JAVASCRIPT

Fashionable and Functional!

JAVASCRIPT

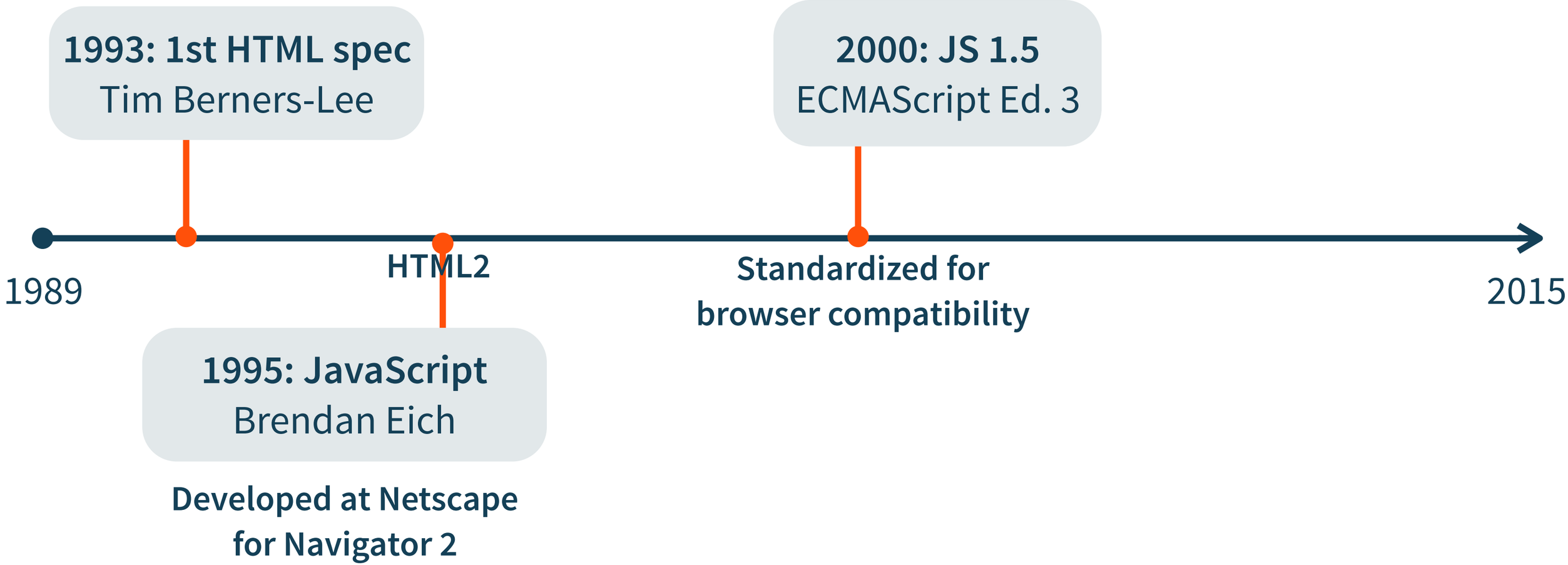
popular scripting language on the Web, supported by browsers

separate scripting from structure (HTML) and presentation (CSS)

client- and server-side programming

object-oriented, imperative, functional

Timeline


1993: 1st HTML spec
Tim Berners-Lee
2000: JS 1.5
ECMAScript Ed. 3
1989
HTML2
Standardized for
browser compatibility
2015
1995: JavaScript
Brendan Eich
Developed at Netscape
for Navigator 2

JAVA : JAVASCRIPT ::

:

VARIABLES

Dynamically typed: types associated with values, not with variables

Use **`var`** to define local variables

variables defined implicitly through assignment have global scope

BASIC DATA TYPES

Booleans: **`true`**, **`false`**

Number: no integers, 64-bit floating point

String: no char, variable-length

Special Types: **`null`**, **`undefined`**

get familiar with String methods

ARRAYS

```
var classes = new Array();

classes[3] = 'cs199rk';

var numbers = [5,3,2,6];

numbers.length;
```

other methods: **push**, **pop**, **sort**, ...

