WEB SERVICES

WEEK 11 – 03/22/2021

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ANNOUNCEMENTS

- No recitation this week
- Web Services Lab is due next week
- TA mid term reviews

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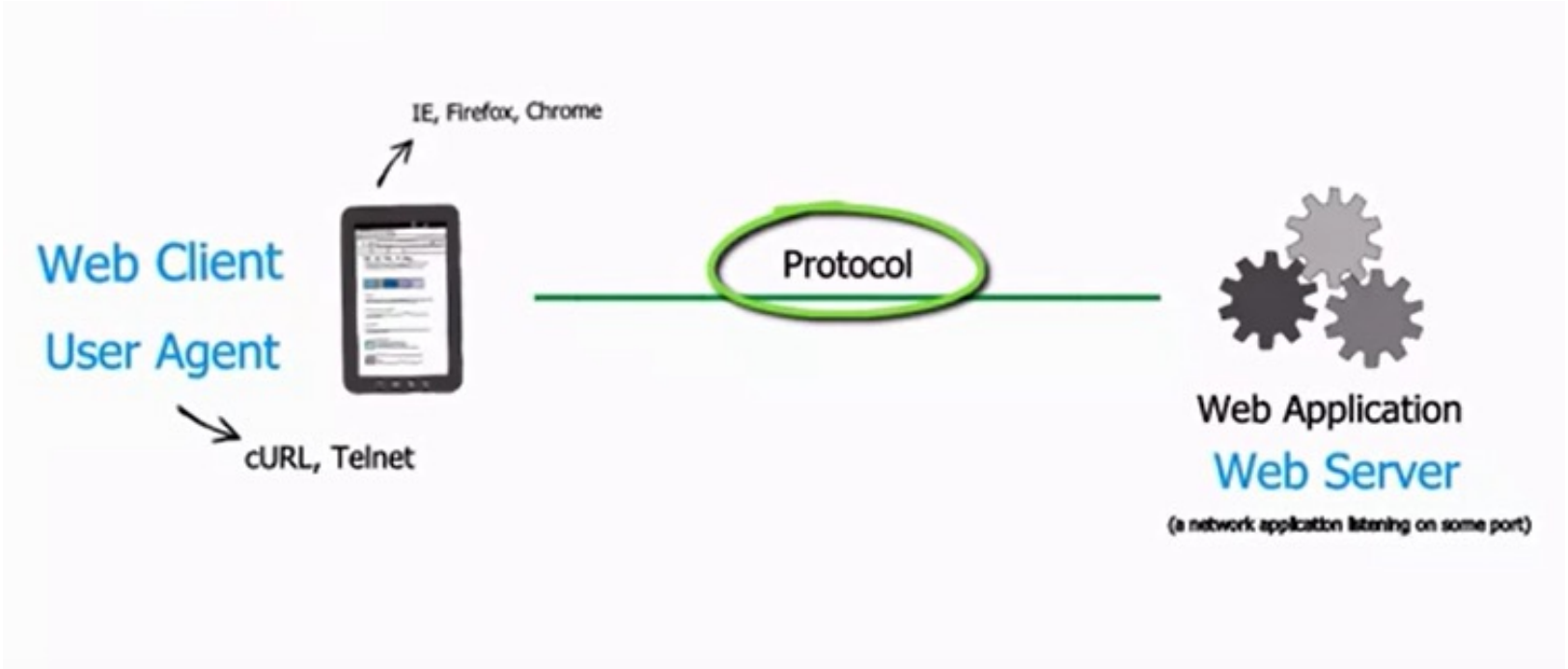
INTERNET PROTOCOLS

What happens when you type a URL into a browser and press <ENTER>?

