HTML

What are We Talking About Today?

- **Introduction to HTML**
  - HTML: Markup language for web content
  - Evolution: From Tim Berners-Lee to HTML5
- **HTML Structure**
  - Elements & Tags: <p>, <a>, <img>, etc.
  - Attributes: Define element properties (e.g., src, href)
- **Advanced HTML Features**
  - Forms, Tables, Multimedia: Enhanced content
  - Validation: Ensuring code quality with tools like W3C Validator

What is HTML?

- HTML stands for **H**yper**t**ext **M**arkup **L**anguage
  - It is a **markup language**, which means it is used for processing, definition, and display of data
- HTML is a tag-based language, similar to XML
  - HTML tags are already defined though

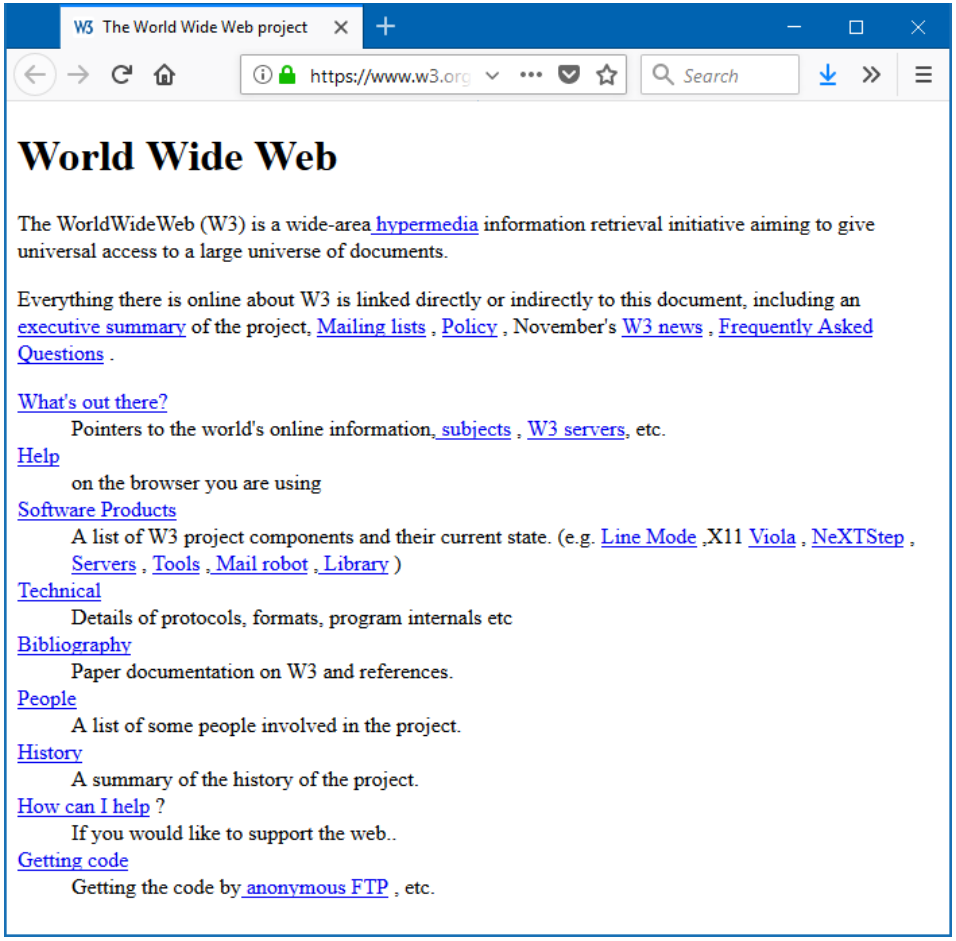
Version	Year
HTML	1991
HTML 2.0	1995
HTML 3.2	1997
HTML 4.01	1999
HTML5	2014

What is HTML?(cont'd)

- Hypertext Markup Language (HTML) is a language in which one can describe:
  - The display and format of text
  - The display of graphics
  - Pointers to other html files
  - Pointers to files containing graphics, digitized video and sound
  - Forms that capture information from the viewer
- HTML was developed by **Tim Berners-Lee** of CERN around 1990
- HTML is supported by Web browsers (e.g., Internet Explorer, Firefox, Chrome, Safari, many others)as well as other applications (such as mail clients, etc) — which interpret and display the output to the viewer

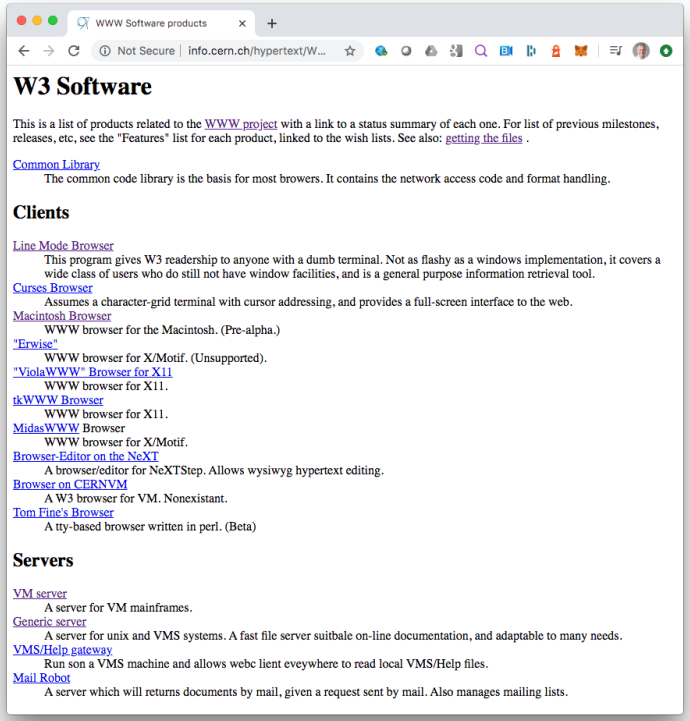
First Web Page

- The first web page ever displayed by Tim Berners-Lee at CERN



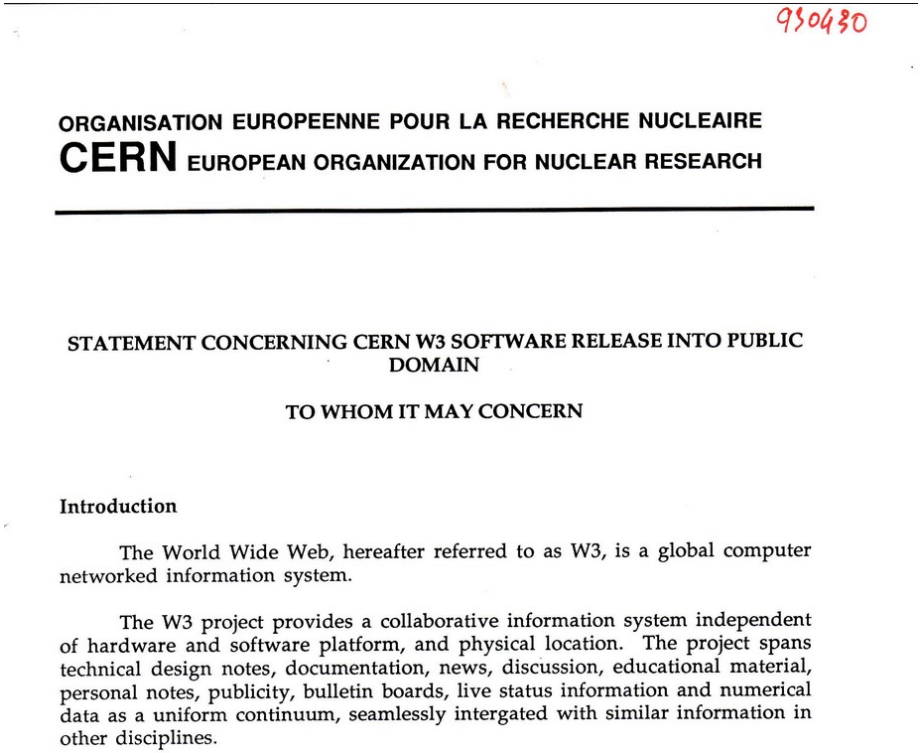
First Web Site

- The original web site of the "WWW Project" is still available at CERN
  http://info.cern.ch/hypertext/WWW/TheProject.html
- Includes documentation on the original browsers and servers



World Wide Web Motivation

- Originally created in 1989 at **CERN** (the European Organization for Nuclear Research) for sharing research in a faster manner than journal publications allowed



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ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

STATEMENT CONCERNING CERN W3 SOFTWARE RELEASE INTO PUBLIC DOMAIN

TO WHOM IT MAY CONCERN

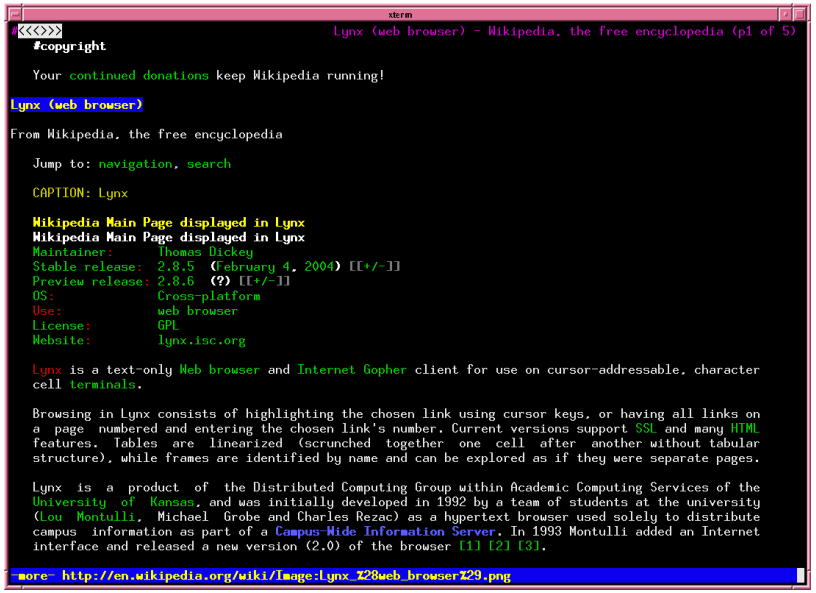
Introduction

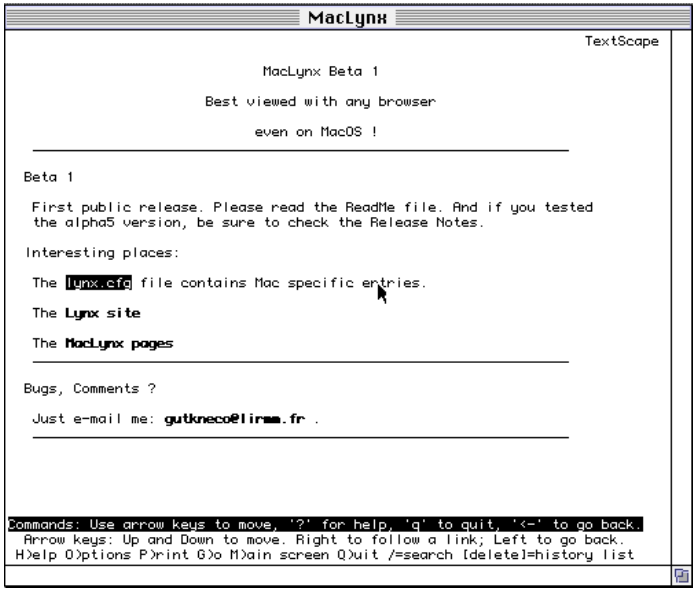
The World Wide Web, hereafter referred to as W3, is a global computer networked information system.

