

# Class Inheritance and Introspection

This document describes TIBCO General Interface extensions to the JavaScript class and inheritance model. With these extensions TIBCO General Interface provides a richer programming environment that is better suited to building complex object-oriented applications.

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## Table of Contents

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Classes and Inheritance in JavaScript 1.x .....	3
jsx3.lang.Object and Classes in General Interface.....	3
Declaring a Class.....	4
Class, Interface, and Package .....	5
Introspection.....	6

## Classes and Inheritance in JavaScript 1.x

JavaScript 1.x supports prototype inheritance. A class is defined by any function:

```
function Plant(latinName, englishName) {
    this.latinName = latinName;
    this.englishName = englishName;
}
```

The prototype field of the class function represents the prototypical instance of the class. A new instance of the class will be a copy of the prototype, including any fields and methods placed in the prototype.

```
Plant.prototype.relatedSpecies = new Array();

Plant.prototype.getLatinName = function() {
    return this.latinName;
};
```

Inheritance is supported by setting the prototype of a class function to a new instance of the superclass:

```
function Tree(latinName, englishName) {
    this.latinName = latinName;
    this.englishName = englishName;
};

Tree.prototype = new Plant();

Tree.prototype.isFlowering = function() {
    return this.flowering;
};
```

JavaScript supports an inheritance-aware `instanceof` operator. The following statements are true:

```
(var aPlant = new Plant()) instanceof Plant;
(var aTree = new Tree()) instanceof Plant;
(var aTree = new Tree()) instanceof Tree;
```

All classes implicitly extend the `Object` class so the following statement is also true:

```
(var aPlant = new Plant()) instanceof Object;
```

## jsx3.lang.Object and Classes in General Interface

General Interface defines its own base class, `jsx3.lang.Object`, which adds the following capabilities to the JavaScript 1.x model:

- Obtaining the defining class from an instance of the class with the `getClass()` method.
- Calling an overridden method in a superclass with the `jsxsuper()` and `jsxsupermix()` methods.
- A better `toString()` method that overrides `Object.toString()` and includes the name of the class from which the object was instantiated.
- Introspection of class and interface membership using the `instanceOf()` method.

`jsx3.lang.Object` works in conjunction with the other classes in the `jsx3.lang` package – `Class`, `Exception`, `Method`, and `Package` – to provide these further advantages over plain old JavaScript 1.x:

- A rich exception model with intelligible stack traces
- Full introspection of classes and methods

- Mixin style interfaces
- Introspectable packages
- Simple declaration of classes and members using standard JavaScript 1.x syntax that frees the developer from the details of prototype inheritance

All classes in General Interface descend from `jsx3.lang.Object`. Developers are encouraged to extend the General Interface base class in application code in order to fully incorporate the features enumerated above.

## Declaring a Class

Classes are defined with the static method `jsx3.lang.Class.createClass()`:

```
static method createClass(strName, objExtends, arrImplements, fctBody)
```

The first parameter, `strName`, is a string that is the fully-qualified name of the class to define, such as `"com.tibco.Widget"`. The `createClass()` method ensures that the namespace object, `com.tibco`, exists before creating the `Widget` constructor.

The second parameter, `objExtends`, is the superclass of the class to define. If none is provided, `jsx3.lang.Object` is assumed. This parameter is usually provided as the constructor function of the superclass, i.e. the fully-qualified class name without quotes.

The third parameter, `arrImplements`, is an array of the interfaces that the class implements. This array can be empty or null.

The fourth parameter, `fctBody`, is a function that defines the contents of the class. The `createClass()` method will execute this function exactly once after it has handled the details of the JavaScript 1.x prototype inheritance implementation. `createClass()` passes one parameter to `fctBody`, which is the constructor function of the newly defined class. This is simply a syntactical shortcut that allows for the following concise idiom:

```
jsx3.lang.Class.createClass(  
  "com.tibco.Widget",  
  jsx3.lang.Object, // Object is implicit so this parameter could be null in this case  
  [jsx3.util.EventDispatcher],  
  
  function(Widget) {  
    // define class members in Widget  
    // define instance members in Widget.prototype  
  }  
);
```