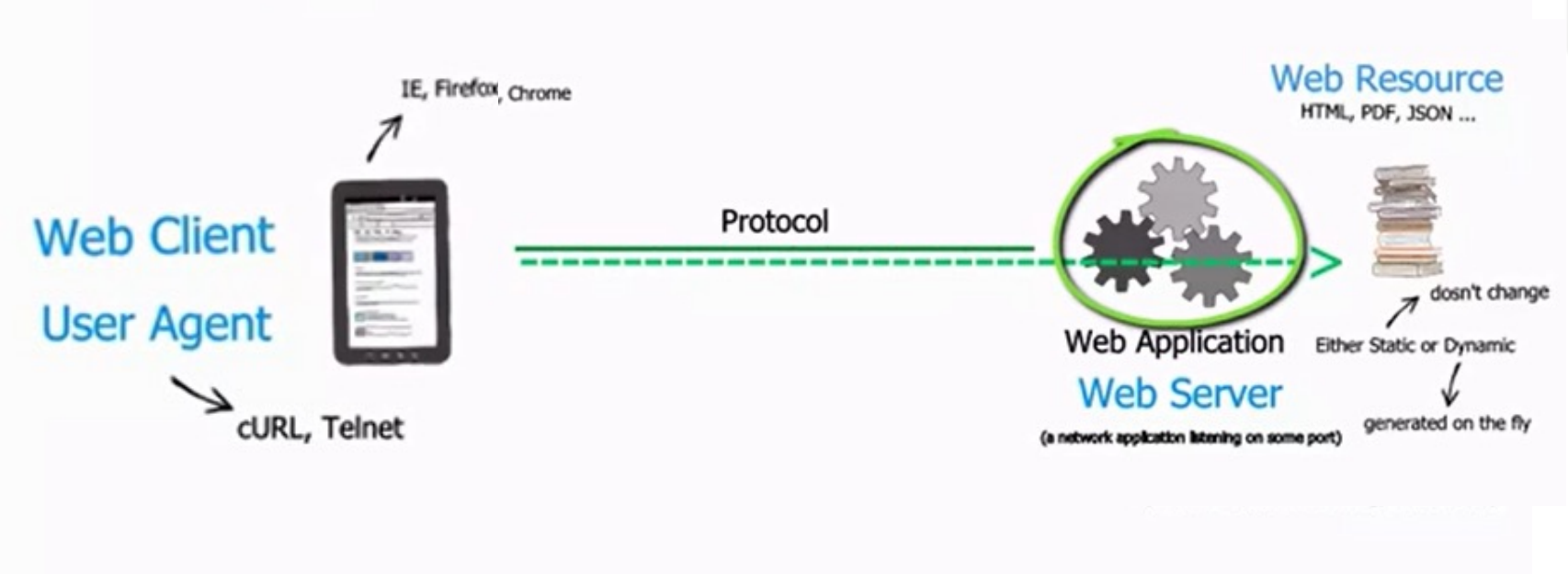
What happens when you click on a hyperlink in a web page?

How do we pass messages and requests from one layer to another?

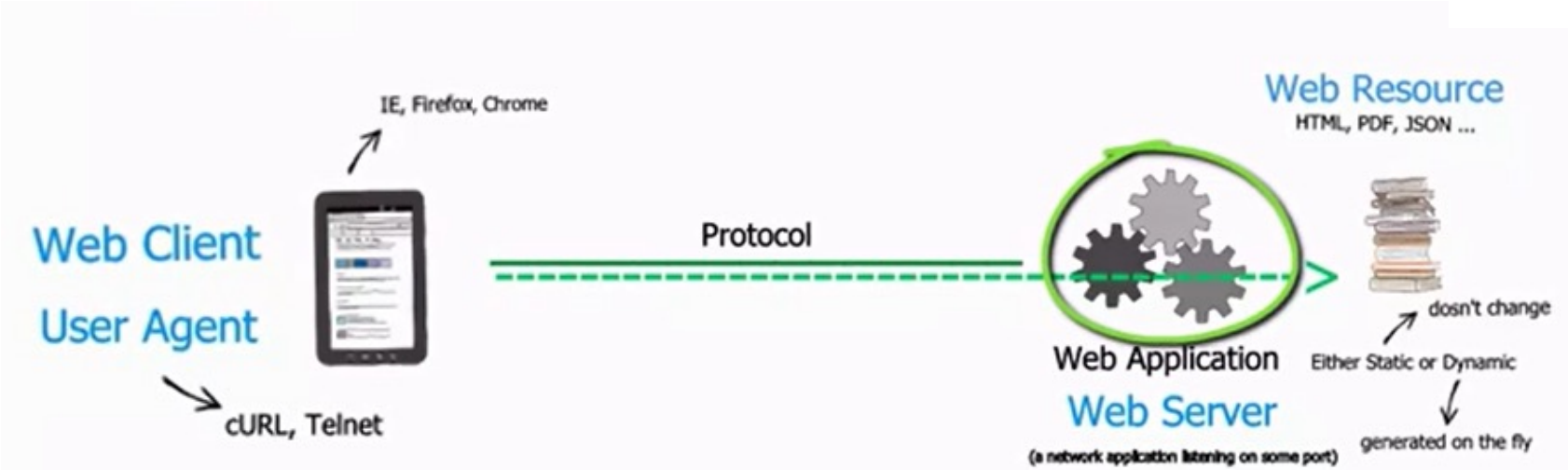
PROTOCOLS !