The W3 project provides a collaborative information system independent of hardware and software platform, and physical location. The project spans technical design notes, documentation, news, discussion, educational material, personal notes, publicity, bulletin boards, live status information and numerical data as a uniform continuum, seamlessly intergated with similar information in other disciplines.

Text Browser – Lynx

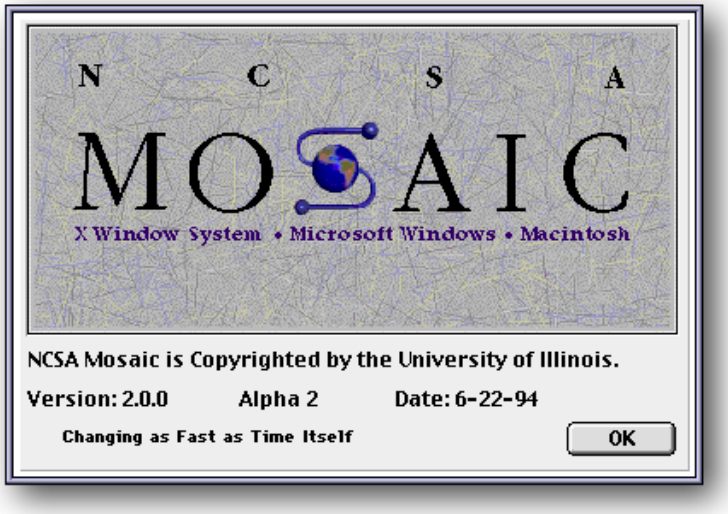
- Developed by Distributed Computing Group within Academic Computing Services of the University of Kansas
- Team of students and staff with initial release in **1992**
- https://en.wikipedia.org/wiki/Lynx_(web_browser)





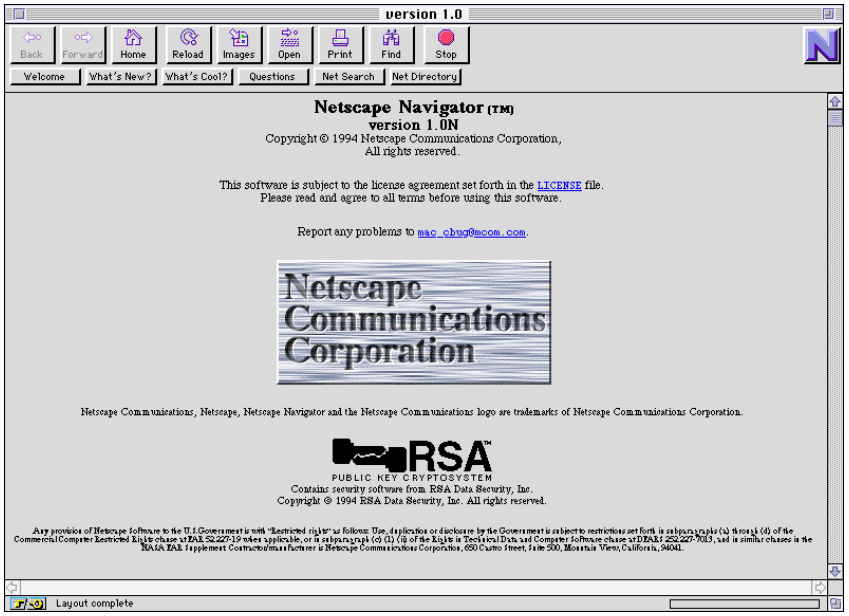
First Graphical Browser – NCSA Mosaic

- Developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign
- Marc Andreessen, lead student developer. NCSA released it in **1993**
- http://www.ncsa.illinois.edu/



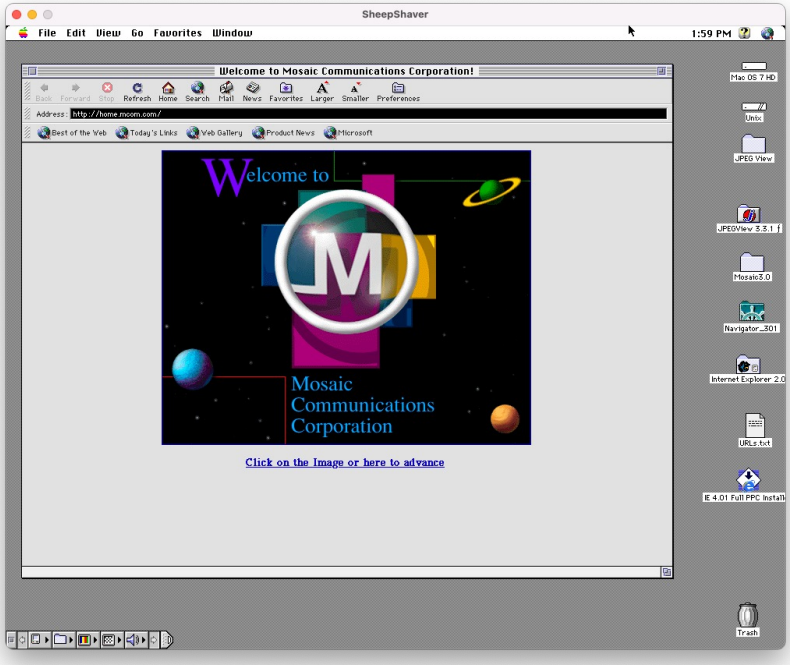
First Commercial Browser – Netscape

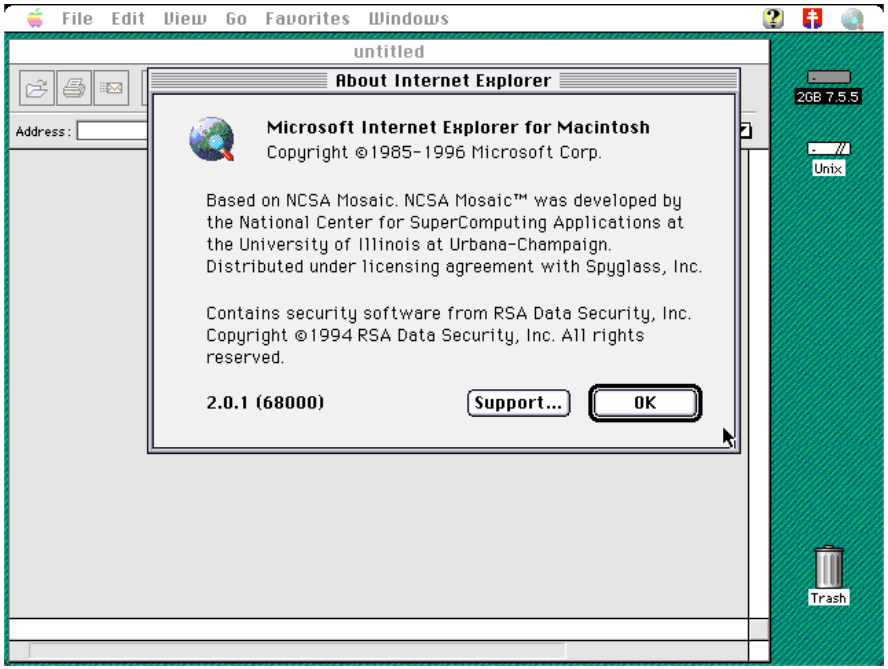
- Netscape **Navigator** was a proprietary web browser, and the original browser of the Netscape line
- Co-written by Marc Andreessen, with initial release in Dec. **1994**
- http://home.mcom.com



First Free Commercial Browser – IE

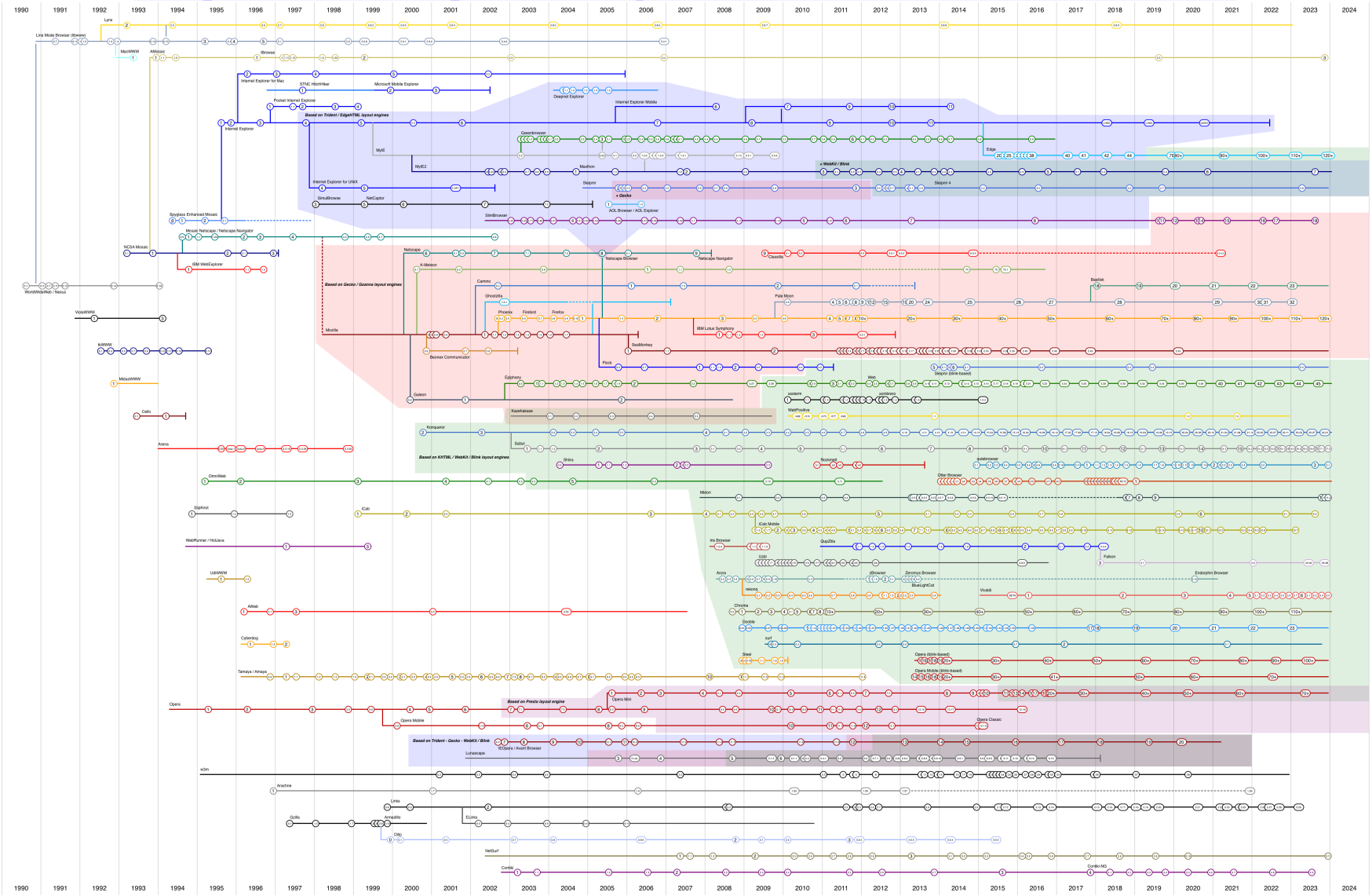
- Microsoft Internet Explorer (IE) killed Netscape **Navigator** as it was bundled with Windows 95
- Licensed from NCSA, with initial release in August **1995**
- https://microsoft.com/ie





