Advanced HTML5

Section 1: Introduction to HTML5

1.1 Introduction, Tags and Elements

HTML5 is the new standard and is a cooperation between W3C and the Web Hypertext Application Technology Working Group (WHATWG) for setting the modern HMTL5. HTML5 offers some new features that make webpage more dynamic.

HTML5 introduces are new sets of tags such as <header> and <section>, a <canvas> element for drawing 2D drawings, access to local storage (*alternative to cookies to store small amount of data in a user's browser*), new form controls like calendar, date and time, media functionality and geolocation.

Most modern browsers support most if not all of the HTML5 features.

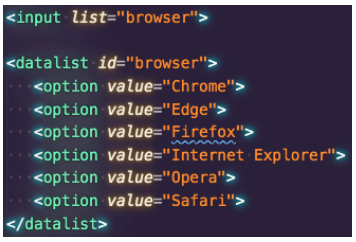
A very useful website for learning more about the HTML5 tags and elements is the W3School website (https://www.w3schools.com/html/default.asp).

1.2 New Form Elements

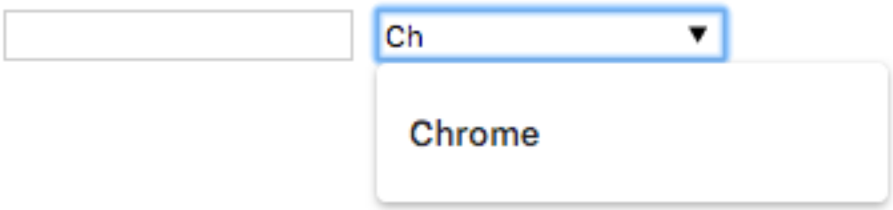
The best new feature of HTML5 are the new form/input element tags which make it easy to create HTML forms for users to interact with a webpage/web app. Below are examples:

Example	Description
<input type="email" name="">	Allows the form to validate the email address format without the use of JavaScript
<input type="tel" name="">	Used to define a field for entering a telephone number with validation
<input type="color" name="">	Allows to select a colour from a colour picker
<input type="date" name="">	Allows the user to select a date from a popup calendar
<input type="range" name="" min="1" max="10">	Control over the number input (like a slider input)
<input type="time" name="">	Used to define a filed for entering a time
<input type="url" name="">	Used to define a field for entering a url/link

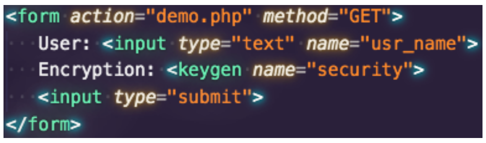
The **<datalist>** is a new form element which specifies a list of pre-defined options for an <input> element. It provides a autocomplete feature on the <input> elements. The element will look like a text input element and the user will see a dropdown list of pre-defined options as they start to input the data (i.e. start typing). The <input> element's list attribute is used to bind it together with a <datalist> element, for example:



```
<input list="browser">

<datalist id="browser">
    <option value="Chrome">
    <option value="Edge">
    <option value="Firefox">
    <option value="Internet Explorer">
    <option value="Opera">
    <option value="Safari">
</datalist>
```

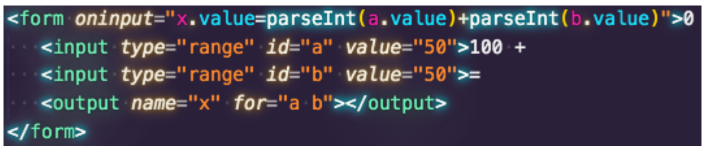


The **<keygen>** form element provides an advanced way to authenticate users on client side. The <keygen> tag specifies a key-pair generator field in a form and when the form is submitted two keys are generated, one private and one public. The private key is stored locally and the public key is sent to the server. The public key could be used to generate a client certificate to authenticate the user in the future. For example:

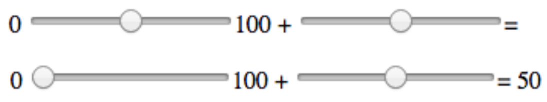


```
<form action="demo.php" method="GET">
    User: <input type="text" name="usr_name">
    Encryption: <keygen name="security">
    <input type="submit">
</form>
```