IE, Firefox, Chrome
Web Client
User Agent
cURL, Telnet
Protocol
Web Application
Web Server
(a network application listening on some port)

PROTOCOLS


IE, Firefox, Chrome
Web Client
User Agent
cURL, Telnet
Protocol
Web Resource
HTML, PDF, JSON ...
Web Application
Web Server
(a network application listening on some port)
dosn't change
Either Static or Dynamic
generated on the fly

PROTOCOLS



PROTOCOLS

Each web resource is identified by a URI

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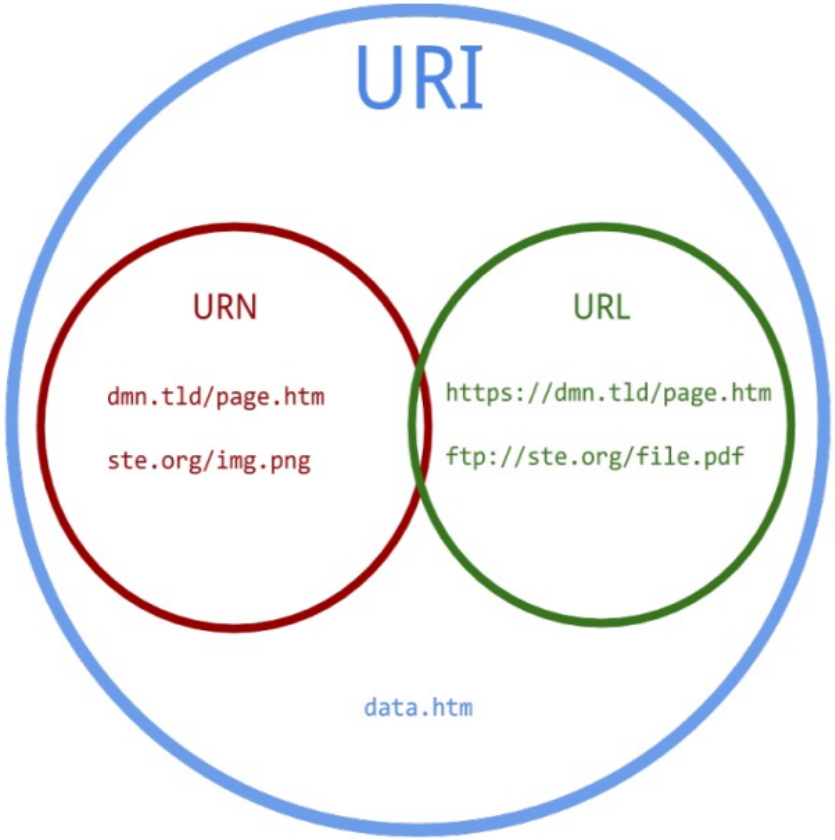
THE URI

- http://www.colorado.edu

- URI, URL, URN ?
  - URL = locator (where/how to find it)
  - URN = name (what is its name)
  - URI = either one



HTTP – HYPERTEXT TRANSFER PROTOCOL

- HTTP – a request/response protocol
- It is **STATELESS**
  - A stateless protocol does not **require** the HTTP server to retain information or status about each user for the duration of multiple requests.
- The client submits a request, HTTP responds with the requested resource and a return code
  - Resources may be static or dynamic
  - Resources may redirect, include other resources, etc.

