JavaScript Inheritance

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Topics

1. Inheritance through Prototype
2. Function constructor and Prototype

Inheritance through Prototype

Prototype-based Languages

- Two different ways for supporting inheritance in programming languages
  - Scheme #1: Through traditional class hierarchy (Java, C, C++, ...)
  - Scheme #2: Through prototype (JavaScript)
- JavaScript is a prototype-based language
- In a prototype-based language, there is no concept of a "class"
  - Inheritance is provided through prototype, however
- In prototype-based language, every object has “prototype” property (the actual name of the “prototype” property is *__proto__*) that points to “prototype” object
  - Since the prototype object itself is a JavaScript object, it has its own “prototype” property, which in turn forms “prototype chain”, until it reaches “Object” object, which has *null* as its prototype

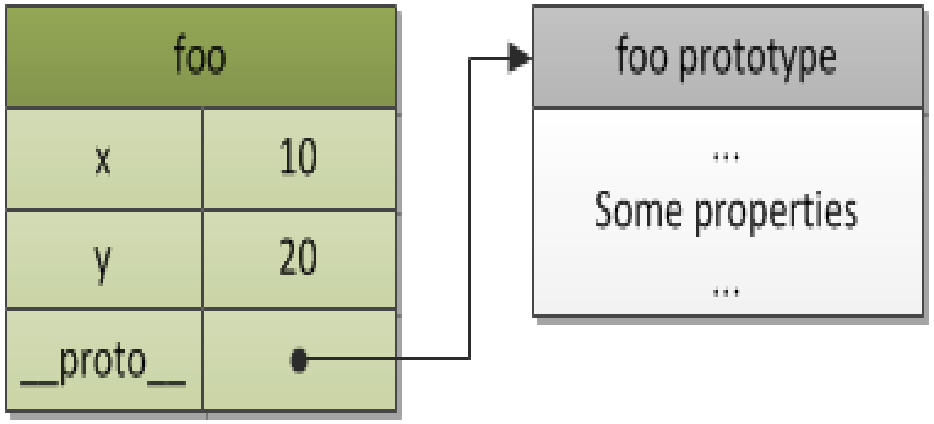
How Does Prototype Provide Inheritance?

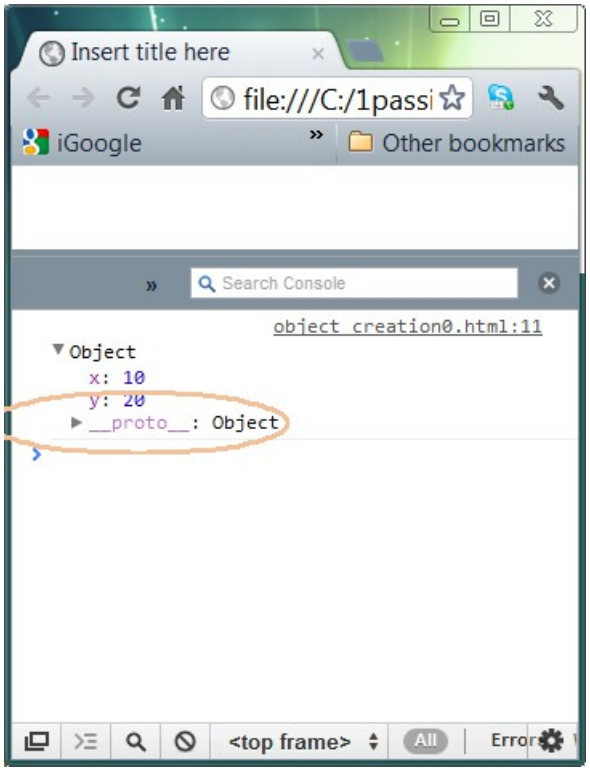
- If an object itself doesn't have a property that is requested, then the prototype objects in the “prototype chain” are searched for that property
- Let's say object “myObject” has a property “a”
  - “*myObject.a*” will access the property “a” as expected
- Let's say object “myObject” does NOT have property “b”
  - “*myObject.b*” will trigger the search of “b” in the prototype chain of the “*myObject*”
  - So if one of the prototype objects in the prototype chain has the property “b”, then “*myObject.b*” returns the value of it
- So prototype objects in the prototype chain can capture shared properties, thus providing inheritance

The prototype property is "__proto__"

