Client-Side Web GIS

HTML

Image from NASA: https://commons.wikimedia.org/wiki/File:Earth_Western_Hemisphere_transparent_background.png#filelinks

The goal of this module is to provide an introduction to Hypertext Markup Language (HTML) for generating and defining web content.

Module Topics

1. HTML language
2. Setting up an IDE for web development
3. HTML page structure
4. Text (p and h1-h6) tags
5. Bold (b) and italic (i)
6. Link (a) tags
7. Image (img) tags
8. Unorder lists (ul)
9. Ordered lists (ol)
10. Tables
11. Horizontal rules (hr)
12. Divs
13. Spans
14. Other tag types

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These are the topics covered in this module.

Client-Side Web Languages

- HTML (Hypertext Markup Language) = used to create the basic structure and content of a webpage

https://www.w3schools.com/html/default.asp

- CSS (Cascading Style Sheets) = used to design the webpage (where everything is placed and how it looks)

https://www.w3schools.com/css/default.asp

- JavaScript = define the interactive elements of a webpage that helps to engage the users

https://www.w3schools.com/js/default.asp

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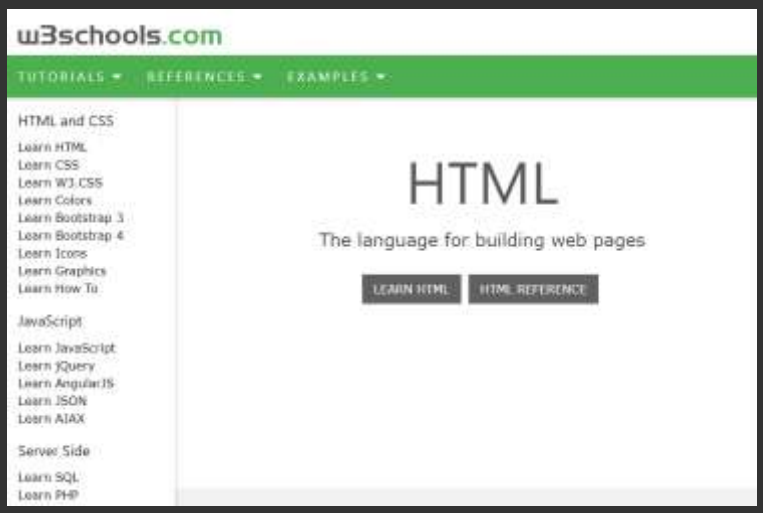
Hypertext Markup Language (HTML) is used to define or build the content of a webpage. For example, it is used to define text, images, lists, links, and additional content on a webpage. Currently, we are using HTML5, the most recent iteration of the language.

Cascading Style Sheets (CSS) are used to define the styling of the webpage, such as fonts, font size, colors, and layout. It is also used for responsive web design, which entails the layout of the page changing based on the screen size. This is how a website can function on screens of variable sizes. Given the wide variety of devices we currently use to access web content, this is extremely important.

JavaScript is a programming language that allows for interactive content. For example, clicking a button on a webpage causes something to happen, such as data from a form being uploaded or the page content changing. JavaScript is also used to generate interactive web maps (for example, the ArcGIS Maps SDK for JavaScript and the Leaflet JavaScript library).

In this course, we will primarily focus on client-side technologies.

Learning to Code



https://www.w3schools.com/

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W3schools.com is a great resources for learning a variety of programming languages for web development.

The material presented in this course draws heavily from these resources.

Book Recommendation

https://www.oreilly.com/library/view/html-css/9781118206911/

https://www.oreilly.com/library/view/javascript-and-jquery/9781118531648/

https://www.wiley.com/en-us/PHP+%26+MySQL%3A+Server+side+Web+Development-p-9781119149217