HTTP METHODS

- **GET** - Retrieves the URI
  - Requests using GET should only retrieve data and should have no other effect.
- **POST** - Submits a resource to the URI
  - The POST method requests that the server accept the entity enclosed in the request as a new subordinate of the web resource identified by the URI.
- **PUT** - Stores a resource under the URI
  - The PUT method requests that the enclosed entity be stored under the supplied URI.
- **DELETE** - Deletes the URI
  - The DELETE method deletes the specified resource.

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COMMON HTTP RETURN CODES

200 : OK	Standard response for successful HTTP requests.
302 : Redirect	Tells the client to temporarily look at (browse to) another URL.
400 : Bad Request	The server cannot or will not process the request due to an apparent client error
401 : Unauthorized	The server cannot or will not process the request because the client is not authenticated
403 : Forbidden	The request contained valid data and was understood by the server, but the server is refusing action because client does not have authorization
404 : Not Found	The requested resource could not be found but may be available in the future.
500 : Server Error	A generic error message, given when an unexpected condition was encountered, and no more specific message is suitable.

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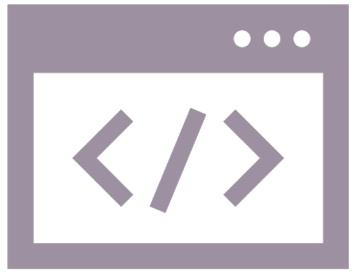
PASSING DATA TO/FROM THE WEB SERVER

XML - Extensible Markup Language



JSON - Java Script Object Notation

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XML - EXTENSIBLE MARKUP LANGUAGE

- "Tag" based, like HTML
- Tags are user-defined
- XML is human readable AND machine readable
- Tags describe the data (XML tags do NOT display the data like HTML tags do)
- You can use a programming language like javascript or php or python to read, parse, modify and write XML documents sent/received to/from a Web Service
- The XML document structure is defined by a DOM – Document Object Model

XML

```
<bookstore>
   <book category="cooking">
      <title lang="en">Everyday Italian</title>
      <author>Giada De Laurentiis</author>
      <year>2005</year>
      <price>30.00</price>
   </book>
   <book category="children">
      <title lang="en">Harry Potter</title>
      <author>J K. Rowling</author>
      <year>2005</year>
      <price>29.99</price>
   </book>
   <book category="web">
      <title lang="en">XQuery Kick Start</title>
      <author>James McGovern</author>
      <author>Per Bothner</author>
      <author>Kurt Cagle</author>
      <author>James Linn</author>
      <year>2003</year>
      <price>49.99</price>
   </book>
</bookstore>
```

JSON

- "Java Script Object Notation"
- Represents data in key:value pair format.
- Many think JSON is easier to use than XML
- More compact than XML
- Like XML, JSON is easy for both humans & computers to understand

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JSON

```
"bookstore": {
        "book": [
            {"title": "Everyday Italian",
            "author": "Giada De Laurentiis",
            "year": "2005",
            "price": "30.00"},
            {"title": "Harry Potter",
            "author": "J K. Rowling",
            "year": "2005",
            "price": "29.99"},
            {"title": "XQuery Kick Start",
            "author": ["James McGovern",
                "Per Bothner",
                "Kurt Cagle",
                "James Linn"],
            "year": "2003",
            "price": "49.99"}]
}
```

JSON vs. XML

JSON:

```
{"employees":[
    { "firstName":"John", "lastName":"Doe" },
    { "firstName":"Anna", "lastName":"Smith" },
    { "firstName":"Peter", "lastName":"Jones" }
] }
```