The **<output>** form element performs a calculation and shows the result in the <output> element. For example:



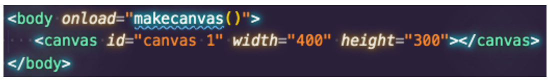
```
<form oninput="x.value=parseInt(a.value)+parseInt(b.value)">0
    <input type="range" id="a" value="50">100 +
    <input type="range" id="b" value="50">=
    <output name="x" for="a b"></output>
</form>
```



1.3 HTML5 Canvas

The canvas element is used to create lines, shapes, etc. on the webpage. The HTML is used to create the canvas while JavaScript is used to draw the 2d objects inside of the canvas.

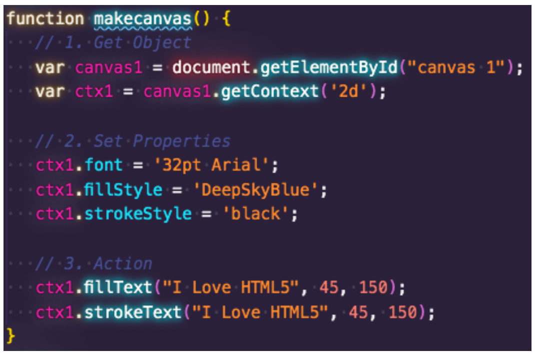
The canvas element requires a width and height attributes. The id attribute allows us to target the element with our CSS and JavaScript.



```
<body onload="makecanvas()">
    <canvas id="canvas 1" width="400" height="300"></canvas>
</body>
```

The onload attribute on the <body> element is a lifecycle event which triggers on load of the html page and can be used to trigger off a JavaScript function. The JavaScript file must be imported using a <script> tag placed either in the <header> element or at the bottom of the <body> element tags depending on how early you want to load/import the JavaScript code.

Below is an example JavaScript code to write some text on the canvas:

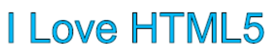


```
function makecanvas() {
    // 1. Get Object
    var canvas1 = document.getElementById("canvas 1");
    var ctx1 = canvas1.getContext('2d');

    // 2. Set Properties
    ctx1.font = '32pt Arial';
    ctx1.fillStyle = 'DeepSkyBlue';
    ctx1.strokeStyle = 'black';

    // 3. Action
    ctx1.fillText("I Love HTML5", 45, 150);
    ctx1.strokeText("I Love HTML5", 45, 150);
}
```

Three Steps:
1. Get object (declare variables)

2. Set the object properties

3. Action i.e. use the object to draw on the canvas.



```
I Love HTML5
```

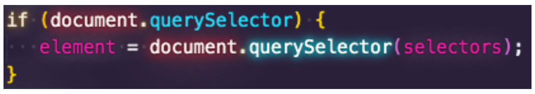
This is a very basic example demonstrating how HTML5 canvas can be used to create 2d objects on a webpage. More advanced JavaScript code can make more complicated objects with animation/particle effects.

1.4 HTML5 Feature Detection & Drag and Drop

Feature detection is finding specific properties or methods in a browser's DOM to detect the browser type and whether it supports a given operation. It is not a browser detection.

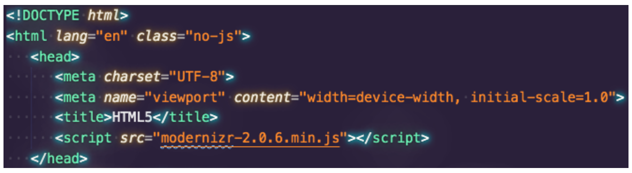
Disclaimer: Developers use to use "UA Sniffing" to detect the user's browser using the navigator.userAgent property. This would detect the actual browser but was unreliable. This is now obsolete and not recommended.