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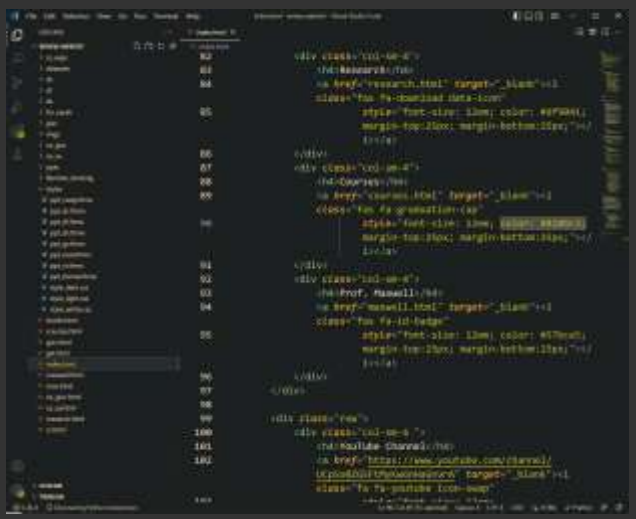
This book series is a great resource if you want to learn web development.

Setting up a Development Environment

Using Text Editors

- Always use a plain text editor
- Don't type code in Word!
- Example: Notepad, Notepad++, Sublime Text, Atom, Brackets
- I like VS Code



https://code.visualstudio.com/

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When writing HTML, or code in any language, you should use a plain text editor. You should never type code in Microsoft Word or other word processing software packages. This is because there is hidden formatting that might impact the interpretation of the code and cause errors.

There are many plain text editors available, and many are free. I would recommend using VS Code, which is free and open-source. However, you can use a different plain text editor if you prefer.

Web Development Tools in VS Code

- Live Server: https://marketplace.visualstudio.com/items?itemName=ritwickdey.LiveServer
- Prettier: https://marketplace.visualstudio.com/items?itemName=esbenp.prettier-vscode

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One of the benefits of VS Codes is the large number of extensions available. Two extensions that I have found to be especially useful are Live Server and Prettier.

Live Server deploys a local server to allow for live previews in the web browser as you edit your webpage.

Prettier allows for auto code formatting, such as fixing indentation issues.

Developer Tools

- Google Development Tools (CTRL+SHIFT+I)
- Used for debugging/finding errors
- Debug HTML, CSS, and JavaScript

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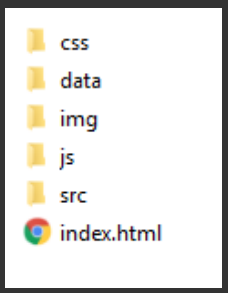
Web browsers offer development tools that are very useful as you generate web pages and attempt to find sources of errors and debug your code.

These tools are useful for debugging HTML, CSS, and JavaScript.

In Google Chrome and Firefox, CTRL+SHIFT+I will open the developer tools. You can also navigate to More Tools followed by Developer tools (Chrome) or Web Developer Tools (Firefox).

Set Up a Folder

- Create a folder to house an HTML project
- Common to name the main page index.html
- Create a folder for JavaScript code (js)
- Create a folder for CSS code (css)
- Create a folder for any downloaded source code (src)
- Create a folder for images and source data (img/data)



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When designing a website on a local computer prior to loading it to a server, you should generate the final folder structure you plan to move to the server once the website is ready to launch.

The main webpage is generally called “index.html” as this is what client machines will look for when opening a webpage from a server. Subsequent pages can be stored as additional html files with different names.

Within a website directory, it is considered good practice to store all additional files in folders. For example, CSS files can be stored in a “css” or “styles” folder while JavaScript code can be stored in a “js” folder. Images used on the webpages can be stored in an “img” folder while required data and assets can be stored in a “data” or “assets” folder.

A “src” folder is generally included to store local versions of source code referenced on your page. For example, you could store the Boostrap and jQuery libraries here to reference on your page. We will talk about how to set up these references in later modules.

In short, I highly recommend setting up this structure before starting to produce your website. Once relative links are established between files in this folder structure, it is easy to migrate the page to a server or a hosting service.

HTML

Basic Structure

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>

</body>
</html>
```

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
   <meta name="author" content="Aaron
         Maxwell">
   <meta name="description" content="An
         example HTML doc.">
</head>
<body>

</body>
</html>
```

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This slide outlines the general structure of an HTML document. All webpage content is defined within tags.

The content in the <head> tag will not show up on the webpage. It is used to define metadata, such as the page name, page creator, page description, and character set.

The title provided in the <title> tag will print to the page tab in the web browser. <meta> tags define metadata.

All HTML documents should start with <!DOCTYPE html> so that the browse appropriately interprets the file as an HTML file.