Web Browsers Timeline

http://en.wikipedia.org/wiki/List_of_web_browsers

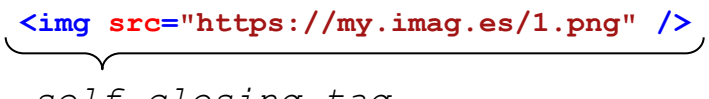


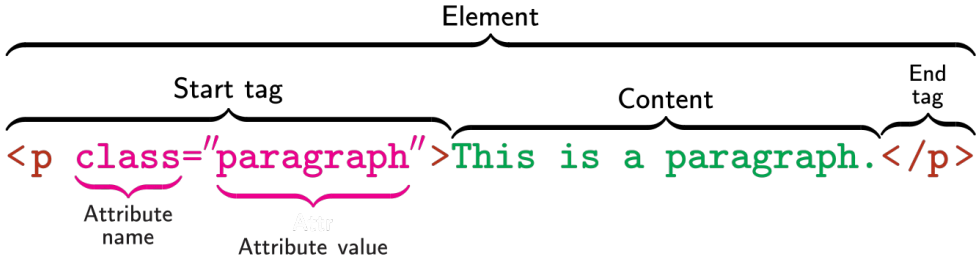
Versions of HTML

- Version 0, 1990, was the original, minimum set of HTML
- Version 1 adds highlighting and images
- Version 2, November 1995, all V.0 and V.1, plus forms
- Version 3.2, January 1997, released by W3CW, tables
- HTML 4.01, December 1999 Recommendation: http://www.w3.org/TR/html401/
- HTML5, October 2014 Recommendation, vocabulary and APIs: http://www.w3.org/TR/html5/
- HTML5, December 2017 HTML 5.2 Recommendation: https://www.w3.org/TR/html52/
- **HTML Living Standard, December 2019:** https://html.spec.whatwg.org
- W3C and WHATWG Agreement https://www.w3.org/blog/news/archives/7753
- "W3C stops independent publishing of a designated list of specifications related to HTML and DOM and instead will work to take WHATWG Review Drafts to W3C Recommendations"

Elements, Tags and Attributes

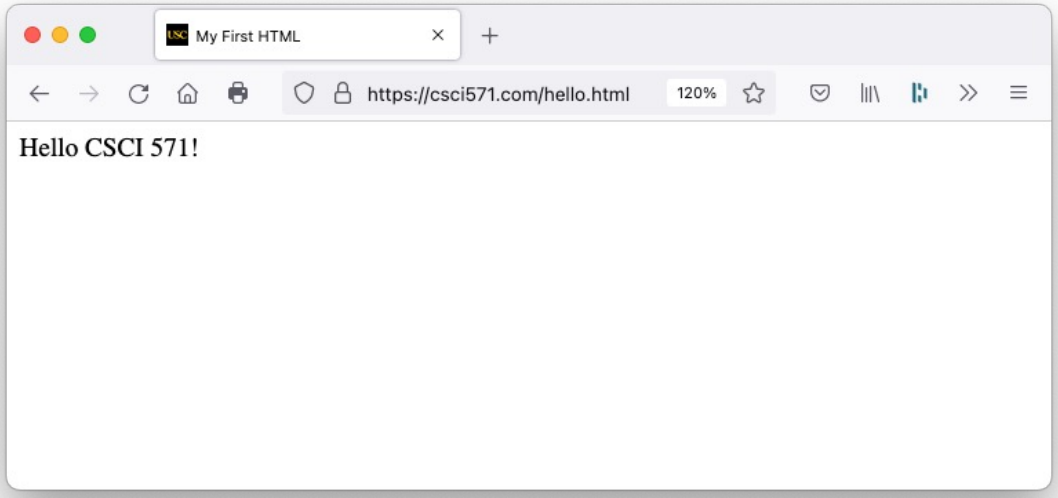
- An HTML file contains Elements, Tags and Attributes
- HTML Element
  - Basic HTML node that adds semantics
  - Can be of two types:
    - Without content: self-closing start-tag
    - With content: start tag, content, end tag
- HTML Tag
  - Composed by the name of the Element surrounded by angle brackets
  - End Tag has a slash after the opening angle bracket (required in HTML5)
- Attribute
  - Specified inside Start Tag
  - Controls element properties / behavior or provides metadata





My First HTML

```
1 <!DOCTYPE html>
2 <!-- My first HTML comment -->
3 <html>
4   <head>
5     <title>My First HTML</title>
6   </head>
7   <body>
8     Hello CSCI 571!
9   </body>
10 </html>
```



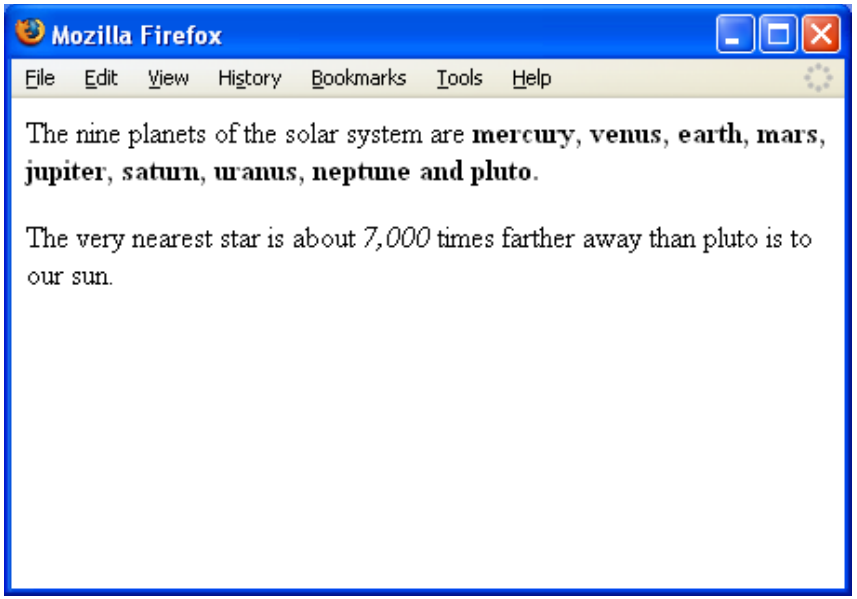
General Structure

- HTML documents have a head and a body
  - *head* contains title and other **metadata**
  - *body* contains **page content** (paragraphs, etc…)
- A leading line indicates which version of HTML this document conforms to

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0//EN" "http://www.w3.org/TR/REC-html40/strict.dtd">
<HTML>

 <HEAD>
  <TITLE>The Solar System</TITLE>
 </HEAD>

 <BODY>
  <P>The nine planets of the solar system are...
 </BODY>

</HTML>
```

Adding Some Markup

```
<P>The nine planets of the solar system are <B>mercury, venus,
earth, mars, jupiter, saturn, uranus, neptune and
pluto.</B></P>
<P>The very nearest star is about <I>7,000</I> times farther
away than pluto is to our sun. </P>
```



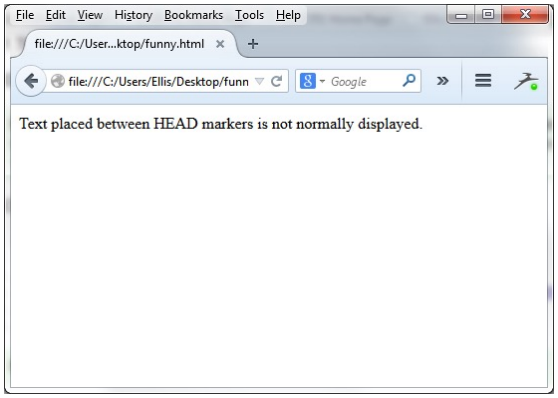
Browsers Are Tolerant

- Browsers follow the rule of being tolerant of mistakes in the input
  - They ignore markup they don't understand
- Edge, Safari, Firefox, Chrome are tolerant browsers
  - They do not insist that the HTML document begin and end with <HTML> and contain doctype
  - <HEAD> and/or <BODY> tags are not required
  - But there is no guarantee that this behavior will be the same for all browsers and across different versions

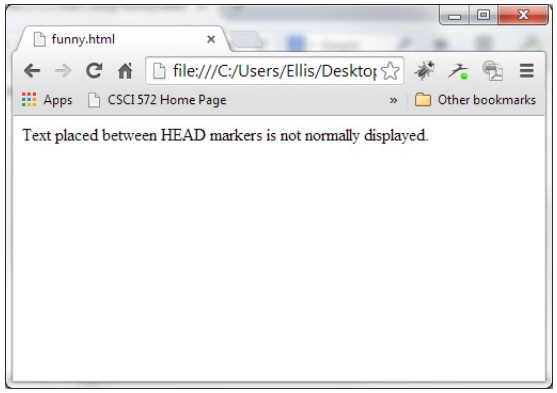
Browsers are Tolerant (examples)

- Suppose the entire document is one line, such as:

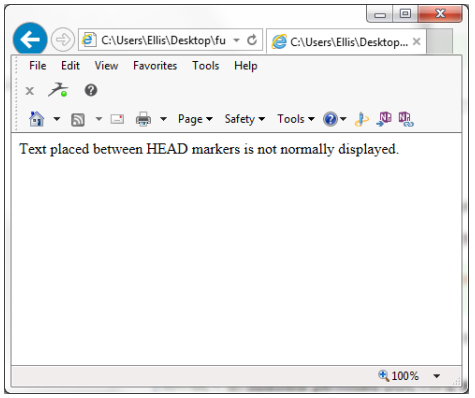
  <HEAD>Text placed between <ODDTAG> HEAD markers is not normally displayed.</HEAD>



Firefox



Chrome



Internet Explorer

HTML Elements

- Each element consists of:
  - a start tag,
  - content (optional),
  - an end tag (optional).
- E.g., <BODY> some text </BODY>
- A slash (/) after the "<" indicates an end tag
- Some elements do not require end tags, e.g., <P> paragraph tag
- Some elements do not require content, e.g., <HR>

horizontal rule tag places a straight line across the page

Attributes

- Elements may have parameters, called attributes
- Attributes are placed in the start tag before the final ">"
- Attributes have the form name=value

E.g., <H1> is the first heading tag

```
<H1 id="Chapter1">
  Start of Chapter 1
</H1>
```

- Attribute values are often enclosed in quotes, either double or single
- Quotes are not required when the value contains only letters, digits, hyphens, and periods.
- Attribute names are case insensitive,
- but attribute values are usually not

Comments in HTML

- Comments start with

  <!--

  and end with

  -->

- Comments cannot be nested
  - White space is permitted between the -- and the closing angle bracket, >
  - It is not permitted between the opening angle bracket, exclamation point, and the --
- E.g.