OBJECTS

collection of properties: name-value pairs

```
llama = {color: 'brown', age:7,
         hasFur: true};
```

add new properties on the fly

```
llama.family = 'camelid';
```

At first blush…

```
var sum = 0;

var numbers = [5,3,2,6];

for (var i=0;i<numbers.length;i++) {

  sum += numbers[i];

}
```

…everything seems typical

Functions are first-class objects

FUNCTIONS ARE OBJECTS

that are callable!

reference by variables, properties of objects

pass as arguments to functions

return as values from functions

can have properties and other functions

DECLARATION

```
function eat() {…}

var sleep = function()
{…}

console.log(eat.name);

console.log(sleep.name);
```

what will this print?

DECLARATION


```
function eat() {…}

var sleep = function() {…}
```

anonymous function

ANONYMOUS FUNCTIONS

create a function for later use

store it in a variable or method of an object

use it as a callback

see more examples next class

SORT COMPARATOR

```
var inventory =
[{product:“tshirt”,price:15.00},
{product:“jacket”,price:35.00},
{product:“shorts”,price:10.00}]

inventory.sort(function(p1,p2){

    return p1.price-p2.price;});
```

VARIABLE NUMBER OF ARGUMENTS

functions handle variable number of arguments

excess arguments are accessed with **`arguments`** parameter

unspecified parameters are **`undefined`**

`this`

the other implicit parameter

a.k.a. function context

object that is implicitly associated with a function's invocation

defined by how the function is invoked (not like Java)

FUNCTION INVOCATION

```
function eat() {return this;}

eat();

var sleep = function()
{return this;}

sleep();
```

`this` refers to the global object

METHOD INVOCATION

```
function eat() {return this;}
var llama = {
  graze: eat
};
var alpaca = {
  graze: eat
};
console.log(llama.graze()===llama);  true
console.log(alpaca.graze()===alpaca);  true
```

this refers to the object

`apply()` *and* `call()`

two methods that exist for every function

explicitly define function context

```
apply(functionContext,arrayOfArgs)
```

```
call(functionContext,arg1,arg2,...)
```

implemented in Javascript 1.6

```
function forEach(list, callback){
  for (var n = 0; n < list.length; n++){
    callback.call(list[n],n);
  }
}

var numbers = [5,3,2,6];
forEach(numbers, function(index){
        numbers[index]= this*2;});
console.log(numbers);
```

don’t need multiple copies of a function
to operate on different kinds of objects!

```
function forEach(list, callback){
  for (var n = 0; n < list.length; n++){
    callback.call(list[n],n);
  }
}

var camelids = ["llama", "alpaca", "vicuna"];
forEach(camelids, function(index){
camelids[index]= this+this;});
console.log(camelids);
```

Classes are defined through functions

OBJECT-ORIENTED PROGRAMMING

`new` operator applied to a constructor function creates a new object

no traditional class definition

newly created object is passed to the constructor as this parameter, becoming the constructor's function context

constructor returns the new object

CONSTRUCTOR INVOCATION

constructors are given the class name

```
function Llama() {
  this.spitted = false;
  this.spit = function() { this.spitted = true; }
}

var llama1 = new Llama();
llama1.spit();
console.log(llama1.spitted); true

var llama2 = new Llama();
console.log(llama2.spitted); false
```