The HTML content, including the content defined in the <head>, must be placed between an <html> opening tag and </html> closing tag.

The content defined in the header will be placed between a <header> opening and </header> closing tag.

The content of the webpage will be placed between opening (<body>) and closing (</body>) tags.

Although HTML is generally forgiving in regard to tabs and spacing, it is generally recommended to indent lines of code that occur within tags, as demonstrated here, to aid in readability.

Encoding

- Defines the character set used
- Provided in meta tag
- Examples: ASCII, ANSI, 8859, and UTF-8
- We will use UTF-8

```
<meta charset="UTF-8">
```

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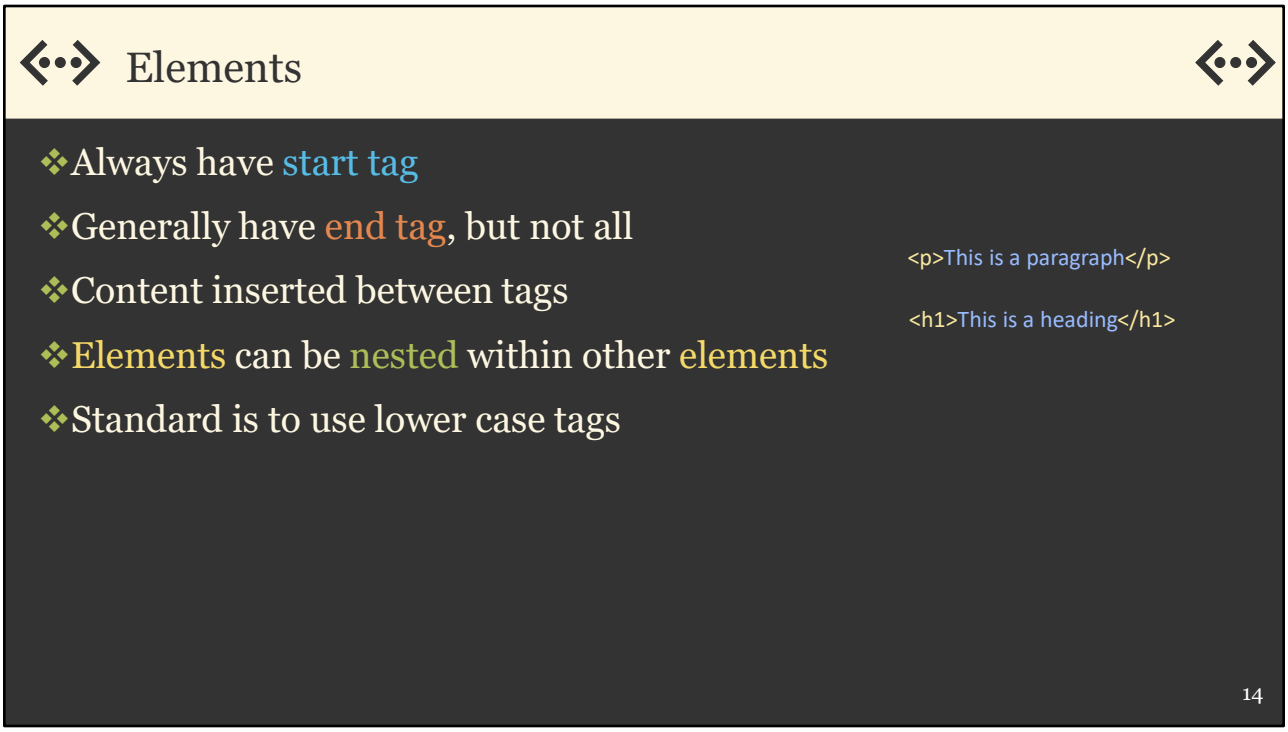
Encoding is important, as it defines the characters that can be used on the page, including alphanumeric and special characters.

Defining the correct encoding will ensure that the web browser renders the page content correctly using the correct characters or as desired.

In this course, we will use UTF-8. UTF-8 stands for 8-bit Unicode Transformation Format and is backward compatible with ASCII (American Standard Code for Information Interchange). This encoding method allows for data to be transferred in the form of binary information or bytes and then subsequently rendered to meaningful characters.

You should always specify the encoding used for the webpage in the <head> tag. You can also specific the language used on the page in the opening <html> tag.



