HTML5 Web Security

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What is this talk about?

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Agenda

What is HTML5?

Vulnerabilities, Threats & Countermeasures

Conclusion

Demo CORS

Demo Web Workers

Quiz and Q&A

The Voting Device

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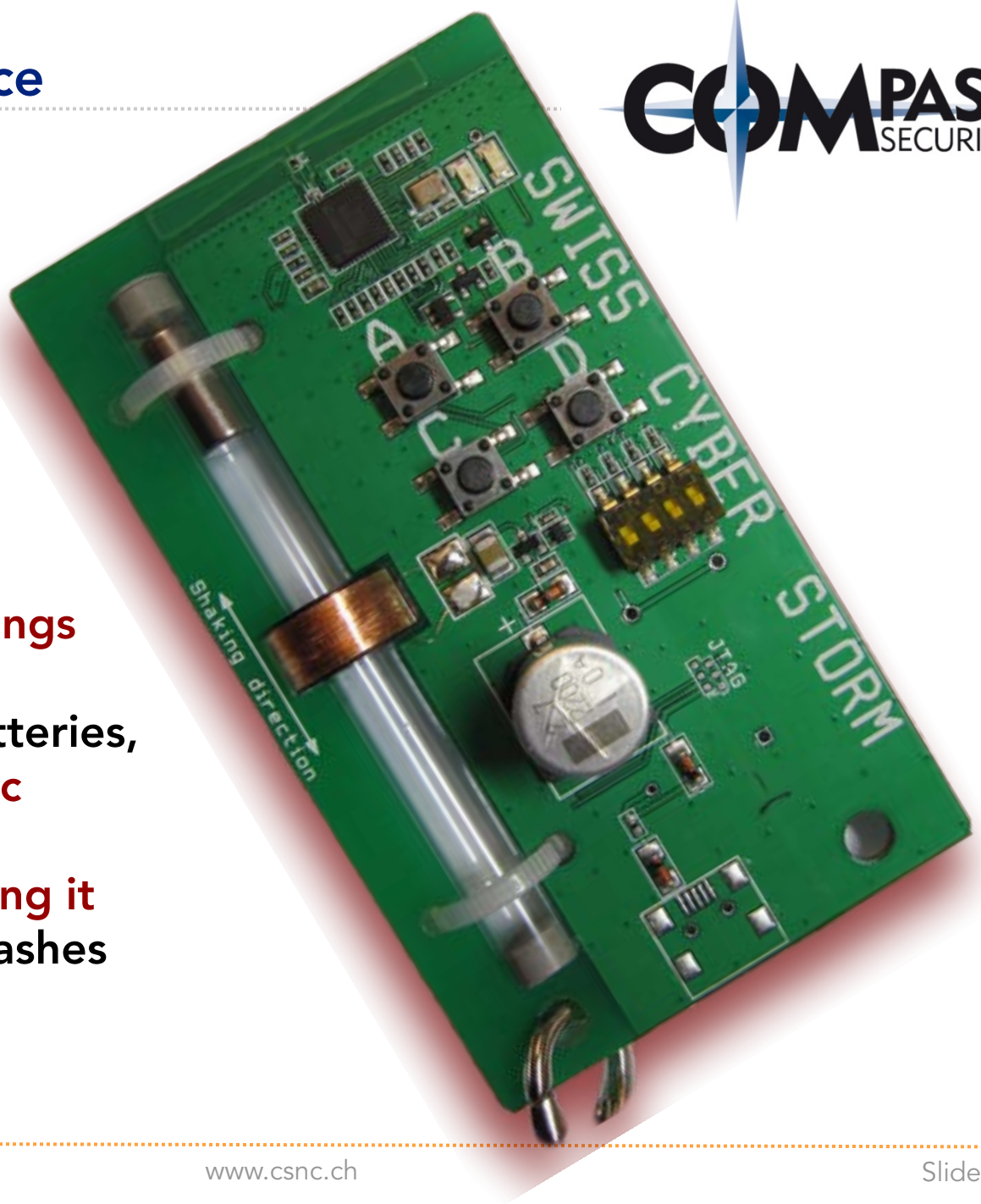
The Voting Device



It enables you to
participate on votings

The device has no batteries,
so it works autarkic

You power it by shaking it
until green light flashes

The Voting

Let's give it a try...

What is HTML5?