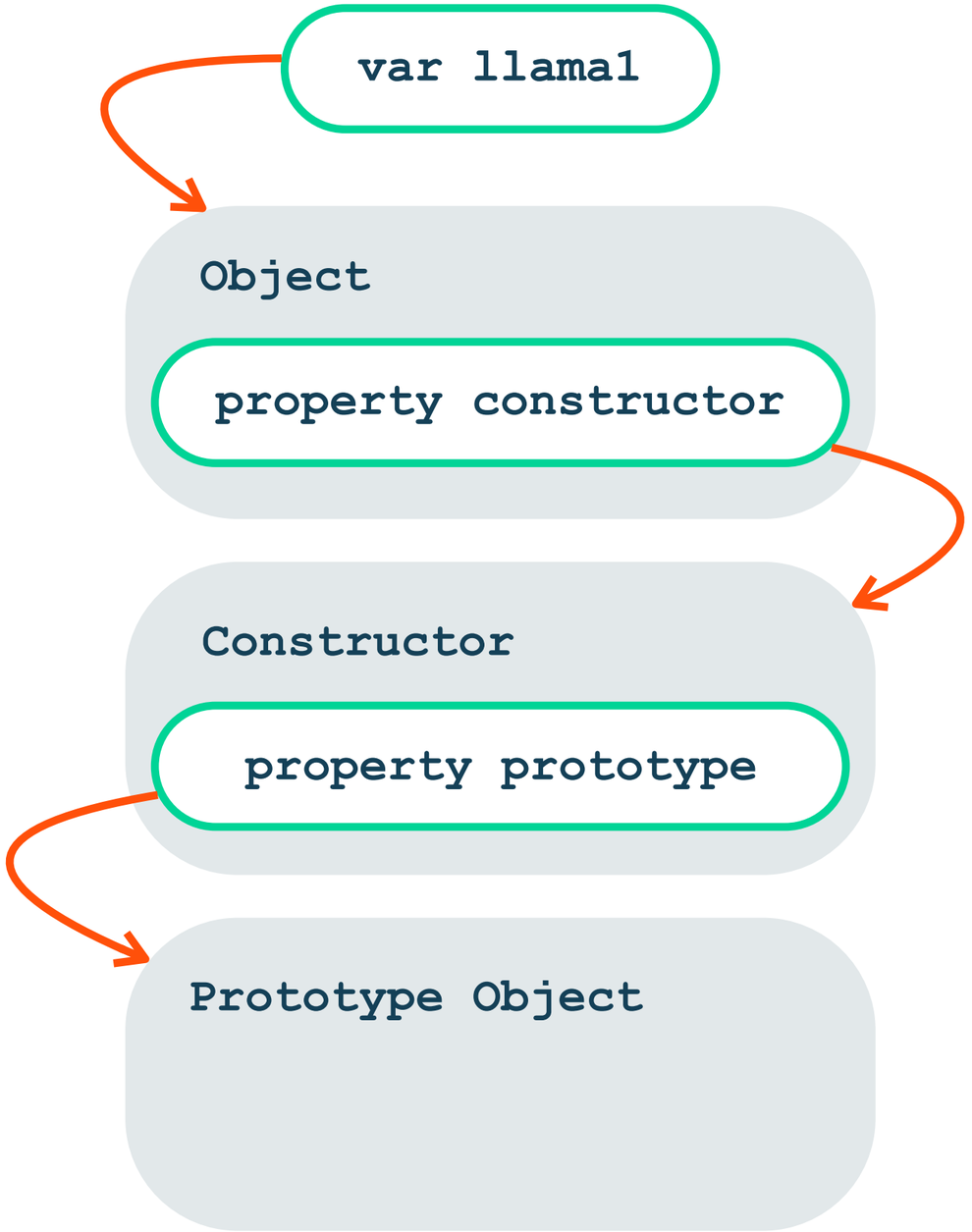
prototype

prototype is a property of the constructor

another way to add methods to objects

```
function Llama() {
  this.spitted = false;
}
Llama.prototype.spit = function() {
   this.spitted = true;
};
```

```
function Llama() {
  this.spitted = false;
  this.spit = function() { this.spitted = true; }
}
Llama.prototype.spit = function() {
   this.spitted = false;
};
var llama1 = new Llama();
llama1.spit();
console.log(llama1.spitted); true
```



binding operations within the constructor always take precedence over those in its prototype