HTML elements are defined using tags. Different tags are used to define different types of content.

All elements have an opening tag, and most elements also have a closing tag, though not all.

Opening tags do not include a forward slash but closing tags do.

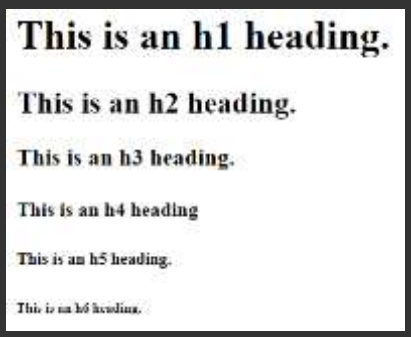
Page content is then inserted between tags, and it is possible to house content defined within a tag within prior tags.

The standard is to use lower case to define all tags.

We will now explore a variety of tags that can be used to define page content.

Headings

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
   <h1>This is an h1 heading.</h1>
   <h2>This is an h2 heading.</h2>
   <h3>This is an h3 heading.</h3>
   <h4>This is an h4 heading</h4>
   <h5>This is an h5 heading.</h5>
   <h6>This is an h6 heading.</h6>
</body>
</html>
```



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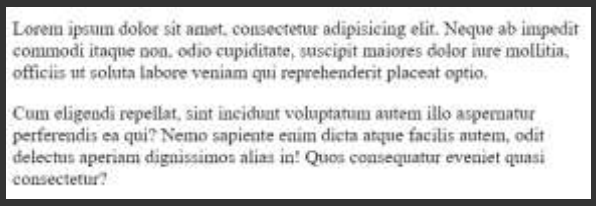
Header or <h> tags define headings and include both opening and closing tags.

Headers from <h1> to <h6> are available, with the default font size decreasing from <h1> to <h6>. Different header levels are commonly used to define page structure and subsections within sections.

You should never use <h> tags to define paragraphs or other non-heading page content.

Paragraphs

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
  <p>Lorem ipsum dolor sit amet, consectetur adipisicing elit. Neque ab impedit commodi itaque non, odio cupiditate, suscipit maiores dolor iure mollitia, officiis ut soluta labore veniam qui reprehenderit placeat optio.</p>
  <p>Cum eligendi repellat, sint incidunt voluptatum autem illo aspernatur perferendis ea qui? Nemo sapiente enim dicta atque facilis autem, odit delectus aperiam dignissimos alias in! Quos consequatur eveniet quasi consectetur?</p>
</body>
</html>
```



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Paragraph, <p> tags define page text and include both an opening and closing tag.

This is one of the most commonly used elements. Again, use <p> tags for text. Do not use <h> tags for any text that is not a header.

Bold and *Italic*

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
      <p>This is how you <b>bold</b>
something.</p>
      <p>This is how you <i>italicize</i>
something.</p>
</body>
</html>
```

This is how you **bold** something.

This is how you *italicize* something.

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Within <p> tags, bold or italicized text can be defined using <b> and <i> tags, which both include an opening and closing tag.

It is also possible to bold or italicize text using CSS, which will be discussed in the next module.

Links

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
<a
href="http://maxwellae.wixsite.com/maxwell-geospatial" target="_blank">My Wepage</a>
</body>
</html>
```

My Wepage

Target attribute controls where to open the linked document

- _blank = open in new tab
- _self = open in same tab (default)
- _parent = open in parent frame
- _top = open in full body of window
- framename = open in a named frame

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Link or <a> tags are used to link to other web pages, including other pages associated with your website, or files to download. They generally include both opening and closing tags.

The link is specified with the “href” attribute. This can be a full URL or web address or a relative path to a HTML file within your website directory.

The “target” argument determines how the page will be displayed.