```
<BODY>
<!-- This is a comment
and hence not displayed -->
But this will be displayed
</BODY>
```

Complete Set of <BODY> tag attributes

- id, assigns a unique name to an element

e.g., <P id=mystart>This is my starting paragraph...

- class, assigns one or more names to an element
- lang, a language code that identifies a natural language spoken, written, or otherwise used
- title, a short description of the body
- style, inline display information
- bgcolor, background color
- Events include

onload, onunload onclick, ondblclick, onmousedown, onmouseup, onmouseover, onmousemove, onmouseout, onkeypress onkeydown, onkeyup

- Deprecated elements in include:

background, text, link, vlink, alink

See http://www.w3.org/TR/html4/struct/global.html#edef-BODY

<BODY> Using Style Sheets

- Deprecated example

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN”
"http://www.w3.org/TR/html4/loose.dtd">
<HTML>
<HEAD>
  <TITLE>A study of population dynamics</TITLE>
</HEAD>
<BODY bgcolor="white" text="black” link=" red" alink="fuchsia" vlink="maroon">
... document body...
</BODY>
</HTML>
```

- Using Style Sheets

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN” "http://www.w3.org/TR/html4/strict.dtd">
<HTML>
<HEAD>
<TITLE>A study of population dynamics</TITLE>
<STYLE type="text/css">
BODY { background: white; color: black}
A:link { color: red } A:visited { color: maroon } A:active { color: fuchsia }
</STYLE>
</HEAD>
<BODY>
... document body...
</BODY>
</HTML>
```

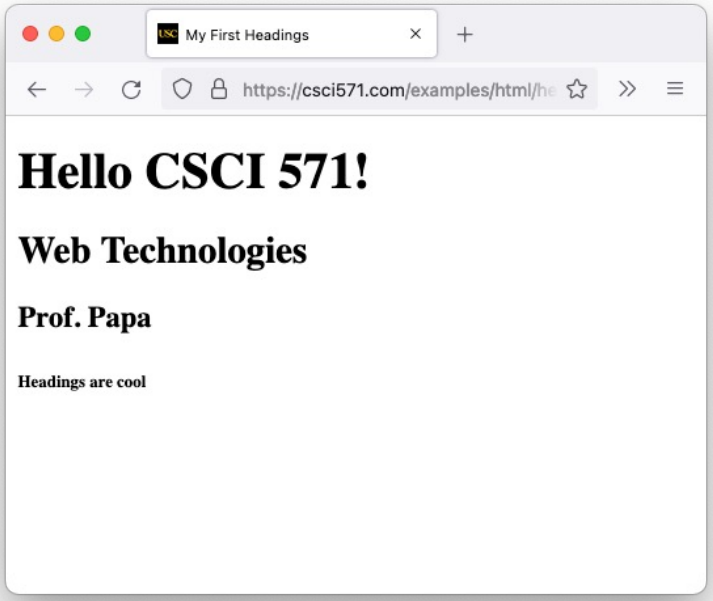
Composing HTML

- Conventional editors let you compose HTML directly
  - e.g., TextEdit,emacs, vi, NotePad, TextPad, etc.
  - use the tools when you are writing HTML directly
- Word Processors include a File SaveAs option which saves your document in HTML format
  - e.g., Microsoft Word
  - **Do not use!**
- There are several free HTML-specific editors, e.g.
  - **Brackets**, http://brackets.io
  - **Visual Studio Code**, https://code.visualstudio.com/
- There are several commercial HTML/CSS suites, e.g.
  - **JetBrains IntelliJ IDEA**
  - Adobe Dreamweaver CC (Creative Cloud subscription)
- For a complete list see http://en.wikipedia.org/wiki/List_of_HTML_editors

HTML Headings

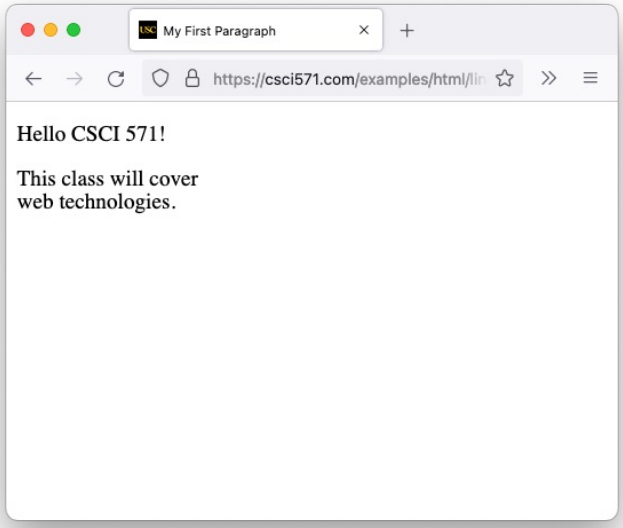
- Heading tags should be used for different levels in a document
  - The size and look can be changed with CSS, so don't use these tags solely to change the size of the font

```
<!DOCTYPE html>
 <html>
  <head>
    <title>My First Headings</title>
  </head>
  <body>
    <h1>Hello CSCI 571!</h1>
    <h2>Web Technologies</h2>
    <h3>Prof. Papa</h3>
    <h6>Headings are cool</h6>
  </body>
</html>
```



HTML Line Breaks

- Paragraph tags separate logical display blocks
- Line breaks are used for formatting




```
<!DOCTYPE html>
<html>
  <head>
    <title>My First Paragraph</title>
  </head>
  <body>
  <p>Hello CSCI 571!</p>
  <p>This class will cover<br />web technologies.</p>
  </body>
</html>
```

HTML Lists

- HTML lists are very common in everyday web development.
- Perhaps the most used are
  - unordered lists (<ul>) and
  - ordered lists (<ol>)
- but there are a few other list options
  - definition list (<dl>), and
  - the menu (<menu>) element,
  - both were deprecated in HTML4, but reintroduced in HTML5
- All lists follow the same pattern:
  - *<start tag of list>*
  - *<list item tag>*
  - *<list item tag>*
  - *<list item tag>*
  - *</ end tag of list>*

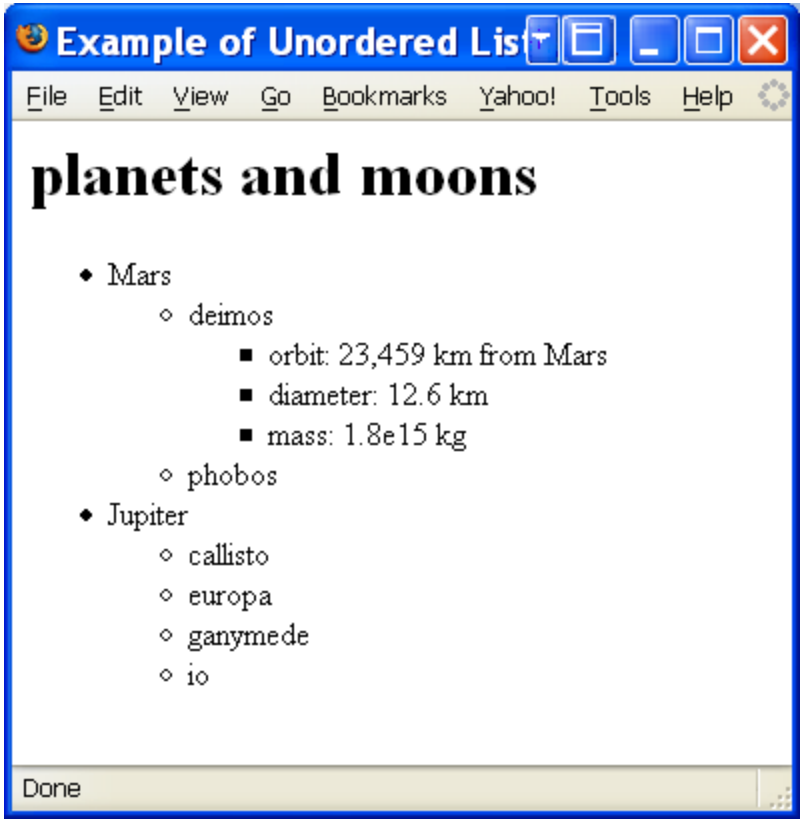
HTML Definition Lists

```
<DL>
  <DT>light year<DD>the distance light travels in one year
<DT>asteroids<DD>are small, irregular shaped objects, mostly occurring between Mars and Jupiter
</DL>
```

HTML Unordered Lists

```
<HTML>
<HEAD> <TITLE>Example of Unordered Lists</TITLE> </HEAD>
<BODY>
  <H1>planets and moons</H1>
  <UL>
    <LI>Mars
      <UL>
        <LI> deimos
          <UL>
            <LI>orbit: 23,459 km from Mars
            <LI>diameter: 12.6 km
            <LI>mass: 1.8e15 kg
          </UL>
        <LI>phobos
      </UL>
    <LI>Jupiter
    <UL><LI>callisto<LI>europa<LI>ganymede<LI>io</UL>
  </UL>
</BODY></HTML>
```

Browser Output of Unordered Lists



HTML Ordered Lists

- Has the general form

<OL><LI> first list item<LI> second list item</OL>

- START attribute can initialize the sequence to a number other than 1
- TYPE attribute can be used to select the numbering style

Type	Name	Style
1	arabic	1, 2, 3, ...
a	lower alpha	a, b, c, ...
A	upper alpha	A, B, C, ...
i	lower roman	i, ii, iii
I	upper roman	I, II, III,

- However, the type attribute is **deprecated**, and list styles should be handled through style sheets, e.g.

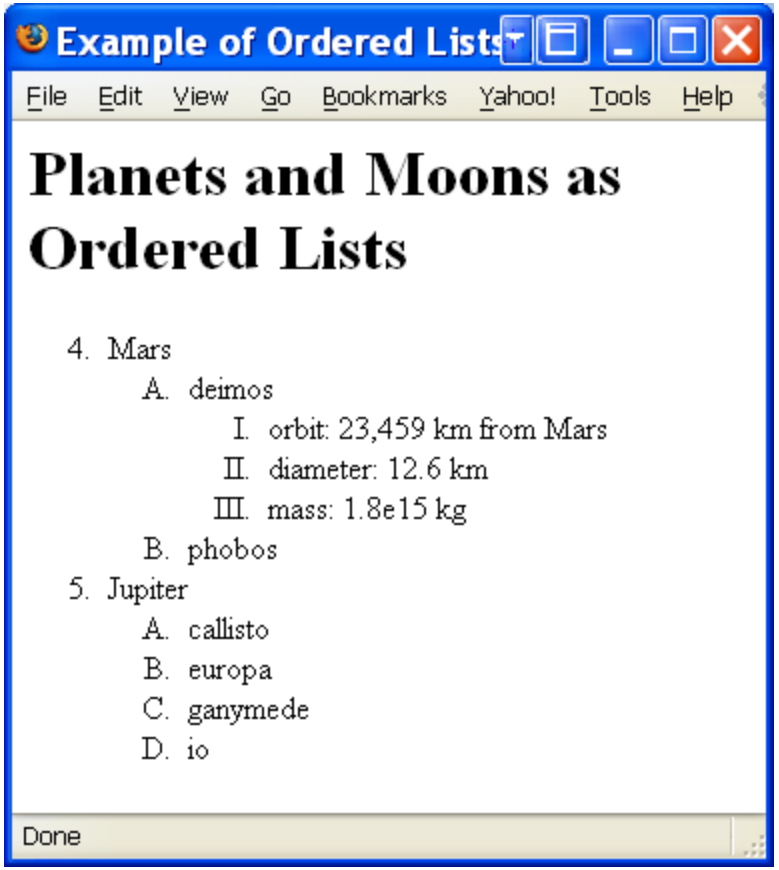
<STYLE type="text/css">

OL.withroman {**list-style-type:** lower-roman}</STYLE>

Example - Ordered Lists