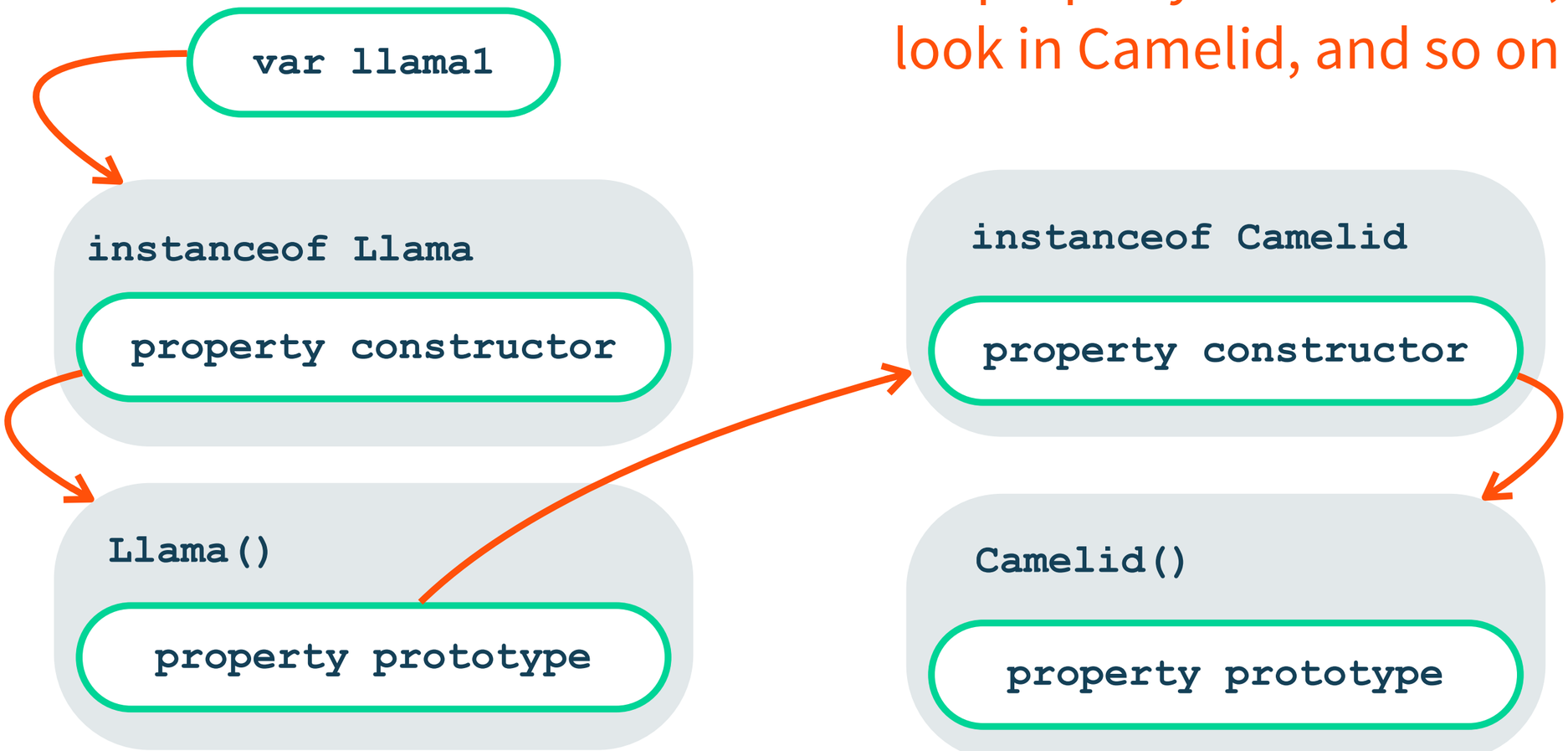
INHERITANCE

create prototype as instance of parent class

```
Llama.prototype = new Camelid();
```

PROTOTYPE CHAINING

if a property isn't in Llama, look in Camelid, and so on



Scoping

SCOPE

```
function outerFunction() {
  var x = 1;
  function innerFunction() {…}
 if(x==1) {var y=2;}
 console.log(y);
}
outerFunction();
```

what will it print?

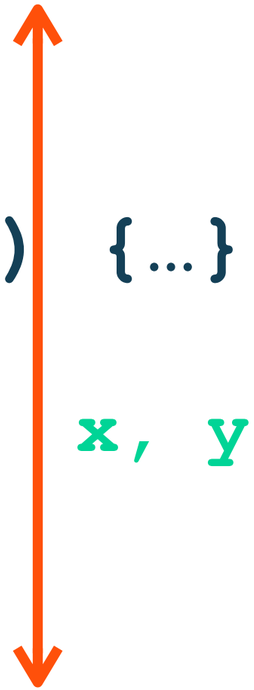
scopes are declared through functions and not blocks { }

HOISTING

Variables and functions are in scope within the entire function they are declared in