_blank: open the link in a new tab

_self: open in the current tab

_parent: open in the parent frame

_top: open in full body of the window

_framename: open in a named frame

Images

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
   <img
src="http://www.wvview.org/assets/img/WV_V
iew-04.png" alt="WV View">
</body>
</html>
```

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Image <img> tags are used to display images and only require an opening tag.

The “src” argument is used to link to the image. This can be a full URL or web address that points to an image or a relative link within the website directory (for example, an image in the “img” folder).

It is generally required to use compressed image files, such as JPEG or PNG. You cannot use uncompressed files, such as TIFF files.

You should also make sure that the images are scaled to an appropriate size.

The “alt” argument is used to define text that will print if the image cannot be loaded. This is also helpful for accessibility.

Image Height and Width

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
      <img
src="http://www.wvview.org/assets/img/WV_View-04.png" alt="WV View"
style="width:700px;height:450px;">
</body>
</html>
```

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
      <img
src="http://www.wvview.org/assets/img/WV_View-04.png" alt="WV View" width="450"
height="700">
</body>
</html>
```

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Image height and width can be set using CSS (the example on the left) or HTML (the example on the right).

It is generally recommended to use CSS. We will discuss this in more detail in the next module.

Image as Link

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
   <a href="http://www.wvview.org/">
      <img
src="http://www.wvview.org/assets/img/WV_V
iew-04.png" alt="WV View">
   </a>
</body>
</html>
```

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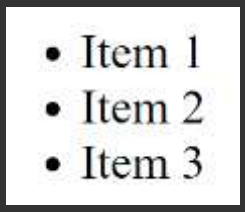
You can also use an image as a link by placing an <img> tag inside of an <a> tag.

The user can then click on the image or the “alt” text to link to another page or content.

Unordered List




```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
  <ul>
    <li>Item 1</li>
    <li>Item 2</li>
    <li>Item 3</li>
  </ul>
</body>
</html>
```

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It is possible to create ordered lists and unordered lists using HTML.

Unordered lists will use bullets by default while ordered lists will use numbers.

An unordered list is defined with the <ul> tag while individual elements in the list are defined with the <li> tag. Both of these elements have open and closing tags.

Ordered List

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
 <ol>
    <li>Item 1</li>
    <li>Item 2</li>
    <li>Item 3</li>
 </ol>
</body>
</html>
```

1. Item 1
2. Item 3
3. Item 3

Type	Description
1	Numbered with numbers
A	Numbered with uppercase letters
a	Numbered with lowercase letters
I	Numbered with uppercase roman numbers
i	Numbered with lowercase roman numbers

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Creating an ordered list is the same as creating an unordered list, except that the <ul> tag is replaced with <ol>.

The <li> tag is still used to define list elements.

Tables

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
 <table style="width:100%">
   <tr>
     <th>Header 1</th>
     <th>Header 2</th>
     <th>Header 3</th>
   </tr>
  <tr>
   <td>Row 1 Col 1</td>
   <td>Row 1 Col 2</td>
   <td>Row 1 Col 3</td>
  </tr>
  <tr>
    <td>Row 2 Col 1</td>
    <td>Row 2 Col 2</td>
    <td>Row 2 Col 3</td>
   </tr>
  </table>
</body>
</html>
```

Header 1	Header 2	Header 3
Row 1 Col 1	Row 1 Col 2	Row 1 Col 3
Row 2 Col 1	Row 2 Col 2	Row 2 Col 3

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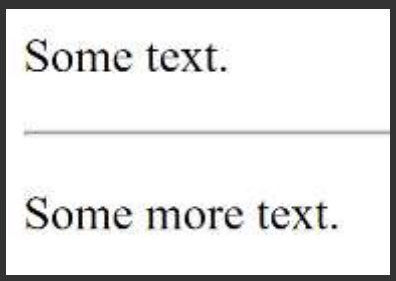
Tables are generated using several different tags.

<table>: initiate the table
<tr>: define a row
<th>: define header elements in a row
<td>: define row elements that are not headers

All of these elements have opening and closing tags.

Horizontal Lines

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Document</title>
</head>
<body>
  <p>Some text.</p>
  <hr>
  <p>Some more text.</p>
</body>
</html>
```



Horizontal lines are defined using the <hr> tag, which does not require a closing tag.

Divs

- Defines division or section in HTML document
- Container for other HTML elements
- Can be used with CSS to define formatting

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
  <div>
    <h1>Header</h1>
  </div>
  <div>
    <p>Some text.</p>
  </div>
</body>
</html>
```

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Block-level elements start on a new line by default.

The division or tag is an example of a block-level element that is commonly used as a container for other elements.