- (As was said) Every JavaScript object has a prototype property – and it is represented by *__proto__* property

```
var foo = {
  x: 10,
  y: 20
};
```





Inheritance through Prototype

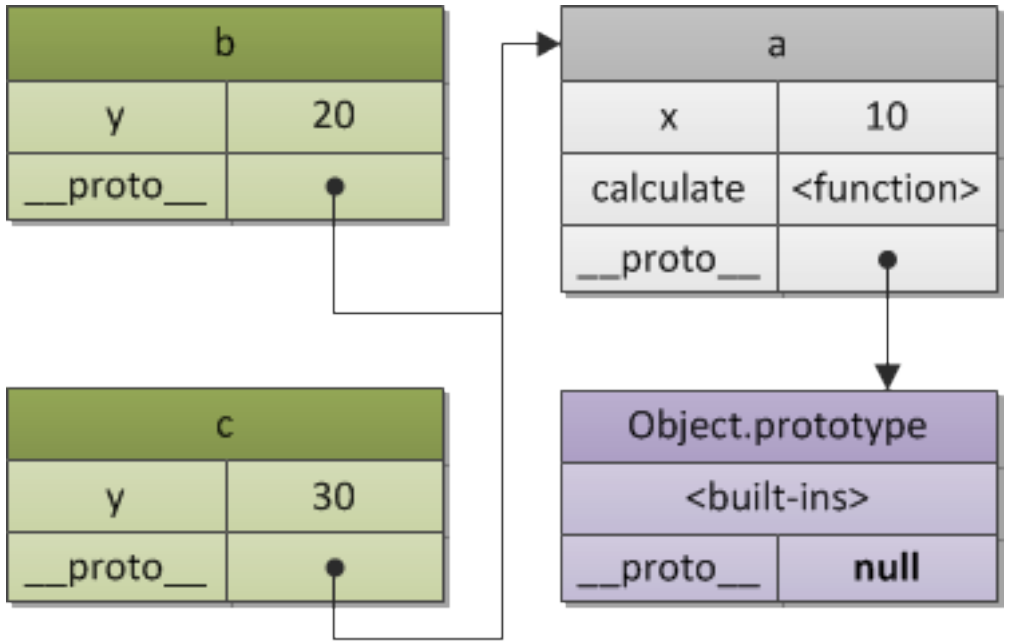
- As an experimentation, let's set prototype property (__proto__ property) of object “b” and “c” to “a” manually – making “a” parent object of “b” and “c”

```
// Consider “a” parent object of “b” and “c”
var a = {
  x: 10,
  calculate: function (z) {
    return this.x + this.y + z
  }
};

var b = {
  y: 20,
  __proto__: a
};

var c = {
  y: 30,
};
c.__proto__ = a;

// call the inherited method
b.calculate(30); // 60 = 10 +20 +30
c.calculate(40); // 80 = 10 +30 +40
```