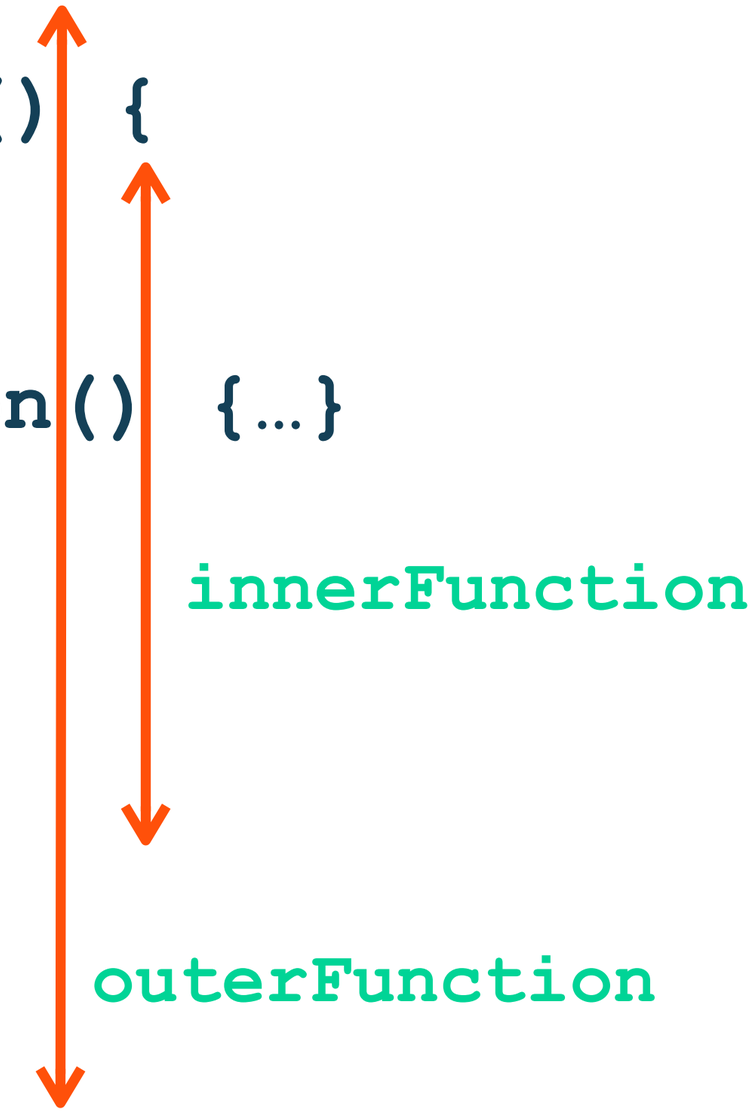
SCOPE

```
function outerFunction() {
  var x = 1;
  function innerFunction() {…}
  if(x==1) {var y=2;}
  console.log(y);
}
outerFunction();
```



SCOPE

```
function outerFunction() {
  var x = 1;
  function innerFunction() {…}
  if(x==1) {var y=2;}
  console.log(y);
}
outerFunction();
```



HOISTING

```
function outerFunction() {
  var x = 1;
  console.log(y);
  if(x==1) {var y=2;}
}
outerFunction();
```

what will it print?

initializations are not hoisted!

`closure` *scope created when a function is declared that allows the function to access and manipulate variables that are external to that function*

CLOSURES

access all the variables (including other functions) that are in-scope when the function itself is declared

inner function has access to state of its outer function even after the outer function has returned!

Closure Example

```
var outerValue = 'llama';
var later;
function outerFunction() {
    var innerValue = 'alpaca';
    function innerFunction() {
        console.log(outerValue);
        console.log(innerValue);
    }
    later = innerFunction;
}
outerFunction();
later();
```

what will this print?

Closure Example

```
var outerValue = 'llama';
var later;
function outerFunction() {
    var innerValue = 'alpaca';
    function innerFunction() {
        console.log(outerValue);
        console.log(innerValue);
    }
    later = innerFunction;
}
outerFunction();
later();
```

prints:

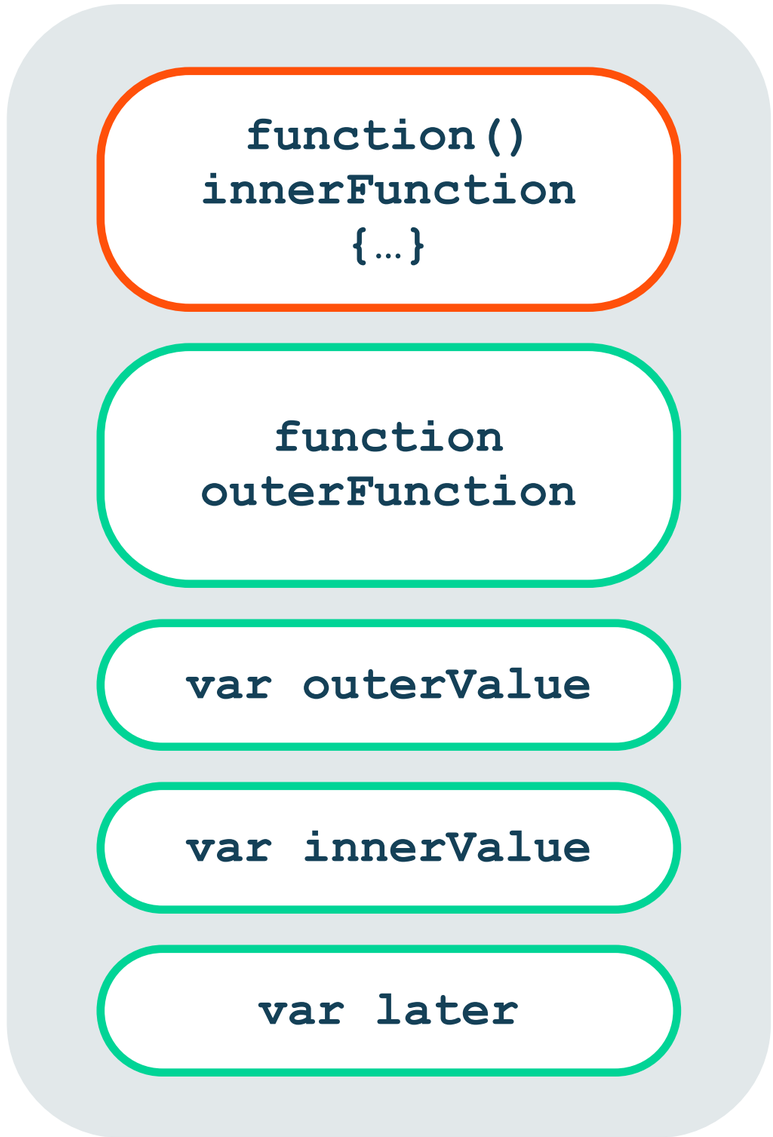
llama

alpaca

innerFunction has access to **innerValue** through its closure

```
var outerValue = 'llama';
var later;
function outerFunction() {
    var innerValue = 'alpaca';
    function innerFunction() {
        console.log(outerValue);
        console.log(innerValue);
    }
    later = innerFunction;
}
outerFunction();
later();
```

Closure of innerFunction



Closure Example

```
var later;
function outerFunction() {
  function innerFunction(paramValue) {
     console.log(paramValue);
     console.log(afterValue);
  }
  later = innerFunction;
}
var afterValue = 'camel';
outerFunction();
later('alpaca');
```

what will this print?

Closure Example

```
var later;
function outerFunction() {
  function innerFunction(paramValue) {
     console.log(paramValue);
     console.log(afterValue);
  }
  later = innerFunction;
}
var afterValue = 'camel';
outerFunction();
later('alpaca');
```

prints:

alpaca

camel

Closure Example

```
var later;
function outerFunction() {
  function innerFunction(paramValue) {
     console.log(paramValue);
     console.log(afterValue);
  }
  later = innerFunction;
}
var afterValue = 'camel';
outerFunction();
later('alpaca');
```

declared after the function declaration!

Closures include:

Function parameters

All variables in an outer scope

PRIVATE VARIABLES

```
var add = (function () {

  var counter = 0;

  return function () {return
  counter += 1;}

})();

add();
```

self-invoking

PRIVATE VARIABLES

```
function Llama() {
  var spitted = false;
  this.spit = function() { spitted =
  true; }
  this.hasSpitted = function { return
  spitted; }
}
```

private data member now!

CURRYING

partial evaluation of functions

```
function curriedAdd(x){
  return function(y){
    return x+y;
  };
};
var addTwo = curriedAdd(2);
addTwo(3);
```

NEXT CLASS:

JAVASCRIPT *and the Web*

courses.engr.illinois.edu/cs498rk1/