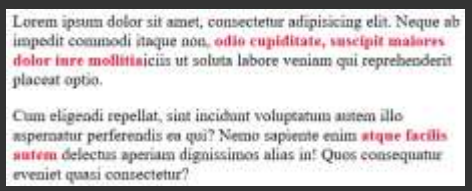
 tags are very useful for defining page layouts, applying responsive designs, and applying CSS.

We will use tags extensively in later modules as we apply styling and make web maps.

Span

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
  <style>
  span{
    color:crimson;
    font-weight: bold;
    }
  </style>
</head>
<body>
  <p>Lorem ipsum dolor sit amet, consectetur adipisicing elit. Neque ab impedit commodi itaque non, <span>odio cupiditate, suscipit maiores dolor iure mollitia</span>iciis ut soluta labore veniam qui reprehenderit placeat optio.</p>
  <p>Cum eligendi repellat, sint incidunt voluptatum autem illo aspernatur perferendis ea qui? Nemo sapiente enim <span>atque facilis autem</span> delectus aperiam dignissimos alias in! Quos consequatur eveniet quasi consectetur?</p>
</body>
</html>
```

- Used to apply styles to inline elements
- Different from div since div is applied at block level



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An inline-level element does not start on a new line by default.

The tag is an example and is commonly used to apply styling to a portion of content defined within another tag.

For example, a portion of the text in a <p> or <h1> tag could be wrapped in a to apply some styling to just that section of the text, as demonstrated on this slide.

Blockquote

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Paragraphs</title>
</head>
<body>
   <blockquote cite="http://www.aag.org/cs/careers">The AAG offers a variety of resources to answer questions, guide your career planning, and help you find a job. AAG members can access job announcements through the Jobs in Geography Center. Members and non-members alike are invited to explore our profiles of individual geographers; information about specific occupations, skills, and salary trends; and an assortment of other career advice and information. Use the links in the left-hand navigation to get started!</blockquote>
</body>
</html>
```

- Block of text cited from another source

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Blockquotes are used to define a block of text as a quote from another source.

Code

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Paragraphs</title>
</head>
<body>
   <h4>Example code below.</h4>
   <code>var y = "Google Earth Engine";</code>
</body>
</html>
```

- Block of code as plain text.

Example code below.

```
var y = "Google Earth Engine";
```

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<code> tags are used to define a block of plain text or code.

These are often used on webpages to provide code examples.

You should be able to copy and paste this plain text for use in a script.

em

- Emphasized text
- Better to just use CSS

Emphasized text!

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Paragraphs</title>
</head>
<body>
   <em>Emphasized text!</em>
</body>
</html>
```

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 tags can be used for emphasis; however, it is generally recommended to use CSS-based styling as opposed to the tag for emphasis.

Strong

- Differentiate important text
- Better to just use CSS

This is important!

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>Paragraphs</title>
</head>
<body>
   <strong>This is important!</strong>
</body>
</html>
```

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 tags can be used to denote important text content. Similar to , it is now considered best practice to use CSS-based styling as opposed to tags.

Comments

- Comments are not executed
- Can be used to make code more usable/human readable
- Can be used for debugging

Some text.

Some more text.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Document</title>
</head>
<body>
 <p>Some text.</p>
 <!-- A comment -->
 <p>Some more text.</p>
</body>
</html>
```

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This slide demonstrates how to define an HTML comment.

Comments are meant for humans and will not be interpreted by the computer to generate content.

I encourage you to comment your code to make it more usable and interpretable.

Additional Tag Examples

https://www.w3schools.com/tags/default.asp

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This w3schools.com page provides a list of all available HTML tags.

As you can see, there are many options; however, I have found that the tags discussed here are the ones I use most often.

Additional Development Tools

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Emmet

- Plug-in
- Speeds up HTML and CSS workflows
- Link: https://emmet.io/
- Cheat Sheet: https://docs.emmet.io/cheat-sheet/

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If you plan to generate webpages using HTML and CSS, I highly recommend using Emmet, which is now built into VS Code and does not require installing an extension.

It provides keyboard shortcuts to generate a wide variety of website elements quickly.

I have found it to be very useful for speeding up my design and development.

Links included on this slide provide a variety of examples of how to apply Emmet.