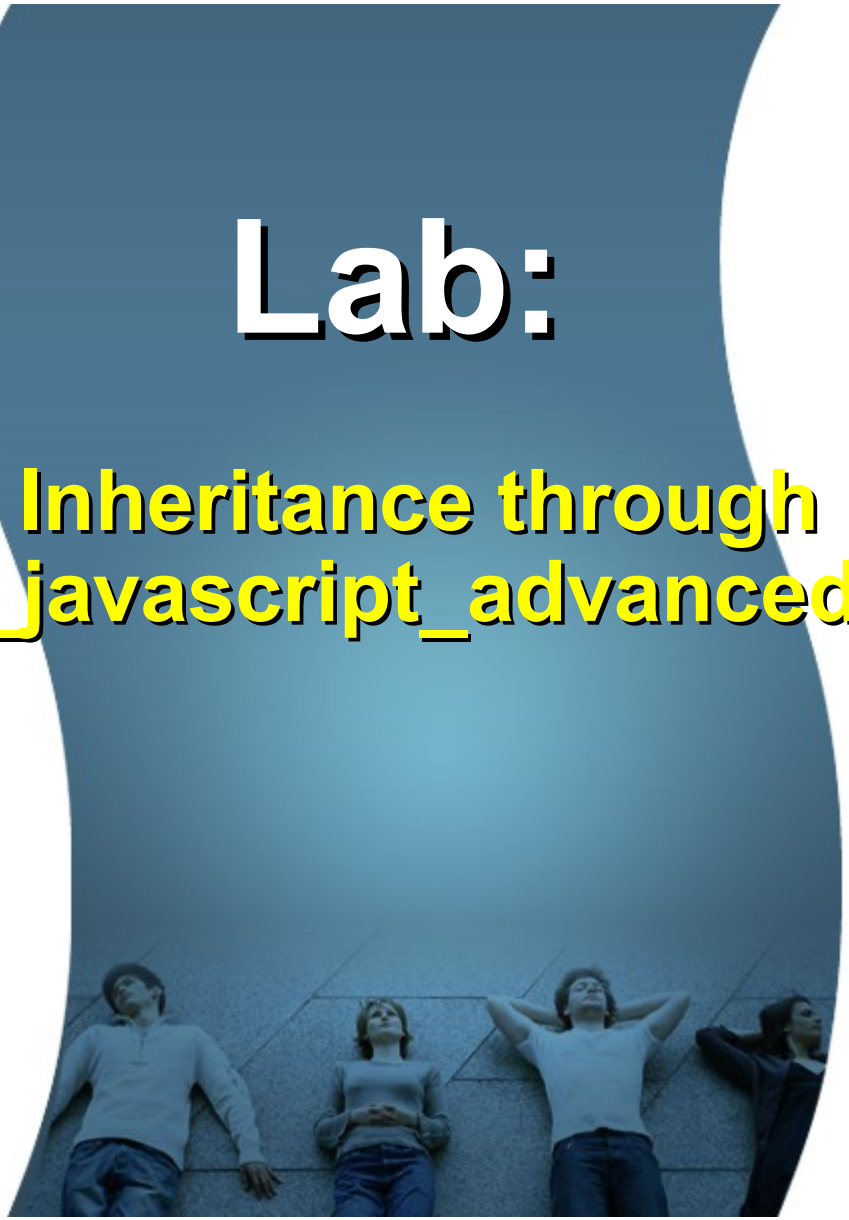
Object.getPrototypeOf(obj)

- *__proto__* field is not standard even though it is supported by most JavaScript implementations
- ECMAScript 5+ compliant engines now provide a standard way to access internal prototype of a JavaScript object through *getPrototypeOf()* method

  Object.getPrototypeOf(myObj) is same as *myObj.__proto__*

Lab:

Exercise 1: Inheritance through Prototype
4266_javascript_advanced.zip



Constructor Function & Prototype

Object Created through Constructor Function

- In our previous examples, we construct inheritance relationship between object instances
  - In other words, it is not general enough
- What we want in general, however, is to construct inheritance relationship for a group of objects
  - In Java, all objects of a child class inherit properties and methods of a parent class
  - In JavaScript, we want all objects created from a Constructor function to inherit all properties of the Constructor function

Object Created through Constructor Function

- Besides creation of objects, a constructor function does another useful thing — it automatically sets a “function prototype” object for newly created objects.
  - This function prototype object is stored in the <ConstructorFunction>.prototype property
  - This is different from __proto__ property
- When a JavaScript object is created from the Constructor Function, the __proto__ property of the resulting object points to the function prototype object
  - In other words, any properties and methods added to the function prototype object are available to the resulting object

(You really don't have to understand this internal mechanics in order to use prototype effectively, however.)

