

# A Collection of Real World (JavaScript) Security Problems

Examples from 21/2 Applications Areas of JavaScript

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July 2, 2014

## *A Collection of Real World (JavaScript) Security Problems*

### Abstract

JavaScript is gaining more and more popularity as an implementation language for various applications types such as Web applications (client-side), mobile applications, or server-side applications. We outline a few security challenges that need to be prevented in such applications and, thus, for which there is a demand for analysis methods that help to detect them during development.

# Agenda

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- 1 Motivation and Basics
- 2 SAP UI5: Client-side JavaScript
- 3 Apache Cordova: JavaScript on Mobile
- 4 HANA XS Engine: Server-side JavaScript

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# What We Want to Find

## Programming Patterns That May Cause Security Vulnerabilities

### Mainly two patterns

Local issues (no data-flow dependency), e. g.,

- Insecure functions

```
1 var x = Math.random();
```

- Secrets stored in the source code

```
1 var password = 'secret';
```

Data-flow related issues, e. g.,

- Cross-site Scripting (XSS)

```
1 var docref = document.location.href;  
2 var input = docref.substring(  
3     docref.indexOf("default=")+8);  
4 var fake = function (x) {return x;}  
5 var cleanse = function (x) {  
6     return 'hello_world';}  
7 document.write(fake(input));  
8 document.write(cleanse(uinput));
```

- Secrets stored in the source code

```
1 var foo = 'secret';  
2 var x = decrypt(foo,data);
```

# Functions as First-Class Objects

```
1 var href = document.location.href;
2 var unsafeInput = href.substring(href.indexOf("default=")+8) // unsafe input
3 var safeInput = "1+2"; // safe input
4
5 // aliasing eval
6 var exec = eval;
7 var doit = exec;
8
9 var func_eval1 = function (x) {eval(x)};
10 var func_eval2 = function (x,y) {eVaL(y)};
11
12 var func_eval_eval = function (x) {func_eval1(x)};
13 var func_doit = function (x) {doit(x)};
14 var func_exec = function (x) {exec(y)};
15 var run = func_eval1;
16 var inject_code = func_exec;
17
18 doit(safeInput); // secure
19 doit(unsafeInput); // code injection
```

# Where is The Code of my Application?

```
1  var input  = document.location.href.substring(document.location..indexOf("default=")+8);
2  var fake = function (x) {return x;}
3  var cleanse = function (x) {return 'hello_world';}
4
5  var uinput = unknown(input); // unknown is nowhere defined
6  document.write(uinput); // secure!?!
7
8  var finput = fake(input);
9  document.write(finput); // not secure
10
11 var cinput = cleanse(input);
12 document.write(cinput); // secure
13
14 var extfinput = extfake(input); // defined externally (part of scan)
15 document.write(extfinput); // not secure
16
17 var extcinput = extcleanse(input); defined externally (part of scan)
18 document.write(extcinput); // secure
19
20 var nobodyKnows = toCleanOrNotToCleanse(input); multiply defined (underspecified)
21 document.write(nobodyKnows); // not secure!?!
```

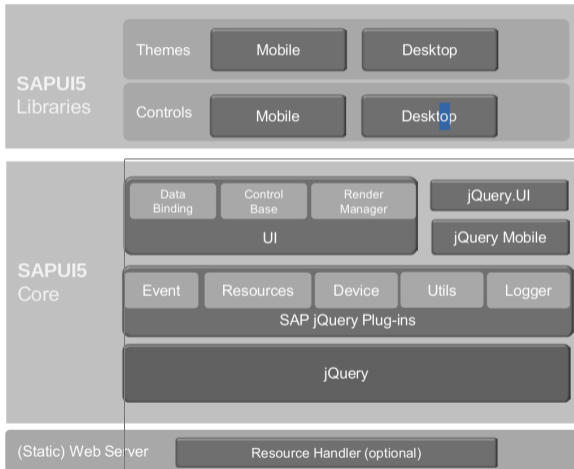
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# The SAP UI5 Architecture



# Prototype-based Inheritance

```
1  var vl = new sap.ui.commons.layout.VerticalLayout();
2  sap.ui.core.Control.extend("foo.Label", {
3      metadata : {
4          properties : {
5              "text" : "string"
6          }
7      },
8      renderer : function(oRm, oControl) {
9          oRm.write("<span>XSSLabel:_"");
10         oRm.write(oControl.getText());
11         oRm.write("</span>");
12     }
13 });
14 var p = jQuery.sap.getUriParameters().get("xss");
15 vl.addContent(new foo.Label({text:p}));
16 return vl;
```

# CSRF Prevention

## You need to know your frameworks

```
1  var request = {
2      headers : {
3          "X-Requested-With" : "XMLHttpRequest",
4          "Content-Type" : "application/atom+xml",
5          "X-CSRF-Token" : "Fetch"
6      },
7  };
8  if (Appcc.CSRFToken)
9      var request = {
10         headers : {
11             "X-Requested-With" : "XMLHttpRequest",
12             "Content-Type" : "application/atom+xml",
13             "X-CSRF-Token" : Appcc.CSRFToken
14         },
15     };
16  else var request = {
17     headers : {
18         "X-Requested-With" : "XMLHttpRequest",
19         "Content-Type" : "application/atom+xml",
20         "X-CSRF-Token" : "etch" // secure?
21     },
22  };
```