```
<HTML><HEAD><TITLE>
Example of Ordered Lists</TITLE></HEAD>
<BODY>
  <H1>Planets and Moons as Ordered Lists</H1>
  <OL START=4>
    <LI>Mars
      <OL type=A>
        <LI>deimos
          <OL type=I>
            <LI>orbit: 23,459 km from Mars
            <LI>diameter: 12.6 km
            <LI>mass: 1.8e15 kg
          </OL>
        <LI>phobos
      </OL>
    <LI>Jupiter
      <OL type=A><LI>callisto<LI>europa<LI>ganymede<LI>io</OL>
</OL>
</BODY></HTML>
```

Browser Output



HTML Table Elements

- <TABLE>, a tag used to define a table
- <CAPTION>, a tag to label a table
  - Its attributes are ALIGN = top, bottom, left, right
- <TH></TH> or <TD></TD>, tags that identify a table header cell and table data cell
  - Headers are the same as data except they use bold font and are centered
- <TR>, a tag that identifies a container for a row of table cells
  - Same attributes as TH and TD

Facts about Tables

- Table cells can be text, lists, images, forms, figures, or even tables
- Table headers are typically rendered in boldface, and table data is typically rendered in the regular font and point size
- A table has an optional caption followed by rows
- Table rows are said to contain table headers and table data
- The browser will set the number of columns to be the greatest number of columns in all of the rows
- Blank cells are used to fill extra columns in the rows

Example - 3 rows x 2 cols

```
<HTML>
  <HEAD> <TITLE>Table: 3 rows 2 Cols</TITLE> </HEAD>

  <BODY>
    <H1>Table: 3 Rows 2 Cols</H1>
    <TABLE BORDER="2">
      <CAPTION>MIME Content-Types</CAPTION>
      <TR>
        <TD>application/postscript</TD>
        <TD>Postscript</TD>
      <TR>
        <TD>application/rtf</TD>
        <TD>MS Rich Text Format</TD>
      <TR>
        <TD>application/x-pdf</TD>
        <TD>Adobe Acrobat Format</TD>
    </TABLE>
  </BODY>
</HTML>
```

Browser Output

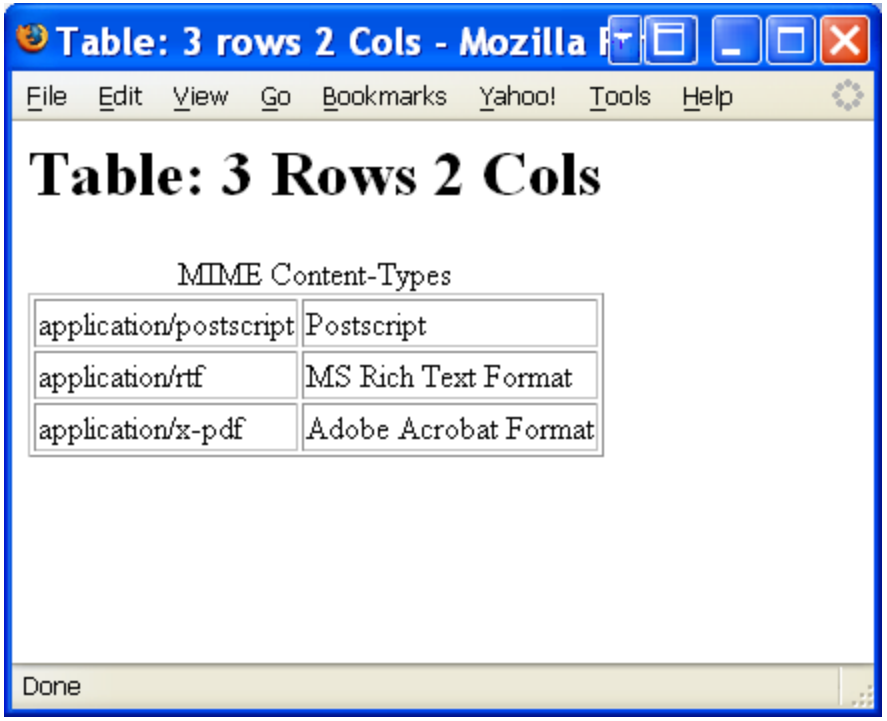
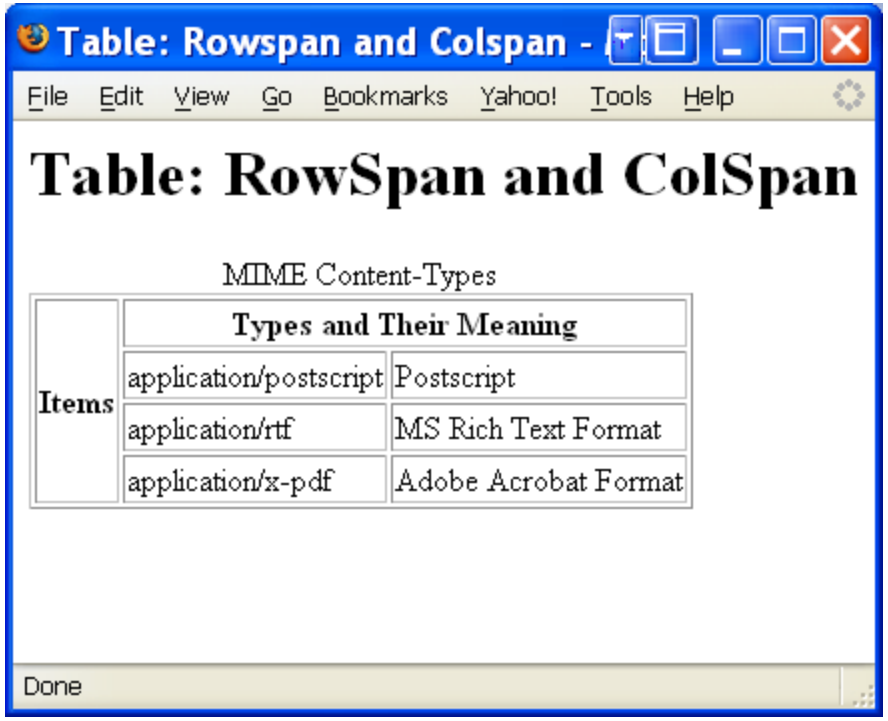


Table Example Rowspan colspan

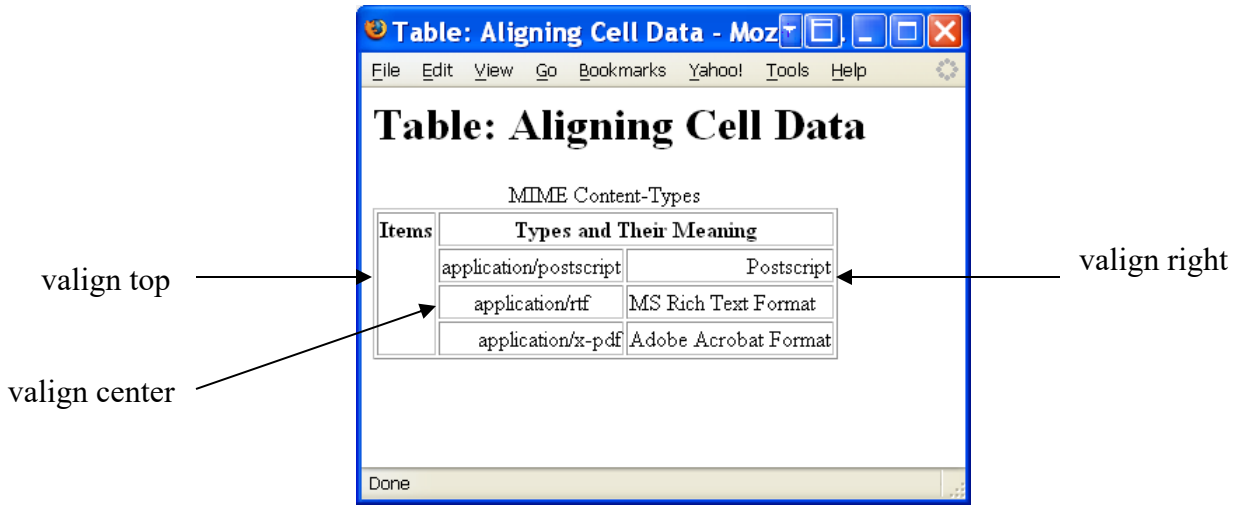
```
<HTML>
  <HEAD><TITLE>Table: Rowspan and Colspan</TITLE></HEAD>
  <BODY>
    <H1>Table: RowSpan and ColSpan</H1>
    <TABLE BORDER="2">
      <CAPTION>MIME Content-Types</CAPTION>
      <TR>
        <TH ROWSPAN=4>Items</TH>
        <TH colspan=2>Types and Their Meaning</TH>
      <TR>
        <TD>application/postscript</TD> <TD>Postscript</TD>
      <TR>
        <TD>application/rtf</TD> <TD>MS Rich Text Format</TD>
      <TR>
        <TD>application/x-pdf</TD> <TD>Adobe Acrobat Format</TD>
    </TABLE>
  </BODY>
</HTML>
```

Browser Output



Arranging Data in a Table

- Originally data in a table could be manipulated using attributes: align left, align right, align center, valign top, valign middle and valign bottom



- The above attributes are **deprecated** in **HTML5** in favor of Cascading Style Sheets (CSS) settings
- What does "deprecated" mean?
- See the slides in the lecture on CSS

HTML Character Set

- HTML uses the **Universal Character Set (UCS)**, defined in [ISO10646]. This standard defines a repertoire of thousands of characters used by communities all over the world.
  - Its latest specification (**Unicode 17.0.0**), dated September 9, 2025, can be found at

    http://www.unicode.org/versions/latest/
  - Includes Unicode Emoji (with skin tone diversity)
- HTML must also specify how characters are encoded during transmission.
- Commonly used character encodings on the Web include
  - ISO-8859-1 (also referred to as "Latin-1",
  - ISO-8859-5 (which supports Cyrillic),
- A browser is informed of the encoding by a line

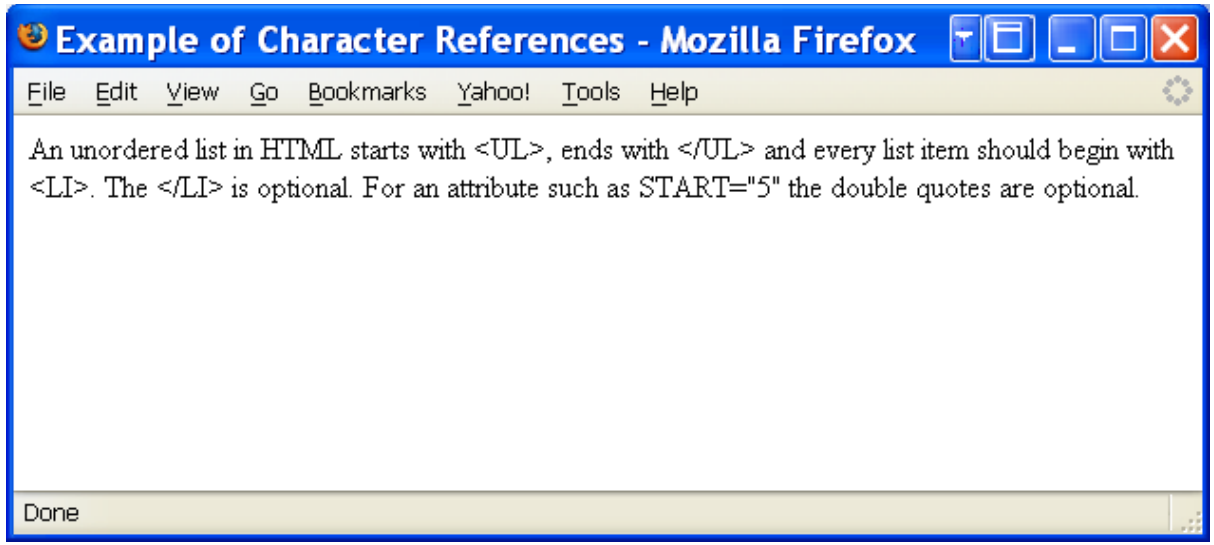
  Content-Type: text/html; charset=EUC-JP

Character references

- Character references in HTML may appear in two forms:
  - **Numeric** character references (either decimal or hexadecimal)
    - å (in decimal) represents the letter "a" with a small circle above it (used, for example, in Norwegian).
    - < represents left angle bracket
    - > represents right angle bracket
    - & represents ampersand sign
    - " represents double quote
  - Character **entity** references.
    - "<" represents the < sign.
    - ">" represents the > sign.
    - "&" represents the & sign.
    - "" represents the " mark.

Example - Character References