XML:

```
<employees>
  <employee>
    <firstName>John</firstName>
    <lastName>Doe</lastName>
  </employee>
  <employee>
    <firstName>Anna</firstName>
    <lastName>Smith</lastName>
  </employee>
  <employee>
    <firstName>Peter</firstName>
    <lastName>Jones</lastName>
  </employee>
</employees>
```

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JSON VS. XML

JSON is Like XML Because

- Both JSON and XML are "self describing" (human readable)
- Both JSON and XML are hierarchical (values nested within values)
- Both JSON and XML can be parsed and used by lots of programming languages
- Both JSON and XML can be fetched with an HTTP Request

JSON is Unlike XML Because

- JSON doesn't use end tags
- JSON is shorter
- JSON is quicker to read and write
- JSON can use array

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FOR AJAX APPLICATIONS, JSON IS FASTER AND EASIER THAN XML

Using XML

Fetch an XML document

Use the XML DOM to loop through the document

Extract values and store in variables

Using JSON

Fetch a JSON string

JSON.Parse the JSON string

AJAX - ASYNCHRONOUS JAVASCRIPT AND XML

OK. So, what is AJAX?

- AJAX is a technique for creating better, faster, and more interactive web applications.
- AJAX uses:
  - **XHTML** for content
  - **CSS** for presentation
  - **DOM** and **JavaScript** for dynamic content display. (JavaScript runs on the client-end)

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WEB SERVICES - HISTORY

Early Web (CGI) 1989

- hypertext / hyperlinks
- page by page

Web 2.0 (AJAX) 2004

- web page stays in place
- parts of the web page are updated

How are web 2.0 requests handled between client and server?

Web Services !

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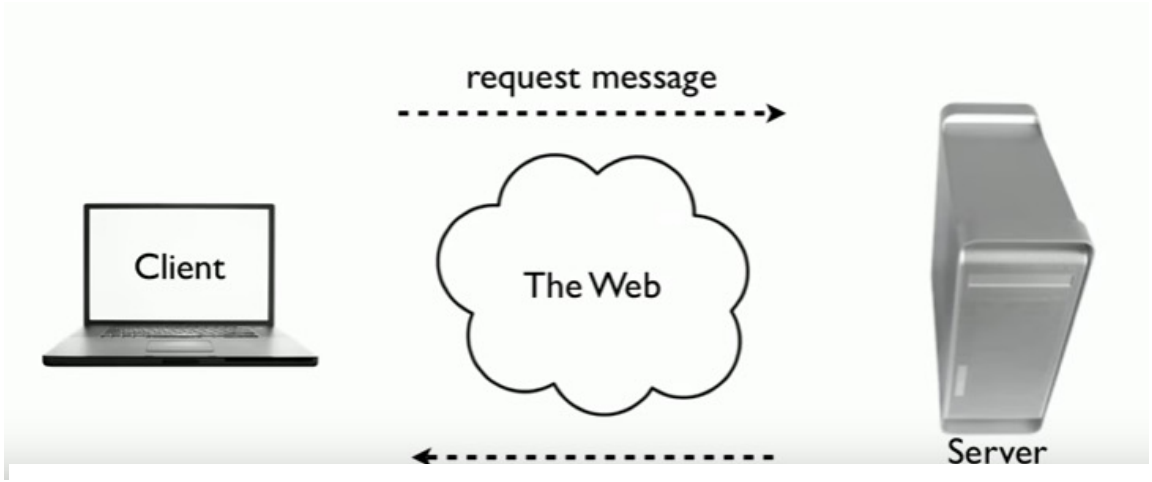
A framework for a conversation between computers over the web



WEB SERVICES

- If you want to use a web service, you must use an API (application programming interface)
- Defines everything you need to know to talk to a web service:
  1. **Message format:** SOAP, XML, JSON, etc.
  2. **Request syntax**: URI, Parameters & Data types
  3. **Actions on the server:** named methods, HTTP verbs
  4. **Security:** authentication (username & password)
  5. **Response format:** SOAP, XML, JSON, etc.

- The web service hides its complexity behind the API

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WEB SERVICES

The web service hides its complexity behind the API