The best way to detect HTML5 and CSS3 features are by using third party JavaScript libraries such as Modenizr (https://modernizr.com/). Modernizr does not try to detect the browser but it detects certain features whether supported by the client browser. Once implemented we can use simple programming such as the below examples:



```
if (document.querySelector) {
    element = document.querySelector(selectors);
}
```

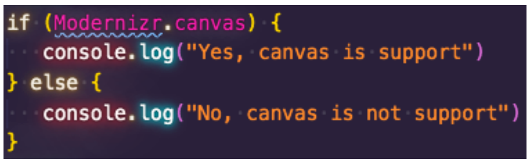
To implement Modernizr in our webpage is to download the file and include it the <head> section and add the class="no-js" to the <html> element tag.



```
<!DOCTYPE html>
<html lang="en" class="no-js">
  <head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>HTML5</title>
    <script src="modernizr-2.0.6.min.js"></script>
  </head>
```

There are other third party JavaScript feature detection libraries but Modernizr is one of the best ones out there.

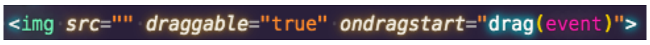
Modernizr creates properties for all of the features that it test for and we can refer to these properties to check whether the browser supports the object and its properties.



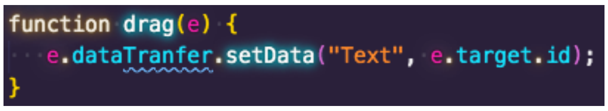
```
if (Modernizr.canvas) {
   console.log("Yes, canvas is support")
} else {
   console.log("No, canvas is not support")
}
```

If statement can be used to check if for example the HTML5 canvas property is supported by the browser and if so run some block of JavaScript code else run another block of JavaScript code.

The drag and drop syntax requires the element to have a draggable attribute to be set to true. Once the element is set to draggable we would need to specify what will happen when the element is dragged. The ondragstart attribute calls the function. Within the function we have the setData( ) function which takes in two arguments of the data type and the value of the drag data.

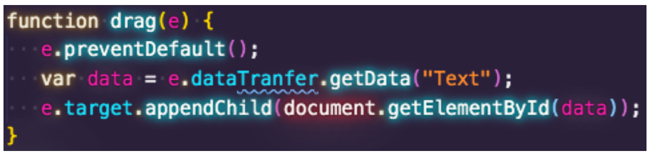


```html
<img src="" draggable="true" ondragstart="drag(event)">
```



```javascript
function drag(e) {
  e.dataTranfer.setData("Text", e.target.id);
}
```