```
<HTML>
  <HEAD><TITLE>Example of Character References</TITLE></HEAD>
  <BODY>
    An unordered list in HTML starts with &lt;UL&gt;, ends
with &#60;/UL&#62; and every list item should begin with
&lt;LI&gt;. The &lt;/LI&gt; is optional. For an attribute such
as START="5&#34; the double quotes are optional.
  </BODY>
</HTML>
```



HTML Hyperlinks (Anchors)

- Hyperlinks are the "novel idea" introduced by Tim Berners-Lee
- Implemented in HTML with Anchor Tags
- An anchor is a way to designate a **link to another document** or to a specific place in the **same document**
- Begins with <A> and ends with </A>
- The link location is given by the "required" **HREF attribute** (Hypertext REFerence); e.g.,

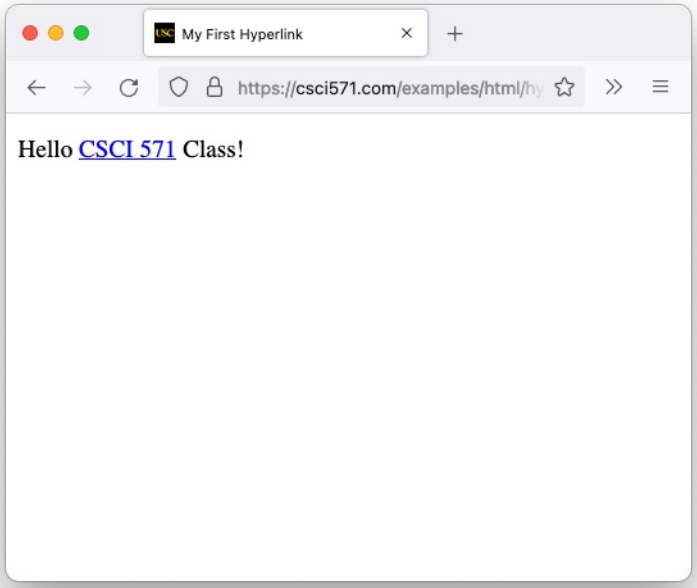
```
<A HREF="http://csci571.com/index.html">Class Home Page</A>
```

- Hypertext links are displayed using underlining, color, and/or highlighting
  - Depends on the browser defaults or style settings
  - Once a link is taken, it should change color
  - HREF, stands for **H**ypertext **REF**erence
- Link destination can be relative or absolute

HTML Hyperlinks (cont'd)

- Anchor tags allow one page to link to another page

```
<!DOCTYPE html>
<html>
  <head>
    <title>My First Hyperlink</title>
  </head>
  <body>
    <p>Hello <a href="https://csci571.com">CSCI 571</a> Class!</p>
  </body>
</html>
```



Syntax of Anchor Names

- **Anchor names** are **identifiers used in HTML to create internal links** within a webpage. They allow users to **jump to specific sections** of a page by using id attributes in combination with anchor (<a>) links.
- An anchor name is the value of the **"id" attribute** when used in the context of anchors.
- Using **"name" attribute** is deprecated
- Anchor ids must observe the following rules:
  - **Id Uniqueness:** Anchor names must be unique within a document, since ids must be unique within the same HTML document.
  - **String matching:** Comparisons between fragment identifiers and anchor names must be done by exact (case-sensitive) match.
- See https://developer.mozilla.org/en-US/docs/Web/HTML/Element/a

Defining Anchors Using the id Attribute

- The id attribute may be used to create an anchor at the start tag of any element (including the A element).
- Example: the **id attribute** places an anchor in an H2 element.

```
You may read more about this in
<A href="#section2">Section Two</A>.
. . . more text . . .
<H2 id="section2">Section Two</H2>
. . . more text
<P>Please refer to <A href="#section2">Section Two</A> above for
   more details.
```

- The id and name attributes share the same name space. They cannot both define an anchor with the same name in the same document. Try this example in IE and Firefox:

```
<P><A href="#label1">...</A>
...more document...
<P><H2 id="LABEL1">...</A>
```

NOTE: browsers work differently

Examples of Anchors

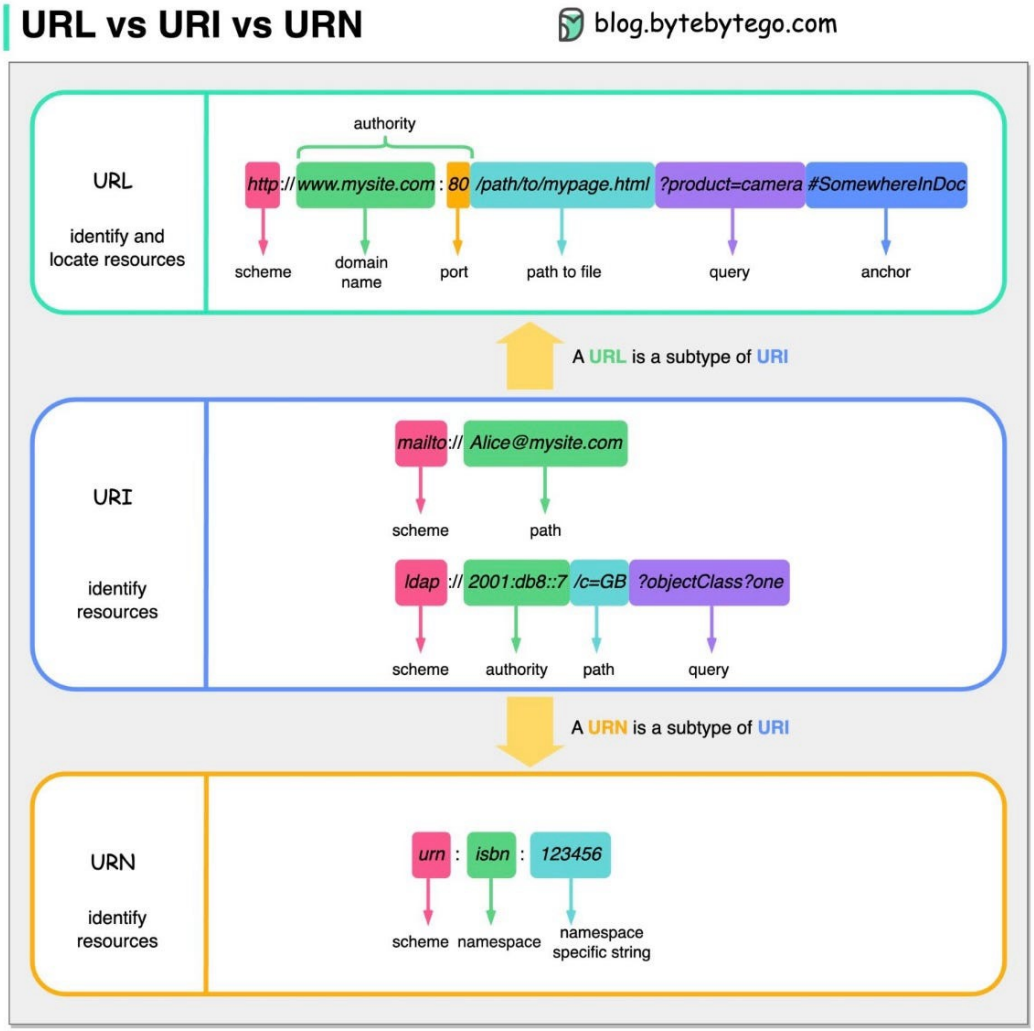
- <A href=myfile.html> a file in the same directory and same domain as the current page
- <A href=http://nunki.usc.edu/mydocs/book.doc> a file in directory mydocs on machine nunki.usc.edu, a WWW site
- <A href=news:comp.compilers> the newsgroup computers.compilers
- <A href=mailto:sales@xyz.com> opens an an e-mail window for sending a message
- <A HREF="ftp://ds.internic.net/rfc/rfc1866.txt"> Download RFC1866 </A> executes the ftp program to fetch a file Given the current position, this <HREF> moves up one directory, connects to Docs/Style/ and displays the document Overview.html, at the document "reference" anchor.
- <A HREF="../Docs/Style/Overview.html#reference"> … </A> Connects to lycos and runs pursuit with three arguments
- <A HREF="http://www.lycos.com/cgi-bin/pursuit?Hypertext+Markup+Language"> … </A>

Anchor Titles

- The **title attribute** may be set to add information about the nature of a link.
- This information may be **spoken** by a user agent, rendered as a **tooltip**, cause a change in cursor image, etc.