Embed a Map in HTML Page

- ArcGIS Online can produce CSS/HTML to add to a web document
- May need to manipulate the code to achieve the desired result.

```
<style>
.embed-container {position: relative; height: 600px; max-width: 75%; margin:auto}

.embed-container iframe, .embed-container object, .embed-container iframe{display: block; top: 0; left: 0; width: 100%; height: 100%;} small{position:
absolute; z-index: 40; bottom: 0; margin-bottom: -15px;}
</style>


<div class="embed-container">
<iframe width="200" height="200" frameborder="100" scrolling="no" marginheight="0" marginwidth="0" title="High Plains Map"
src="http://maps.arcgis.com/apps/Embed/index.html?
webmap=20dd28b82cc4de5a7530e2047c69b47&extent=-103.7274,-29.2456,97.9615,76.8530&zoom=true&previewImage=false&scale=true&legendlayers=true&basemap_galle
ry=true&disable_scroll=true&theme=light"></iframe>
</div>
```


ArcGIS Online can generate HTML and CSS code to embed a web map into an HTML page.

This code can be inserted into an HTML document at the desired location to render it as part of the page.

Specifically, this makes use of the <iframe> tag, which can embed HTML content into another HTML document.

I have found that the generated code often requires editing to obtain the desired result.

Embed a Map in HTML Page

- Open map
- Embed in Website 

- Configure
- Copy generated HTML and CSS
- Add to HTML document
- May need to edit to achieve desired results

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This slide describes the process of embedding an ArcGIS Online web map into a webpage.

Embed App in a Website

- Some apps can be embedded in an iframe on a webpage
- Select Share in the app Configuration to obtain the code

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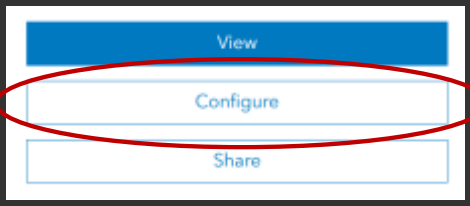
This slide describes how apps, as opposed to maps, can be embedded into an HTML webpage.

Embed App in a Website

- Some apps can be embedded in an iframe on a webpage
- Select Share in the app Configuration to obtain the code



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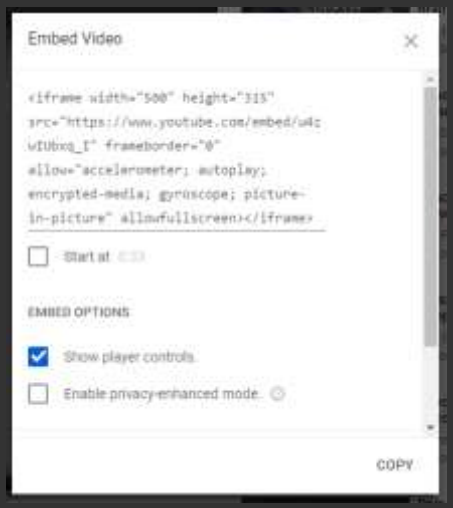
This slide describes how apps, as opposed to maps, can be embedded into an HTML webpage.

Embed a YouTube Video in HTML Page

- Go to YouTube
- Find Video
- Click SHARE
- Use Embed
- Copy generated code to HTML document
- May need to edit to achieve desired results



It is also possible to embed a video into a webpage.

For example, YouTube can generate code to embed a hosted video into a webpage.

Similar to a map, this code will need to be placed in the HTML document at the desired location.

Linking Pages

- You can link pages to other pages using links and buttons
- Can link using URL for webpage
- Can link using link to HTML document on server

```
<ul class="nav navbar-nav">
    <li><a href="http://www.wvview.org/" target="_blank">WV View</a></li>
    <li><a href="course_directory.html">Courses</a></li>
    <li><a href="http://maxwellae.wixsite.com/maxwell-geospatial" target="_blank">Prof Maxwell</a></li>
</ul>
```

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Another use of link or <a> tags is to link multiple HTML documents into a multi-page website.

Links can be made to external webpages or HTML files stored in the webpage directory.

Such methods are commonly used in the production of navigation or nav bars.

We will discuss this in more detail in the CSS and Bootstrap modules.

This is the end of this lecture module.

Please return to the West Virginia View Webpage for additional content.

Thanks! Hope you found this useful.