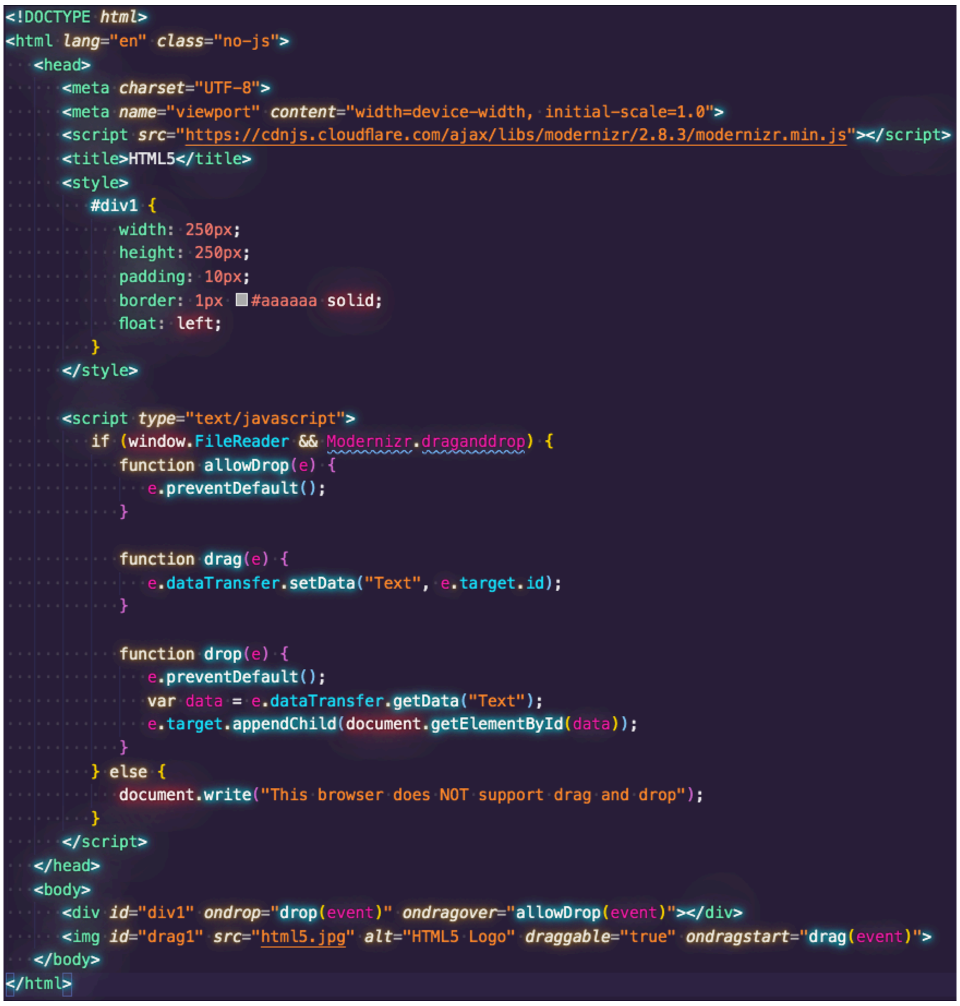
By default, data/elements cannot be dropped in other elements. To allow a drop, we need to prevent the default handling of the element and this is done with the event.preventDefault( ) function. So the syntax for the function would now look like:



```javascript
function drag(e) {
  e.preventDefault();
  var data = e.dataTranfer.getData("Text");
  e.target.appendChild(document.getElementById(data));
}
```

The .appendChild method will do the drop of the dragged element.

Below is a sample code of implementing both the feature detection and the drag and drop HTML5 features.
Disclaimer: The CSS and JavaScript code are added in the <head> element tags for demonstration and is not considered good practice.



```html
<!DOCTYPE html>
<html lang="en" class="no-js">
  <head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <script src="https://cdnjs.cloudflare.com/ajax/libs/modernizr/2.8.3/modernizr.min.js"></script>
    <title>HTML5</title>
    <style>
      #div1 {
        width: 250px;
        height: 250px;
        padding: 10px;
        border: 1px #aaaaaa solid;
        float: left;
      }
    </style>

    <script type="text/javascript">
      if (window.FileReader && Modernizr.draganddrop) {
        function allowDrop(e) {
          e.preventDefault();
        }

        function drag(e) {
          e.dataTransfer.setData("Text", e.target.id);
        }

        function drop(e) {
          e.preventDefault();
          var data = e.dataTransfer.getData("Text");
          e.target.appendChild(document.getElementById(data));
        }
      } else {
        document.write("This browser does NOT support drag and drop");
      }
    </script>
  </head>
  <body>
    <div id="div1" ondrop="drop(event)" ondragover="allowDrop(event)"></div>
    <img id="drag1" src="html5.jpg" alt="HTML5 Logo" draggable="true" ondragstart="drag(event)">
  </body>
</html>
```

1.5 Multimedia

HTML5 introduces a much simpler way of adding videos and audio clips in web pages. Previously plugins such as Flash/Shockwave was required to display videos in a web page. It is now as simple as including an image.

The types of media (MIME Types) supported for videos are Mp4, WebM and Ogg while for audio Mp3, Ogg and Wav are supported.

HTML5 Element Tags	Description
<video></video>	Define a video or audio content
<source></source>	Define multiple sources for the video/audio element(s)
<track></track>	Defines text tracks in media player

Important Note: Javascript is needed for extra functionality and controls.