There are four types of members that can be included in the class definition: static fields, static methods, instance fields, and instance methods. Each of these types is introspectable with methods of the `jsx3.lang.Class` class. Static members are declared by defining fields of the class constructor. Continuing the preceding code example:

```
// define two static fields  
Widget.SERIAL = 1;  
Widget.ALL_WIDGETS = new Array();  
  
// define a static method  
Widget.getWidgetBySerial = function(serial) {  
  return Widget.ALL_WIDGETS[serial];  
};
```

Static members are globally available using the fully-qualified name of the member, such as `com.tibco.Widget.getWidgetBySerial()`. The same member can be referenced with `Widget.getWidgetBySerial()`

within the class declaration function because `com.tibco.Widget` is effectively imported into function as `Widget`. Unlike in Java, static members are not accessible through instances of a class (that is, `aWidget.SERIAL` is undefined).

Instance members are declared by defining fields in the prototype field of the class constructor:

```
// define two instance fields
Widget.prototype.serial = null;
Widget.prototype.name = "?";

// define an instance method
Widget.prototype.getSerial = function() {
    return this.serial;
};
```

All classes must define a special instance method called `init()`. `defineClass()` throws an exception if no `init()` method is declared in the class declaration function. `init()` is effectively the constructor function. However, `defineClass()` actually creates the class constructor so the developer has no way of customizing it. Instead, the generated class constructor simply calls the `init()` method passing all the parameters that were passed to the constructor. Here is the `init()` method for the `Widget` class:

```
Widget.prototype.init = function(name) {
    this.name = name;
    this.serial = Widget.SERIAL++;
};
```

The following code will instantiate a `Widget`:

```
var widget = new com.tibco.Widget("myFirstWidget");
```

## Class, Interface, and Package

The `jsx3.lang` package defines three class-like constructs – Class, Interface, and Package. These constructs are not exactly equivalent to their Java/C++ namesakes.

Classes:

- Define static fields, static methods, instance fields, instance methods, and abstract instance methods
- Are instantiated
- Can be the superclass of another class
- Descend from `jsx3.lang.Object`
- Are defined with `jsx3.lang.Class.defineClass()`

Interfaces:

- Define static fields, static methods, instance methods and abstract instance methods,
- Are not instantiated
- Can be the superclass of another interface
- Can be implemented by a class
- Are defined with `jsx3.lang.Class.defineInterface()`

Packages:

- Define static fields and static methods
- Contain classes and interfaces defined with `jsx3.lang.Class`
- Are defined with `jsx3.lang.Package.definePackage()`

Unlike in Java, General Interface interfaces may contain concrete instance methods. When a class implements an interface, the instance methods of the interface are mixed into the class. A mixed in method will override a method of the same name inherited from the superclass but will not override a method defined in the implementing class or mixed in from an interface coming earlier in the `arrImplements` parameter to `Class.defineClass()`.

Packages must be explicitly defined with `jsx3.lang.Package.definePackage()` in order to be introspectable. Simply defining the class `com.tibco.Widget` will not define the package `com.tibco`. Defining a package is not required for the class to work. It simply allows the package to be introspected.

Both classes, interfaces, and packages can "contain" classes/interfaces. Consider the following code assuming that the class `com.tibco.Widget.Encoding` is defined:

```
// returns [com.tibco.Widget, com.tibco.Widget.Encoding]
jsx3.lang.Package.forName("com.tibco").getClasses();

// returns [com.tibco.Widget.Encoding]
jsx3.lang.Class.forName("com.tibco.Widget").getClasses();
```

## Introspection

Once a class, interface, or package has been defined as described above, it is introspectable. There are a few ways of getting a handle to an instance of `jsx3.lang.Class` or `jsx3.lang.Package`:

```
var aClass = anObject.getClass(); // returns an instance of jsx3.lang.Class
var aPackage = aClass.getPackage(); // returns an instance of jsx3.lang.Package

com.tibco.Widget.jsxclass; // instance of jsx3.lang.Class
com.tibco.jsxpackage; // instance of jsx3.lang.Package

// the following return null if any part of the namespace is undefined:
jsx3.lang.Class.forName("com.tibco.Widget");
jsx3.lang.Package.forName("com.tibco");
```

Consult the API Documentation for all the methods of these classes that can be used to introspect their contents.