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History

HTML 4.01
XHTML 1.0
XHTML 1.1

XHTML 2.0

Web Applications 1.0

HTML5

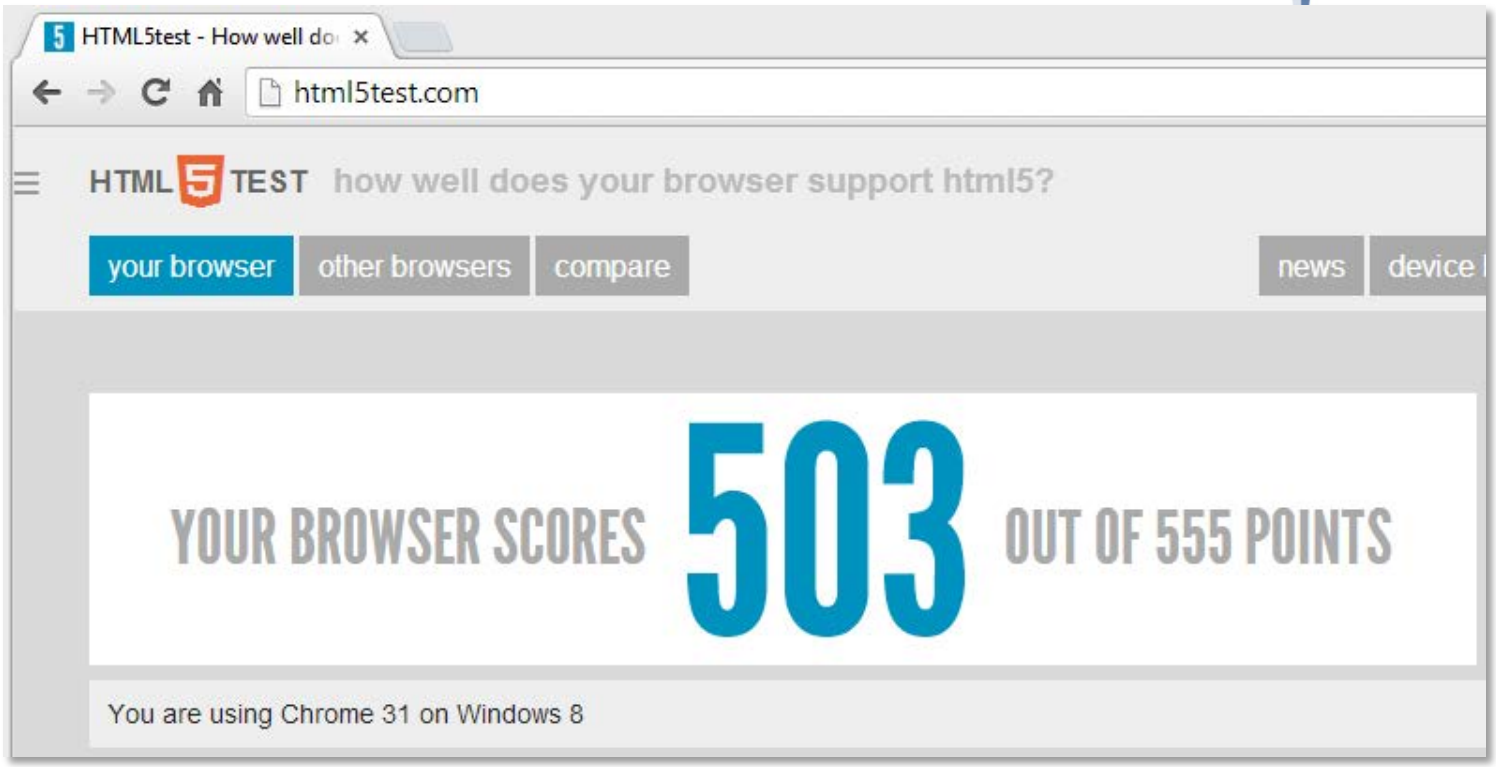
History

HTML5 is not finished!

The specification achieved CANDIDATE RECOMMENDATION status on 17 December 2012. Newest version is from 6 August 2013.