```
<BODY>
 ...some text...
<P>You'll find a lot more in <A href="chapter2.html"
          title="Go to chapter two">chapter two</A>.
See also this <A href="../images/solarsystem.gif"
          title="GIF image of solar system">view of the
   solar system.</A>
   </BODY>
```

Universal Resource Identifier (URI)
Universal Resource Locator (URL)



https://blog.bytebytego.com/

Universal Resource Identifier (URI) cont'd

- *URIs* typically consist of three pieces:
  - The **scheme** of the mechanism used to access the resource.
  - The name of the machine **hosting** the resource.
  - The name of the **resource** itself, given as a **path**

  E.g., http://www.usc.edu/dept/cs/index.html
- **Fragment identifiers** are URIs that refer to a location within a resource

  e.g., http://www.usc.edu/dept/cs/index.html**#section2**
- Relative URIs have a path that refers to a resource on the same machine as the current document, e.g., ".." means one level up
- See p. 24 in:

  https://datatracker.ietf.org/doc/html/rfc3986
- See also:

  https://en.wikipedia.org/wiki/Fragment_identifier

The <LINK> Element

- Should only appear in the HEAD
- It may appear any number of times
- It conveys relationship information that may be rendered in a variety of ways (e.g., a tool-bar with a drop-down menu of links, external files)
- Example - The current document is "Chapter2.html". The rel attribute specifies the relationship of the linked document with the current document.

```
<HTML>
<HEAD>
  <TITLE>Chapter 2</TITLE>
  <LINK rel="Index" href="../index.html">
  <LINK rel="Next" href="Chapter3.html">
  <LINK rel="Prev" href="Chapter1.html">
</HEAD>
  ...the rest of the document...
```

How is <LINK> Used

- To provide a variety of information to search engines:
  - Links to **alternate versions** of a document, written in another human language, e.g.

```
<LINK lang="fr" title="La documentation en Fran&ccedil;ais"
      type="text/html" rel="alternate" hreflang="fr"
      href="http://domain/manual/french.html">
```

  - Links to alternate versions of a document, designed for **different media**

```
<LINK media="print" title="The manual in postscript"
      type="application/postscript" rel="alternate"
      href="http://domain/manual/usermanual.ps">
```

  - Links to the starting page of a collection of documents.
  - Links to style sheets and "**media queries**" used in Responsive Web Design

Creating Graphics

- Digital cameras & Smartphones
  - Snap and the image is digitized and can be transferred to a computer
  - Typical resolutions are 1280x720, 1920x1080
- Graphic editors
  - Permit the combination of text, drawing, and color
  - For example, Adobe Photoshop
- Scanners
  - Convert text and graphics into machine readable form

Image Formats

- Five image formats are always supported by Web browsers
  - x-pixelmaps (obsolete)
    - Similar to x-bitmaps, but 8 bits are given to each pixel, permitting 256 colors in the image
  - Graphic Interchange Format (**GIF**)
    - Support black and white, grayscale, and color
    - Patented by Unisys (expired, abandoned)
  - Joint Photographic Experts Group (**JPEG**)
    - Designed for photographic images
    - Includes image compression
  - Portable Network Graphics (**PNG**)
    - An open, extensible image format with Lossless Compression
    - Patent-free replacement for GIF and TIFF
    - W3C Recommendation: http://www.w3.org/TR/PNG/\
  - Scalable Vector Graphic (**SVG**) – since 2008

Image Formats (cont'd)

- There are some modern image formats supported
  - **WEBP** (2010, open format, based on VP8 codec)
    - Baseline (96% adoption – except IE or old browsers <2020)
  - **AVIF** (2019, open format, based on AV1 codec)
    - Baseline 2024 (93% adoption – supported in Edge since 2024)
  - **JPEG XL** (2021, open format)
    - Limited availability (12% adoption – Safari only, support (behind a flag) was dropped by Chrome in 2022)
  - **HEIF** – container for different formats (AVIF, HEIC, JPEG, WXAM)
    - Limited availability (12% adoption – Safari only)
- Those formats could save a lot of bandwidth; however, we need to check if they are supported: **<picture>** tag + **<source type=**


```
<picture>
  <source srcset="photo.avif" type="image/avif" />
  <source srcset="photo.webp" type="image/webp" />
  <img src="photo.jpg" alt="photo" />
</picture>
```

Will use avif if supported, otherwise - webp if supported, otherwise - jpg

HTML Image Element

- The **img** element embeds an image in the current document, e.g., <IMG SRC="file.gif">
- Attributes of <img> include:
  - **src**, the HREF or name of the image
  - **srcset & sizes**, HREFs and sizes for different screen sizes and types
  - Align=top, middle, or bottom to align text around an image
  - **height** and **width** to control the dimensions of the image
  - **alt** to replace an image with "accessible" text

```
<img
  src="photo-800.jpg"
  srcset="photo-400.jpg 400w, photo-800.jpg 800w, photo-1600.jpg 1600w"
  sizes="(max-width: 600px) 90vw, 800px"
  alt="Landscape">
```

HTML Picture Element

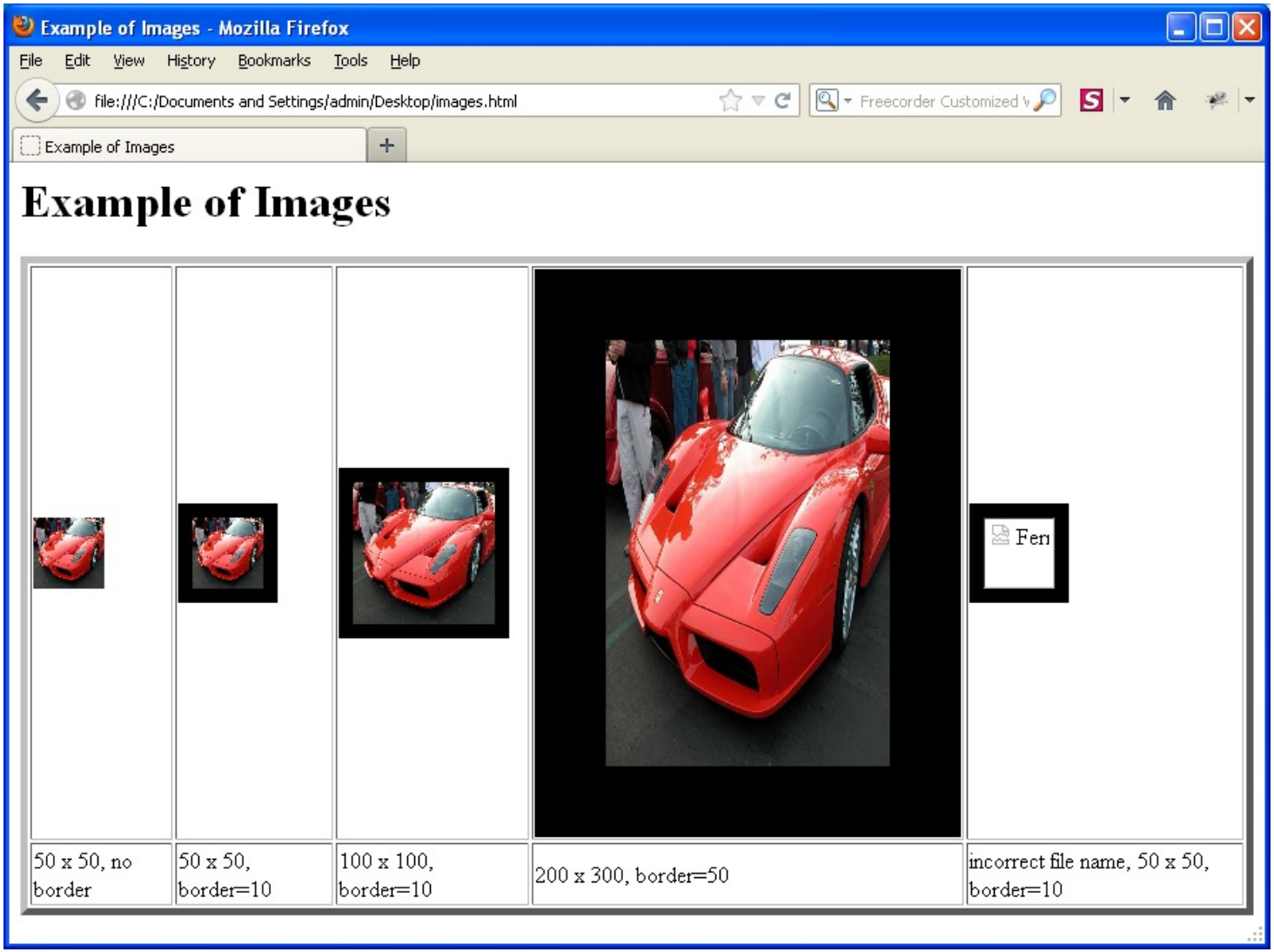
- The **picture** element:
  - Acts as a **container for multiple image sources**
  - Enables **art direction** (different images for different conditions)
  - Browser selects **between entirely different images**, not just sizes
  - Introduced in 2016 with HTML 5.1
- <picture> uses:
  - One or more **<source>** elements
  - Media queries and/or image formats
  - A required fallback <img>

```
<picture>
  <source media="(max-width: 600px)" srcset="portrait.jpg">
  <source media="(min-width: 601px)" srcset="landscape.jpg">
  <img src="landscape.jpg" alt="Scenic view">
</picture>
```

Example - Images

```
<HTML><HEAD><TITLE>Example of Images</TITLE></HEAD>
<BODY>
<H1>Example of Images</H1>
<table border=5>
  <tr>
    <td><IMG SRC="ferrari.jpg" ALT="Ferrari" BORDER=0 WIDTH=50 HEIGHT=50>
    <td><IMG SRC="ferrari.jpg" ALT="Ferrari" BORDER=10 WIDTH=50 HEIGHT=50>
    <td><IMG SRC="ferrari.jpg" ALT="Ferrari" BORDER=10 WIDTH=100 HEIGHT=100>
    <td><IMG SRC="ferrari.jpg" ALT="Ferrari" BORDER=50 WIDTH=200 HEIGHT=300>
    <td><IMG SRC="xferrari.jpg" ALT="Ferrari" BORDER=10 WIDTH=50 HEIGHT=50>
  </tr>
  <tr>
    <td>50 x 50, no border</td>
    <td>50 x 50, border=10</td>
    <td>100 x 100, border=10</td>
    <td>200 x 300, border=50</td>
    <td>incorrect file name, 50 x 50, border=10</td>
  </tr>
</table>
</BODY></HTML>
```

Browser Output



Active Images

- Active images are images that can be clicked and, just like an anchor, they act as a hypertext link

