JavaScript Crash Course

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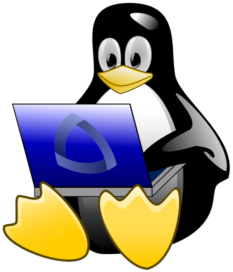

Colorado School of Mines
Linux Users Group

JavaScript is ***NOT*** Java [1]

- JavaScript was written was created in 10 days in May 1995 by Brendan Eich.
- JavaScript was originally called Mocha and was renamed to LiveScript before being renamed again to JavaScript.
- Why **Java**Script? Because Java happened to be popular then (that was before people realized how much Java sucks in a browser) and JavaScript looks syntactically similar at a glance.
- JavaScript is standardized[2] by Ecma International and there have been a number of ECMAScript versions. The latest is ECMAScript 6, but it is not fully supported by any browsers, including Firefox which only has partial support.

[1] Lots of this slide's information is from: `https://www.w3.org/community/webed/wiki/A_Short_History_of_JavaScript`

[2] JavaScript standards aren't actually that standard.

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Objects & Primitives

- Everything is either a primitive or an object.
- Objects are ALWAYS passed by reference
- Primitives are ALWAYS passed by value
- Objects in JavaScript are mutable keyed collections/dictionaries.
- JavaScript is *pseudoclassical*.
- JavaScript uses *prototypes* for inheritance.
- There is no such thing as a *class* in JavaScript.[1]

[1] ECMAScript 6 added support for classes, but JavaScript classes are just wrappers around the underlying prototype-based structure.

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Primitives: Types[1]

JavaScript has six primitive types:

- Boolean
- Null
- Undefined (yes, this is a type)
- Number (can be a number between $-(2^{53}-1)$ and $2^{53}-1$, `NaN`, `-Infinity`, or `Infinity`).
- String (single or double quotes declares a string literal[2])
- Symbol (new in ECMAScript 6)

[1] Info on this slide from: `https://developer.mozilla.org/en-US/docs/Web/JavaScript/Data_structures`

[2] Single quotes are recommended by Douglas Crockford because HTML normally uses double quotes and to avoid conflicts when manipulating DOM objects, single quotes should be used.

Objects: Inheritance and the Prototype Chain

- Every JavaScript object is linked to a *prototype*. If a member is not found in an object (i.e. if `obj.foobar == undefined`) then the prototype is searched. It defines a sort of “default” set of values for the object.
- “Empty” objects start with `Object.prototype` defined as their prototype.
- You can set the prototype of an object to another object (or to `undefined`) by calling `myObj.prototype = otherObj;`
- Since the prototype of an object is just another object, it too can have a prototype. Hence the prototype *chain*. When you access a property of an object, the whole prototype chain is searched for it.
- The prototype relationship is a dynamic relationship. If a property is added to the prototype, it is automatically visible to all objects based on that prototype.

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Objects: Syntax

```javascript
var myObj = { // this is an object literal
    a: 3,
    'b': 'JavaScript',
    'is-awesome?': true,
    doSomething: function () {
        console.log(this.a); // 3
        console.log(a); // error
    }, // trailing commas are allowed
};
myObj.doSomething();
console.log(myObj.b, myObj['is-awesome?']);
```

Output:

```
3
error: a is undefined
JavaScript true
```

Objects: Arrays

JavaScript arrays are basically vectors (and are also objects, remember?).

```javascript
var arr = [1, 'a', {}, [], true];
arr[0] = 'not a number';
arr.push('this is basically a vector');
console.log(arr);
```

Output:

```
[ 'not a number', 'a', {}, [], true, 'this is basically a vector' ]
```

Note that the elements of an array do not have to be the same type.

Variables

JavaScript is an **untyped** language. I don't know what that means and I don't think that Brendan did either when he wrote the language.

Variables are declared using the `var` keyword[1].

Examples:

- `var name;` - creates variable `name` of type `undefined`.
- `var name = 'Sumner';` - string literal
- `var age = 18;` - declaring a number literal
- `var hasFriends = false;` - declaring a boolean
- `var significantOther = null;`

[1] Sometimes you don't need to use `var` as I have described above.

Functions

- Functions are just objects with two special properties: a context (scope) and the function code.
- Functions can be defined anywhere where an object can be defined and can be stored in variables.
- Functions can access all arguments passed to a function via the `arguments` variable.
- Functions can access the callee of a function (`callee.func()`) via the `this` variable.
- Functions can also have named parameters.
- Functions always return a value. If no return is explicitly specified, the function will return `undefined`.