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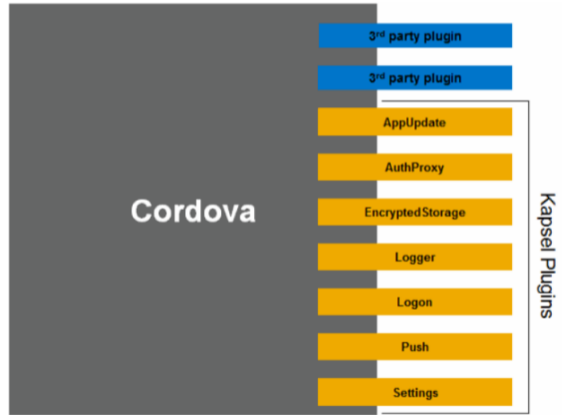
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# Apache Cordova (SAP Kapsel): Overall Idea

An integrated platform for developing hybrid mobile apps

- Apache Cordova plus
  - App management
  - Encrypted Storage
  - Authentication
  - Logging
  - ...
- Application management (SMP)
- Can be used with device management solutions



# Exploiting the JavaScript to Java Bridge

- We can expose Java methods in JavaScript

```
foo.addJavascriptInterface(new FileUtils(), "FUtil");
```

- And use them in JavaScript easily

```
1 <script type="text/javascript">// <br/>2 filename = '/data/data/com.livingsocial.www/' + id + '_cache.txt';<br/>3 FUtil.write(filename, data, false);<br/>4 // ]]&gt;&lt;/script&gt;</pre></div><div data-bbox="45 631 538 670" data-label="List-Group"><ul><li>• Which might expose much more than expected</li></ul></div><div data-bbox="62 704 734 861" data-label="Text"><pre>1 function execute(cmd){<br/>2     return<br/>3     window._cordovaNative.getClass().forName('java.lang.Runtime').<br/>4         getMethod('getRuntime',null).invoke(null,null).exec(cmd);<br/>5 }</pre></div><div data-bbox="27 954 237 975" data-label="Page-Footer"><p>© 2014 SAP AG. All Rights Reserved.</p></div><div data-bbox="893 954 974 975" data-label="Page-Footer"><p>Page 14 of 18</p></div>
```

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# The HANA XS Engine Architecture

## Overview

### Front-end Technologies

- http/s
- HTML5 / SAPUI5
- Client-side JavaScript

### Client: Browser or Mobile



Presentation logic

### Control Flow Technologies

- OData
- Server-Side JavaScript
- XMLA

### SAP HANA



Control flow logic

### Data Processing Technologies

- SQL / SqlScript
- Calculation Engine Functions
- Application Function Library (AFL)



Data

Calculation logic



# History Repeats: SQL Injection

```
1 $.response.contentType = "text/html";
2 var userInput = $.request.parameters.get('userStuff');
3
4 // We assume
5 // - $.db.getConnection().prepareStatement(x0, ..., xn) is secure iff x0 is *not*
6 //   influenced by user input
7 // - sql_sanitize() safeguards us against SQL injections.
8 // - any other preparedStatement call is evil regardless if it is influenced by
9 //   user input or not
10
11 if (userInput) {
12
13     var sql      = "select*_from_SFLIGHT.SNVOICE_where_CustomID_='"
14                   + userInput + "'";
15     var safe_sql = "select*_from_SFLIGHT.SNVOICE_where_CustomID_='"
16                   + sql_sanitize(userInput) + "'";
17
18     var db_object = $.db;
19     var conn      = db_object.getConnection();
20
21     var pstmt00 = $.db.getConnection().prepareStatement(sql);           // SQL injection
22     var pstmt01 = $.db.getConnection().prepareStatement(safe_sql);     // secure
```

# History Repeats: SQL Injection

```
1 var sql      = "select*_from_SFLIGHT.SNVOICE_where_CustomID_='"  
2             + userInput + "'";  
3 var safe_sql = "select*_from_SFLIGHT.SNVOICE_where_CustomID_='"  
4             + sql_sanitizе(userInput) + "'";  
5  
6 var db_object = $.db;  
7 var conn      = db_object.getConnection();  
8  
9 var pstmt00 = $.db.getConnection().prepareStatement(sql);           // SQL injection  
10 var pstmt01 = $.db.getConnection().prepareStatement(safe_sql);     // secure  
11  
12 var pstmt02 = db_object.getConnection().prepareStatement(sql);     // SQL injection  
13 var pstmt03 = db_object.getConnection().prepareStatement(safe_sql); // secure  
14  
15 var pstmt04 = conn.prepareStatement(sql);                           // SQL injection  
16 var pstmt05 = conn.prepareStatement(safe_sql);                     // secure  
17  
18 var pstmt06 = conn.prepareStatement("..._where_ID_=' $1'", userInput); // secure  
19 var pstmt07 = myconn.prepareStatement("..._where_ID_=' $1'", userInput); // SQL injection  
20  
21 var pstmt08 = $.mydb.getConnection().prepareStatement(sql);       // SQL injection  
22 var pstmt09 = $.mydb.getConnection().prepareStatement(safe_sql);  // SQL injection
```

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