ConstructorFunction.prototype

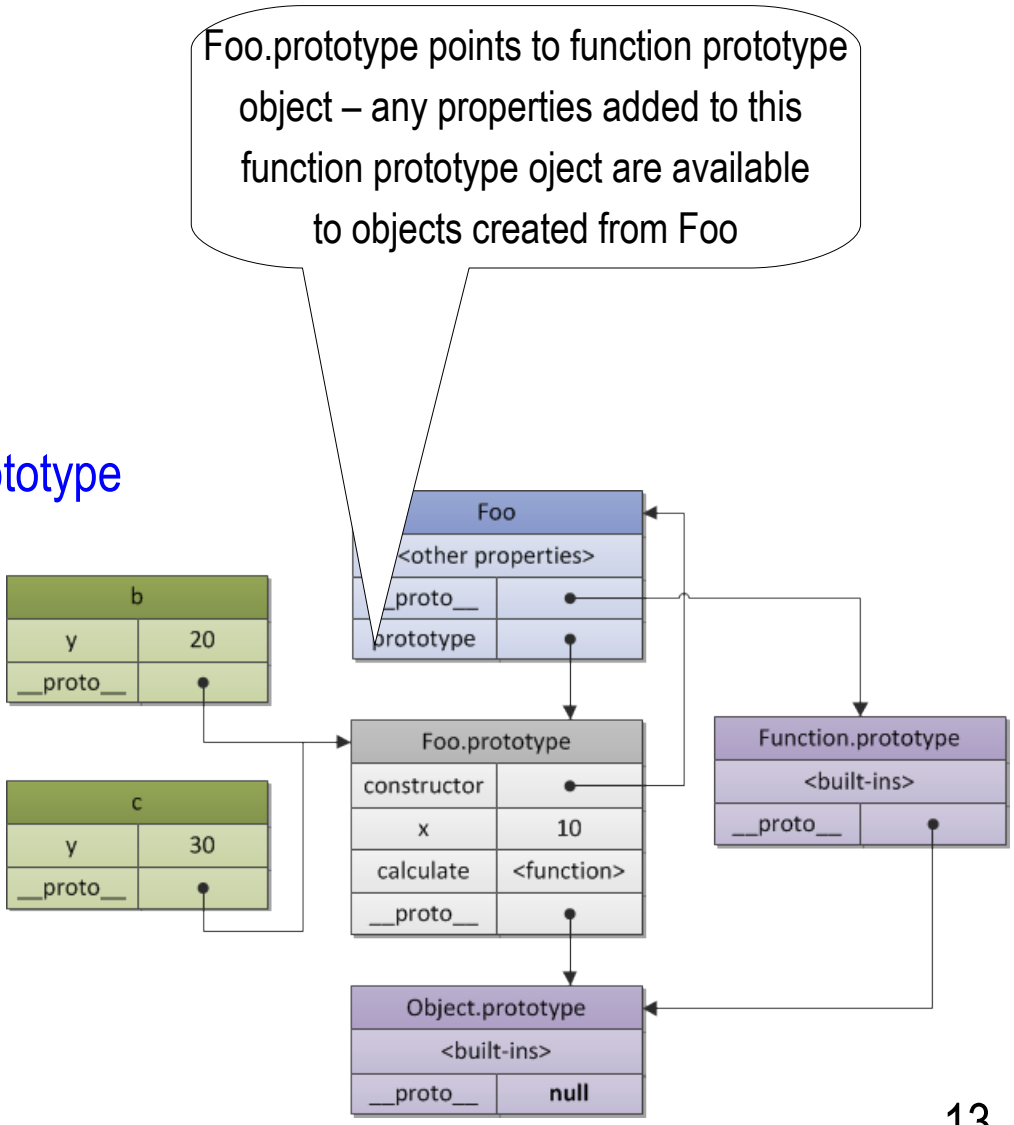
```
// Function constructor
function Foo(y) {
  this.y = y;
}

// Add property "x" to function prototype
Foo.prototype.x = 10;

// Add method "calculate" to function prototype
Foo.prototype.calculate = function (z) {
  return this.x + this.y + z;
};

// now create our "b" and "c"
// objects are created from “Foo”
var b = new Foo(20);
var c = new Foo(30);

// call the inherited method
b.calculate(30); // 60
c.calculate(40); // 80
```



Another Example: ConstructorFunction.prototype

```
// Constructor (Template) of the MyObject
function MyObject(name, size){
    this.name=name;
    this.size=size;
}
// Add a function to the prototype
MyObject.prototype.tellSize=function(){
    alert("size of  " + this.name+" is " + this.size);
}

// Create an instance of the object. Note that new object
// has tellSize() method.
var myObj=new MyObject("Desk", "30 inches");
myObj.tellSize();
```

More Explanation...

- __proto__ provides inheritance only between object instances
- We need inheritance in JavaScript something like Java “class” level
  - In Java, an object that is created from class inherits all properties and methods of that class
  - So in Java, if you create a new child class with new properties and new methods, any new Java objects created from that child class have the new properties and methods
  - In JavaScript, there is no “class” concept - a Constructor function plays that role, however
  - So if we add properties to a Constructor function in JavaScript, we want new objects to inherit those newly added properties
  - The “prototype” field of the Constructor function creates an intermediate object called “function prototype object”, the newly added properties are then added
  - The newly created object's __proto__ points to this intermediate object

Lab:

Exercise 2: Function Constructor & Prototype
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