Learning how references work in JavaScript

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Nov 13, 2016

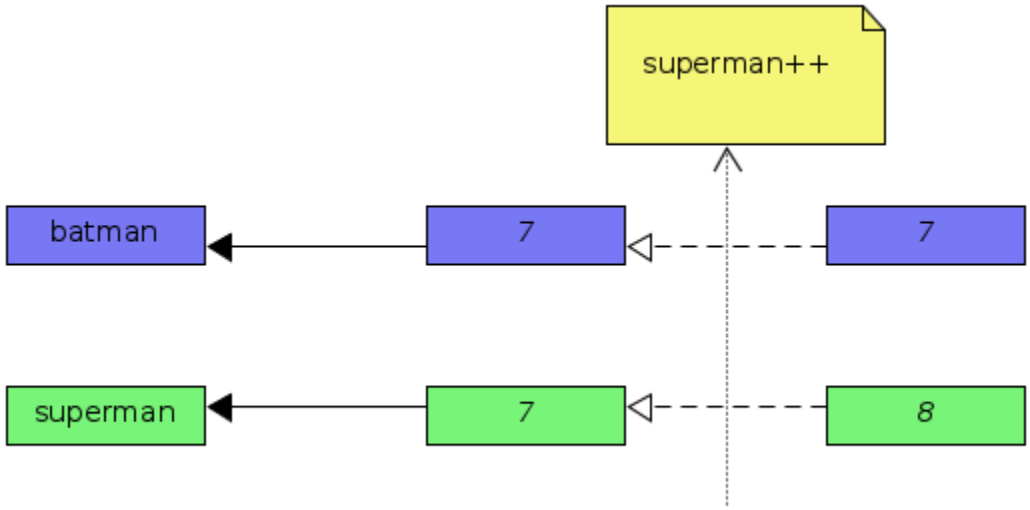
TL;DR**:* There are NO pointers in JavaScript and references work differently from what we would normally see in most other popular programming languages. In JavaScript, it's just NOT possible to have a reference from one variable to another variable. And, only compound values (Object, Array) can be assigned by ***reference.

Bottom line:

1. The *typeof* value assigned to a variable decides whether the value is stored with *assign-by-value* or *assign-by-reference*
2. On variable assignment, the scalar primitive values (Number, String, Boolean, undefined, null, Symbol) are *assigned-by-value* and compound values (Object, Array) are *assigned-by-reference*
3. The references in JavaScript only point at contained values and NOT at other variables or references
4. In JavaScript, scalar primitive values (Number, String, Boolean, undefined, null, Symbol) are *immutable* and compound values (Object, Array) are *mutable*

A quick example on assign-by-value:

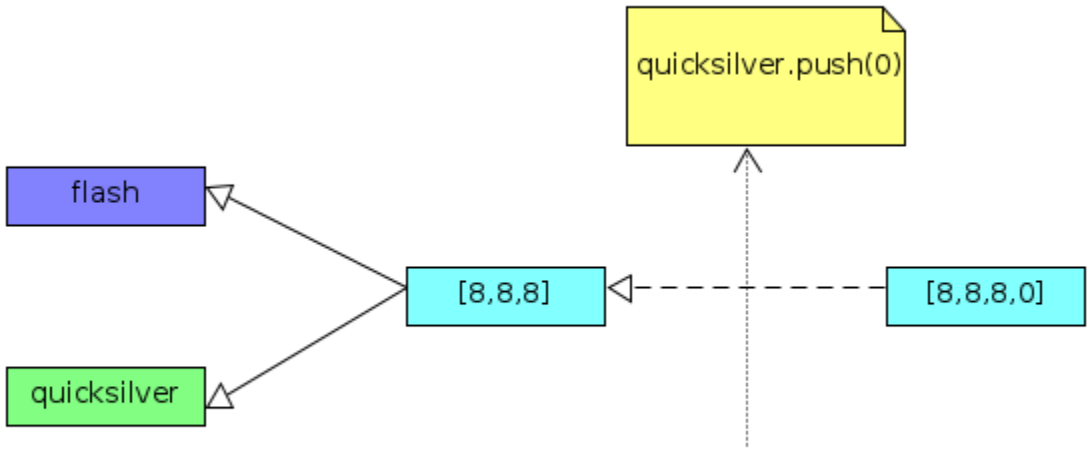
In the code snippet below, we are assigning a scalar primitive value (number) to a variable and thus *assign-by-value* applies here. Firstly, the variable `batman` is initialized and when the variable `superman` is assigned with the value stored in the variable `batman`, it creates a new copy of the value and stores it. When the variable `superman` is modified, variable `batman` is left unaffected as they point to distinct values.