```
<A HREF="http://sunset.usc.edu:8080/index.html">
<IMG SRC="USCimage.gif"> </A>
```

  - Active images have a border around them and the cursor changes shape when passed over

Image Maps

- Image maps are active images with multiple clickable regions
- each region can be associated with a specific action (e.g., retrieve a document, run a program, etc.)
- When the region is activated by the user, e.g., by a mouse click, the action is taken
  - the pixel coordinates are interpreted by the browser (**usemap** attribute).
  - The **<map>** tag is used to associate the image and the regions.

An ImageMap Example from Wikipedia

To see the ImageMap work
go to
http://en.wikipedia.org/wiki/Image_map
and click on each of the individuals
at the table

<**img** class="thumbimage" width="720" height="523"
usemap="#ImageMap_1_2013620197"
src="//upload.wikimedia.org/wikipedia/commons
/b/ba/JoshuaReynoldsParty.jpg" alt="">

<**map** id="ImageMap_1_2013620197"
name="ImageMap_1_2013620197">
<**area** title="Dr Johnson – Dictionary writer"
alt="Dr Johnson – Dictionary writer"
coords="133,343,124,287,159,224,189,228,195,291,222,
311,209,343,209,354,243,362,292,466,250,463"
shape="poly" **href**="/wiki/Samuel_Johnson">
<**area** title="Boswell – Biographer" alt="Boswell"
coords="76,224,84,255,43,302,62,400,123,423,121,361,
137,344,122,290,111,234,96,225"
shape="poly" href="/wiki/James_Boswell">
<**area** title="Sir Joshua Reynolds – Host"
alt="Sir Joshua Reynolds – Host"
coords="190,276,208,240,229,228,247,238,250,258,286,
319,282,323,223,323,220,301,200,295"
shape="poly" href="/wiki/Joshua_Reynolds">

Imagemaps

- Add USEMAP attribute to <IMG> tag to indicate a client-side imagemap, e.g.

```
<IMG SRC="images/banner.gif" USEMAP="#bannerbar">
```

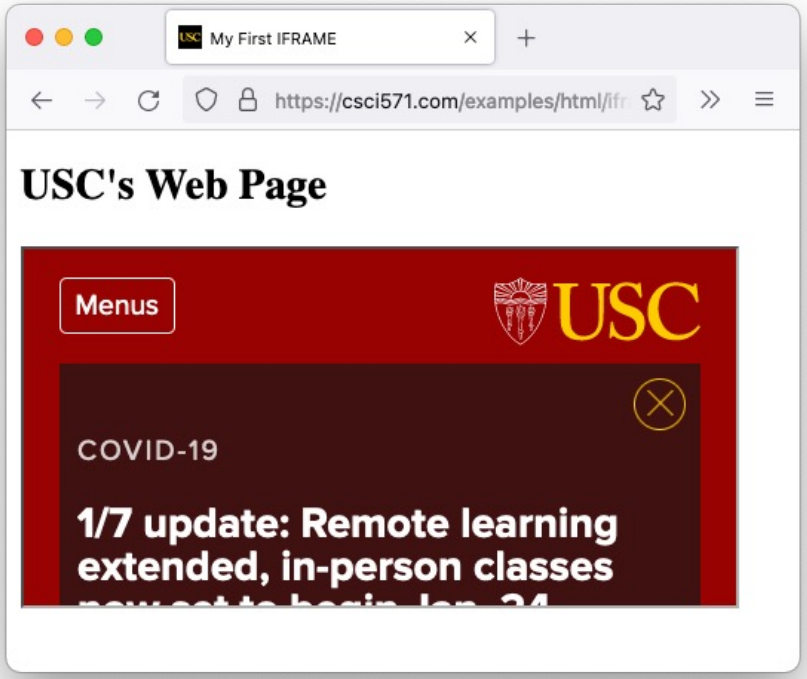
- Different regions of the image are described using <MAP> tag, e.g.

```
<MAP NAME="bannerbar">
<AREA SHAPE="RECT" COORDS="10,10,50,50" HREF="p1.html">
<AREA SHAPE="RECT" COORDS="50,10,90,50" HREF="p2.html">
<AREA SHAPE="RECT" COORDS="90,10,130,50" HREF="p3.html">
<AREA NOHREF SHAPE=default>
</MAP>
```

- Possible values for SHAPE are:
  - **default**: Specifies the entire region.
  - **rect**: Defines a rectangular region.
  - **circle**: Defines a circular region.
  - **poly**: Defines a polygonal region.

HTML Inline Frame

- Used to "embed" a website




```
<!DOCTYPE html>
<html>
<head>
  <title>My First IFRAME</title>
</head>
<body>
  <h2>USC's Web Page</h2>

  <iframe src="https://www.usc.edu" height="200" width="400" />

</body>
</html>
```

<META> Element

- Allows you to insert Name/Value pairs describing document properties, e.g.

```
<META NAME="Author" CONTENT="Ellis Horowitz">
```

- USC CS dept home page header

```
<META name="description"
content="The Computer Science Department at the University of Southern California, Los Angeles (USC) provides education leading to the Bachelors, Masters and Ph.D. degrees in Computer Science.">
<META name="keywords" content="USC, computer science, computer science research, computer science teaching">
<META name="author" content="Ellis Horowitz">
```

<META> Element

- Moving a Web page to a new site

```
<HTML>
<HEAD>
  <META HTTP-EQUIV="REFRESH" CONTENT="5; URL=http://www.usc.edu/dept/cs/">
  <META NAME="GENERATOR" CONTENT="Mozilla/4.04 [en] (Win95; I) [Netscape]">
  <TITLE>This site has moved</TITLE>
</HEAD>

<BODY>
  <CENTER>This site has moved to a new location which is:
    <A HREF="http://www.usc.edu/dept/cs/"> http://www.usc.edu/dept/cs/</A><BR>
Your browser should automatically move to the correct URL in five seconds.
  </CENTER>
</BODY>

</HTML>
```

Meta Tag and Robot Exclusion

<meta name="robots" content="noindex,nofollow">

<title>...</title> </head> <body> ...

- The content of the Robots META tag contains directives separated by commas.
- The currently defined directives are
  - **[NO]INDEX**. The INDEX directive specifies if an indexing robot should index the page.
  - **[NO]FOLLOW**. The FOLLOW directive specifies if a robot is to follow links on the page.
  - The defaults are INDEX and FOLLOW. The values ALL and NONE set all directives on or off: ALL=INDEX,FOLLOW and NONE=NOINDEX,NOFOLLOW.
- Some examples:

<meta name="robots" content="index,follow">

<meta name="robots" content="noindex,follow">

<meta name="robots" content="index,nofollow">

<meta name="robots" content="noindex,nofollow"> Note the "robots" name of the tag and the content are case insensitive.

Validating Your HTML

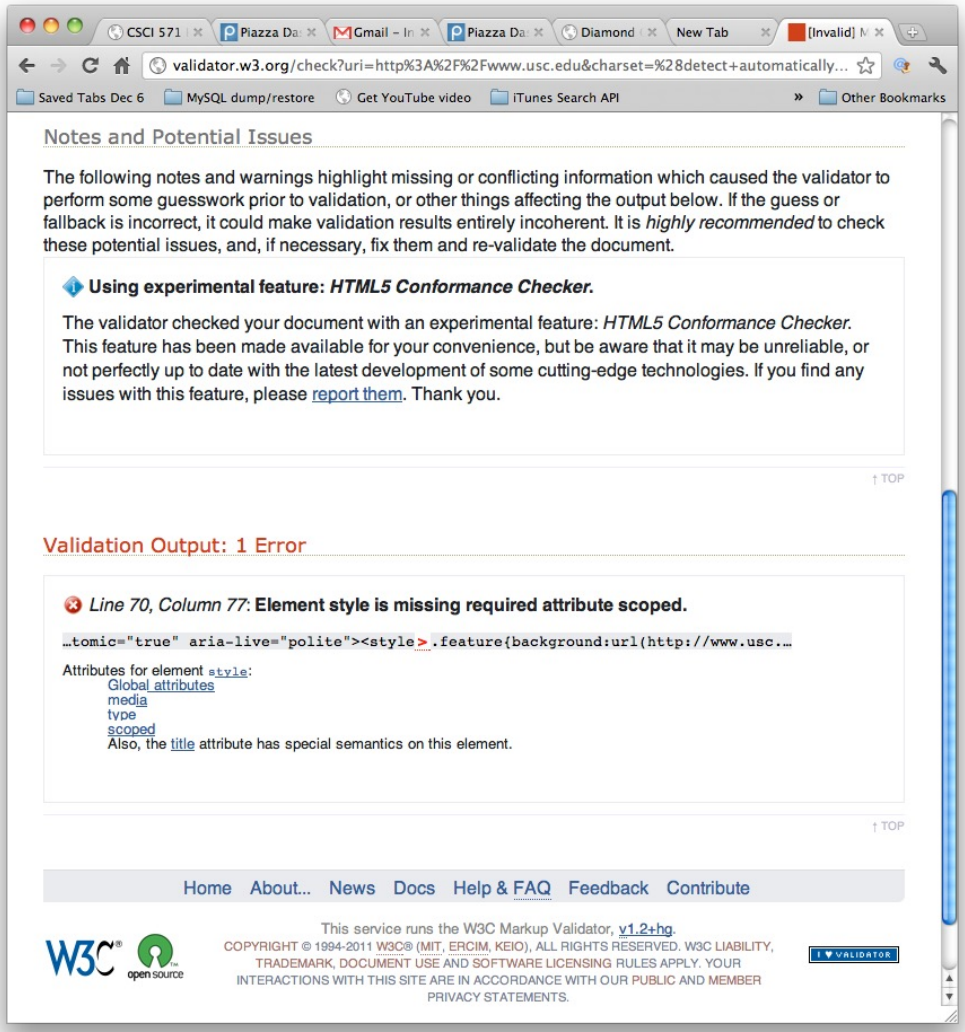
- The reasons for validation
  - Browsers display HTML differently
  - Browsers treat HTML errors differently
- What validators do
  - Flag syntax errors with respect to HTML DTD
  - Compare your pages to HTML 4.x, XHTML, and even HTML 5 (experimental)
- Some tools are downloaded to your site; others read your Web page from a URL
- HTML validation tools can be found at:
  http://search.yahoo.com/bin/search?p=html+validation
- W3C Markup Validation Service:
  http://validator.w3.org/
- W3C Nu Html Checker:
  https://validator.w3.org/nu/

W3C Markup Validation Service

- Options: character encoding & Document type

Validating Your HTML

- Sample output



Helpful Links to Play with

- W3 Schools
  https://www.w3schools.com/html/
- MDN (Mozilla Developer Network)
  https://developer.mozilla.org/en-US/docs/Web/HTML/Element
- MDN Recommended articles
  https://developer.mozilla.org/en-US/curriculum/
- CODEPEN
  https://codepen.io/
- JS Fiddle
  https://jsfiddle.net/
- JS BIN
  https://jsbin.com/?html,output