Text, Image, Audio, Video
- Transmission of media type in HTTP message
  - HTTP requires that data be transmitted in the context of e-mail-like messages, even though the data may not actually be e-mail.