JavaScript Methods	Description
addTextTrack( );	Adds a new track
canPlayType( );	Checks if the browser can play a file type
load( );	Reloads the audio/video element
play( );	Starts playing the audio/video
pause( );	Pauses the playing of the audio/video

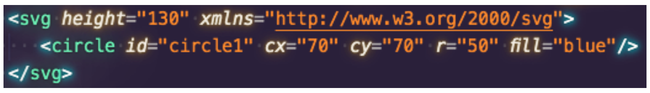
1.6 SVG in HTML5

Scalable Vector Graphic (SVG) is used to define vector-based graphics on a web page. Graphics are defined in Extensive Markup Language (XML) and vector graphics do not lose any quality whether resized smaller or larger. SVG are recommended by the W3C.

SVG is mostly useful for vector type diagrams like Pie Charts, Two-dimensional Graphs in a X,Y coordinate system, etc.

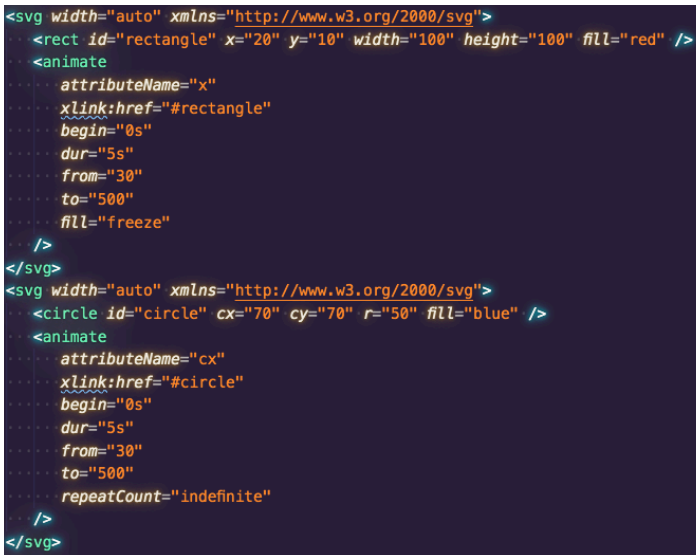
Most modern web browsers can display SVG just like they can when displaying PNG, GIF and JPG files.

HTML5 allows embedding of SVG directly using the <svg></svg> element tag.



```
<svg height="130" xmlns="http://www.w3.org/2000/svg">
    <circle id="circle1" cx="70" cy="70" r="50" fill="blue"/>
</svg>
```

We can also animate SVG using the <animate /> element tag nested within the <sgv></svg> tags as seen in the below example:



```
<svg width="auto" xmlns="http://www.w3.org/2000/svg">
  <rect id="rectangle" x="20" y="10" width="100" height="100" fill="red" />
  <animate
    attributeName="x"
    xlink:href="#rectangle"
    begin="0s"
    dur="5s"
    from="30"
    to="500"
    fill="freeze"
  />
</svg>
<svg width="auto" xmlns="http://www.w3.org/2000/svg">
  <circle id="circle" cx="70" cy="70" r="50" fill="blue" />
  <animate
    attributeName="cx"
    xlink:href="#circle"
    begin="0s"
    dur="5s"
    from="30"
    to="500"
    repeatCount="indefinite"
  />
</svg>
```

The attributeName is the attribute of the SVG we wish to animate. In this example we are moving the rectangle on the X axis from start position 30 to end position 500 on the X axis.

The freeze value will freeze the element at the end position rather than jumping back to the start position when the anumation duration ends.

We can use the repeatCount property on <animate /> to repeat the animation for a number of time or indefinitely.

We can chain multiple <animate /> tags on a single SVG to perform multiple animation such as moving the element from left and right and changing the colour as it moves.

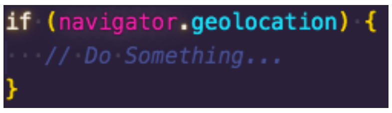
2.1 Geolocations

Geolocation is an HTML5 API that allows you to get the geographical location of a website user. The user must approve this before you can get the users position. This usually occurs via a browser popup authorisation button. All modern browsers support the use of the HMTL5 geolocation feature.

There are a lot of great uses for Geolocation such as public transportation websites, real estate websites, online gaming, local weather forecast, job postings, nearby cinema's/ shopping retail store. The possibilities are endless!