Tool: UMLet (GNU Linux client)

A quick example on assign-by-reference:

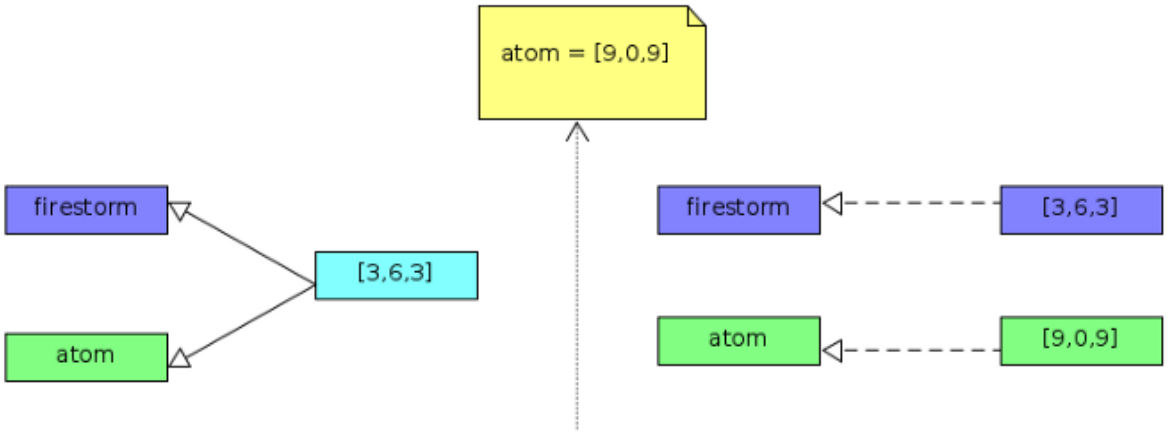
In the code snippet below, we are assigning a compound value (array) in a variable and thus *assign-by-reference* applies here. The variables `flash` and `quicksilver` are references to the same value (aka shared value). The references will point to the updated value when the shared value is modified.



Tool: UMLet (GNU Linux client)

How to create a new reference?

When the compound value in a variable is reassigned, a new reference is created. In JavaScript, unlike in most other popular programming languages, the references are pointers to value stored in variables and NOT pointers to other variables, or references.



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How references work when values are passed as function parameters?

In the code snippet below, the variable `magneto` is a compound value (Array object), thus it is assigned in variable (function argument) `x` with assign-by-reference. The `Array.prototype.push` method invoked inside IIFE mutates the value in variable `magneto` through JavaScript reference. But, the reassignment of variable `x` creates a new reference, and further modifications on it do NOT affect the reference to the variable `magneto`.

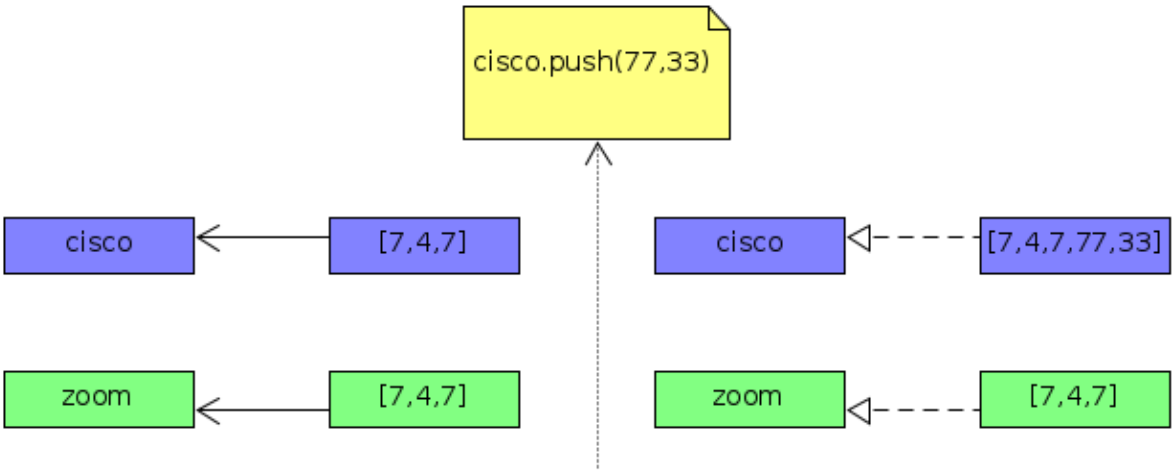
How to change the original value in a compound variable passed as a function argument through JavaScript reference?

The solution here would be to modify the existing compound value where the reference is pointing to. In the code snippet below, the variable `wolverine` is a compound value (Array object) and on IIFE invocation, variable (function argument) `x` is assigned by reference. The `Array.prototype.length` property can be used to create an empty array by setting its value to `0`. Thus, the variable `wolverine` is changed to the new value set in a variable `x` through JavaScript reference.

How to store a compound value through assign-by-value?

The solution here would be to make a manual copy of the compound value and then assign the copied value to a variable. Therefore, the reference of the assigned value does NOT point back to the original

value. The recommended approach to creating a (shallow) copy of the compound value (Array object) is to invoke `Array.prototype.slice` method on it with no arguments passed.



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How to store a scalar primitive value through assign-by-reference?

The solution here would be to wrap the scalar primitive value in a compound value (Object, Array) as its property value. Thus, it can be assigned-by-reference. In the code snippet below, the scalar primitive value in the variable `speed` is set as a property on the object `flash`. Therefore, it is assigned-by-reference on IIFE invocation to the variable (function argument) `x`.

An aside:

In JavaScript, the scalar primitive values are *immutable* while compound values are *mutable*.

Summary: A good understanding of references in JavaScript can help developers to avoid many common mistakes and write better code.

Happy coding!!