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Functions: Callback

Since JavaScript functions are objects, they can be passed just like other objects.

```
function doStuff(callback) {
    // do a bunch of processing
    var x = 3;
    console.log('in doStuff');
    callback(x);
}

doStuff(function(x) {
    console.log(x * 3);
});
```

Output:

```
in doStuff
9
```

Functions: New

JavaScript functions can be invoked with the `new` keyword, mimicking traditional class-based languages:

```
function Thing(val) {
    this.v = val;
}

var t = new Thing(12);
console.log(t.v); // prints 12
```

But don't be fooled. Really that is just equivalent to:

```
...

var t = {};
t.prototype = Thing.prototype;
t.Thing(12); // the important bit!
console.log(t.v); // prints 12
```

Scope

There are two scopes in JavaScript: global and function.[1]

Variables declared outside of a function are automatically in the global scope.

Variables declared within a function *without* the `var` keyword are also in the global scope.

```
var a = 2;
(function() {
    b = 3
    var c = 5;
})(); // this creates and invokes the function
      // immediately

console.log(a); // logs 2
console.log(b); // logs 3
console.log(c); // error since c is undefined
                // in global scope
```

Global Abatement

Because your code could coexist with other people's code, on the same HTML page, it is recommended that you reduce your *global footprint* by only creating a few global objects and then putting all assets into that object.

```
myGlobal = (function() {
    var myInternalData = 10;
    return {
        data: 5,
        subObject: {
            cool: 'things',
        },
        fn: function() { return myInternalData; },
    };
})();
```

Since you can add properties to objects at will, you can still split your code into multiple files.

Private Variables

You can simulate private variables the same way:

```javascript
var Dog = function(name) {
    var gender = 'male';
    this.name = name;
    this.isBoy = function () {
        return gender == 'male';
    };
};

var myDog = new Dog('Sebastian');
console.log(myDog.gender);  // logs undefined
console.log(myDog.name);    // logs 'Sebastian'
console.log(myDog.isBoy()); // logs true
```

Syntax: Control Statements

```javascript
// if statement syntax is identical to C++
if (condition) {
} else if (condition) {
} else {
}

// ternary syntax is just like C++
var a = condition ? val_if_true : val_if_false;

for (initializer; condition; incrementor) {
    // for loop syntax is identical
}

for (var prop in obj) {
    obj[prop].doThing(); // prop is the key
                         // could be a number or a string
}
```

Pitfalls: Variable Hoisting

Variables are *hoisted* to the top of the function they are declared in. Thus, the following is entirely valid.

```
function scopeEx() {
    b = 5;
    console.log(b); // logs 5
    var b = 3
    console.log(b); // logs 3
}
```

This is confusing. Just declare your variables before you use them.

[1] In ES6, variables declared with `let` are actually block scope.

Pitfalls: Truthy, Falsy and == vs ===

JavaScript has the notion of being *truthy* and *falsy*.

The following values are always falsy: `false`, `0`, `""`, `null`, `undefined`, `NaN`.

Do not expect all falsy values to be equal to each other (`false == null` is false).

JavaScript has two equality operators:

- == compares without checking variable type. This will cast then compare.
- === compares and checks variable type.

Additional Resources

A lot of this presentation was based off of *JavaScript: The Good Parts* by Douglas Crockford. This is an essential read for anyone interested in learning JavaScript for anything more than writing a few simple scripts.

MDN is the best resource for JavaScript documentation (`https://developer.mozilla.org/en-US/`).

JSHint (`http://jshint.com/about/`) is a tool which checks JavaScript syntax and helps prevent bugs in your code. JSHint has plugins for most IDEs and text editors. Here's a SO article on the Vim plugin: `http://stackoverflow.com/questions/473478/vim-jslint/5893447`

Additional Resources: Libraries

There are **lots** of JavaScript libraries. One of the most widely used is jQuery (`http://jquery.com/`). It has good documentation and is really good for DOM manipulation.

Basically, if you want to do anything in JavaScript, somebody else has probably also wanted to do that and have created a library for it. Google is your friend.

DOM Manipulation

The *Document Object Model* is an API used by JavaScript to interact with the elements of an HTML document.[1]
jQuery is great for simple DOM manipulation.

```html
<div id="cool">Cool</div>
<div class="myCls">jQuery Demo</div>
```

```javascript
var coolDiv = document.getElementById('cool'); // pure JS
coolDiv.style.background = 'blue';

var coolDiv = $('#cool');                      // jQuery
coolDiv.css('background-color', 'blue');
```

jQuery does a ton of other useful things as well, but that's what the docs are for.

[1] https://en.wikipedia.org/wiki/Document_Object_Model

Canvas

Live Demo from Sam

Sources

I relived heavily on *JavaScript the Good Parts* by Douglas Crockford in preparing this presentation. In fact, almost every slide contains some information I got from that book.