Geolocation works by scanning common sources of location information which include the following:

- Global Positioning System (GPS) which is the most accurate
- Network Signals i.e. IP address, RFID, WiFi and Bluetooth MAC addresses
- GSM/CDMA cell IDs
- User Input



```
if (navigator.geolocation) {
  // Do Something...
}
```

The Geolocation API provides a very useful function to detect support for geolocation and is simple as looking at the navigator object for the geolocation property.

The getCurrentPosition API is the main function that uses geolocation. It retrieves the current geographic location of the user's device. The location is expressed as a set of geological coordinates together with information about the heading and speed. The location information is returned in a position object.

```
getCurrentPosition(showLocation, ErrorHandler, options);
```

This method takes three arguments:

- **showLocation** (mandatory) - defines the callback method that retrieves location information.
- **ErrorHandler** (optional) - defines the callback method that is invoked when an error occurs in processing the asynchronous call.
- **options** (optional) - defines a set of options for retrieving the location information.

The possible return values from the getCurrentPosition function are:

Location Return Values	Description
coords.latitude	The latitude coordinate expressed as a decimal value
coords.longitude	The longitude coordinate expressed as a decimal value
coords.accuracy	The accuracy of the position
coords.altitude	The altitude in meters above the main sea level
coords.altitudeAccuracy	The altitude accuracy of the position
coords.heading	The heading as degrees clockwise from North
coords.speed	The speed in meters per second
timestamp	The date/time of the response

Once the position has been successfully obtained from the client there are two ways to present it to the user: geodetic and civic.
The geodetic way of describing position refers directly to the latitude and longitude while the civic representation of location data is a more human readable and understandable format. For example:

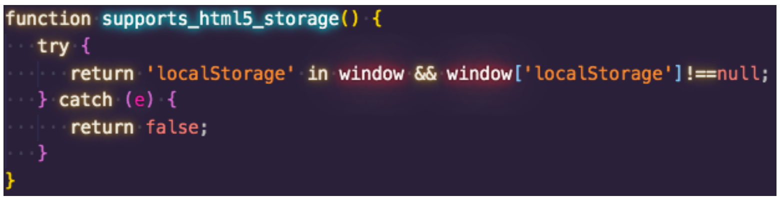
Attribute	Geodetic	Civic
Position	59.3, 18.6	Stockholm
Elevation	10 meters	4th Floor
Heading	243 degrees	To the city centre
Speed	5 km/h	Walking
Orientation	45 degrees	North-East

2.2 Web Storage

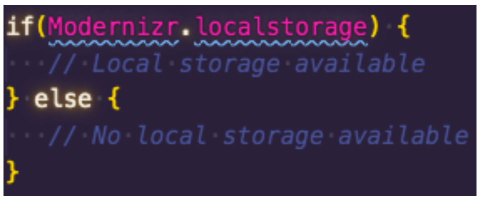
Web storage allows us to store data on a users local computer. The aim is to replace JavaScript cookies which was the only way in the past to have this kind of functionality.

Web storage is much better than cookies because it is more secure, faster and it stores a larger amount of data. The stored data is not sent with every server request and is only included when it is asked for (which is the huge advantage over cookies).

All modern browsers support HTML5 Storage but we can detect this feature with either JavaScript code or using a third party library such as Modernizr.



```
function supports_html5_storage() {
  try {
    return 'localStorage' in window && window['localStorage']!==null;
  } catch (e) {
    return false;
  }
}
```

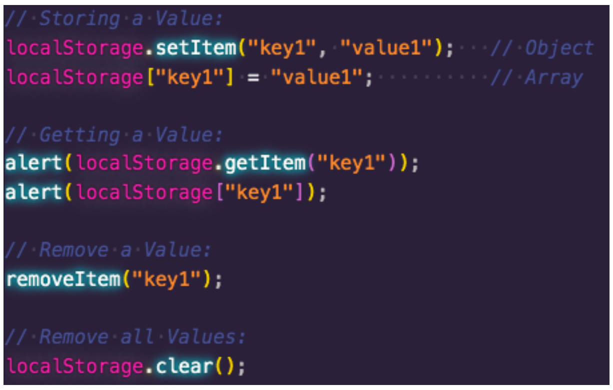


```
if(Modernizr.localstorage) {
  // Local storage available
} else {
  // No local storage available
}
```

There are two types of HTML5 web storage which are local storage and session storage. The difference between the two is that local storage has no expiration date while session storage only stores data for one session (i.e. when the user closes the browser the data is destroyed for the session).

localStorage and sessionStorage objects create a key=value pair for example: key="Name", value="Doe"

They are stored as strings but can be converted after if required by using JavaScript functions such as parseInt( ), parseFloat( ), etc.



```
// Storing a Value:
localStorage.setItem("key1", "value1");   // Object
localStorage["key1"] = "value1";          // Array

// Getting a Value:
alert(localStorage.getItem("key1"));
alert(localStorage["key1"]);

// Remove a Value:
removeItem("key1");

// Remove all Values:
localStorage.clear();
```

The syntax for both localStorage and sessionStorage are the same and are fairly simple to use as seen in the example on the left.

Note: Replace localStorage with sessionStorage to use the sessionStorage.

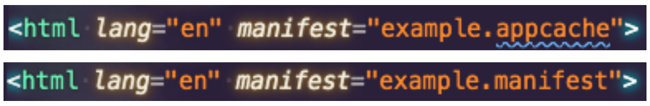
We can store data as either an object or an array value.

2.3 Application Cache

Using HTML5 Apache, we can make a web application work offline without an internet connection. All modern browsers can support AppCache. The advantages of application cache is that it allows the user to browse web pages offline, the pages load faster and there is less load for the server.

In order to use application cache you need to have a manifest file. The cache manifest file is a simple text file that lists the resources the browser should cache for offline access. This specifies not just only files (*HTML, CSS, JavaScript*) but also images to be cached and available for offline browsing.

The manifest attribute must be included on the document's html tag which points to the location of the manifest file which should be placed in root of the application:

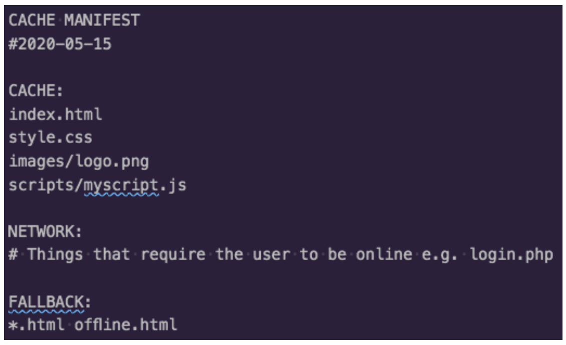


```html
<html lang="en" manifest="example.appcache">
<html lang="en" manifest="example.manifest">
```

Disclaimer: Either .appcache or .manifest can be used as the file extensions.

This should be on all the HTML pages you wish to cache for offline browsing.

The manifest structure can be a very simple and minimal as seen in the example to the right:



```
CACHE MANIFEST
#2020-05-15

CACHE:
index.html
style.css
images/logo.png
scripts/myscript.js

NETWORK:
# Things that require the user to be online e.g. login.php

FALLBACK:
*.html offline.html
```

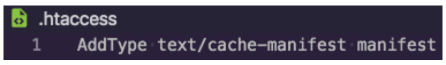
The four files will be cached and if the manifest file or a resource specified in it fails to download, the entire cache process fails.

Disclaimer: The CACHE MANIFEST is required at the beginning of the manifest file.

The NETWORK header lists the files that require an internet/network connection while the FALLBACK header lists the fallback files. In the example any .html files that fails to download then the offline.html file should be used as the fallback file.

The file needs to be served with a **content-type header of text/cache-manifest**; and is done with an .htacess file on the server. This will serve all files with an extension of manifest/appcache with the appropriate content-type header.

Example .htaccess file:



.htaccess

```
AddType text/cache-manifest manifest
```

The application that was cached will remain until either the user clears it out, the manifest has been modified or the cache is updated.

END