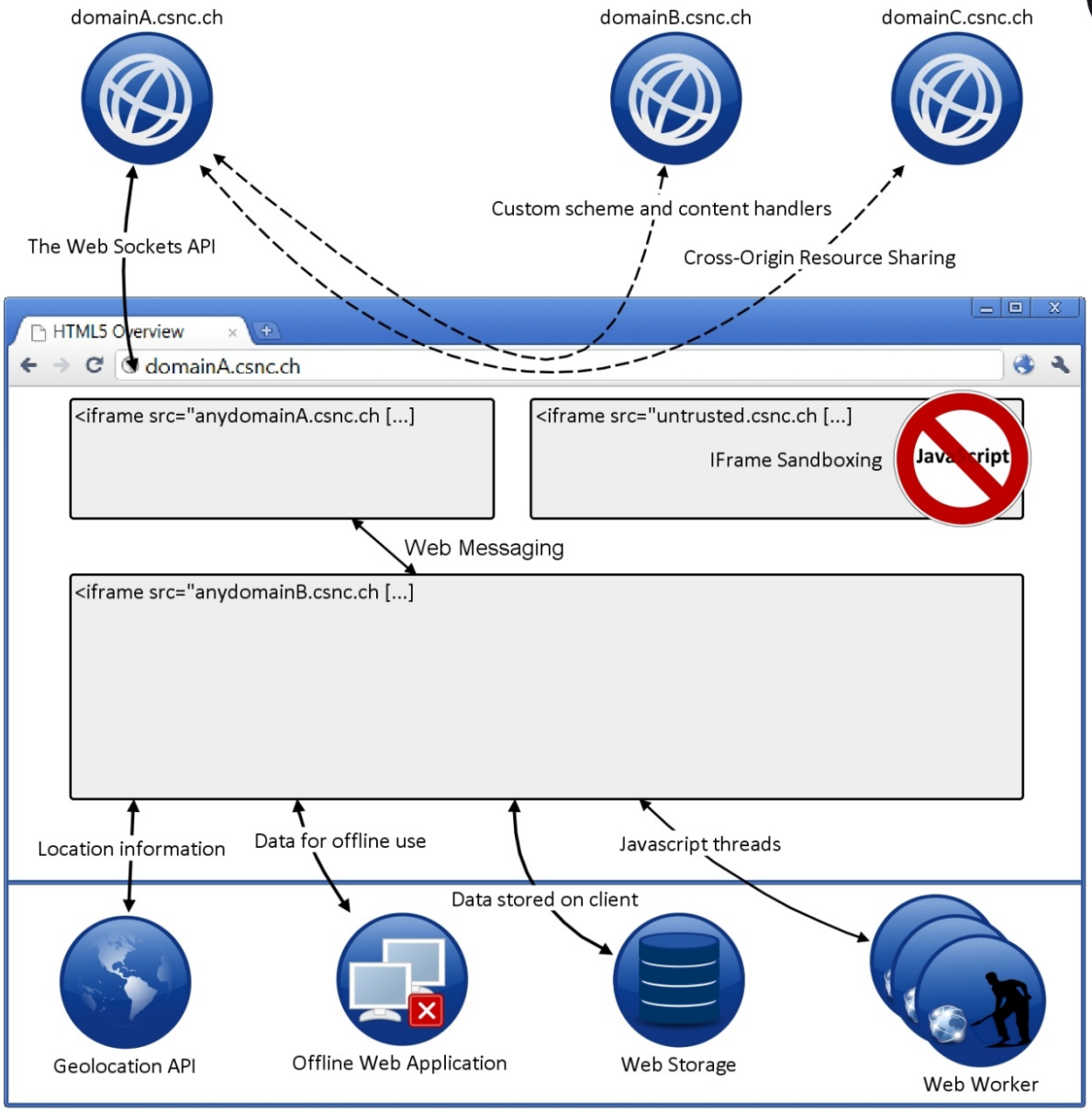
However, it is still a draft version and may be updated.

HTML5 TEST - http://html5test.com/



503	447	377	424	415
Chrome 31	Firefox 25	Internet Explorer 11	Android 4.4	iOS 7.0

Overview


domainA.csnc.ch
domainB.csnc.ch
domainC.csnc.ch
The Web Sockets API
Custom scheme and content handlers
Cross-Origin Resource Sharing
HTML5 Overview
domainA.csnc.ch
<iframe src="anydomainA.csnc.ch [...]
<iframe src="untrusted.csnc.ch [...]
IFrame Sandboxing
Web Messaging
<iframe src="anydomainB.csnc.ch [...]
Location information
Data for offline use
Data stored on client
Javascript threads
Geolocation API
Offline Web Application
Web Storage
Web Worker

Vulnerabilities, Threats and Countermeasures *(if any)*

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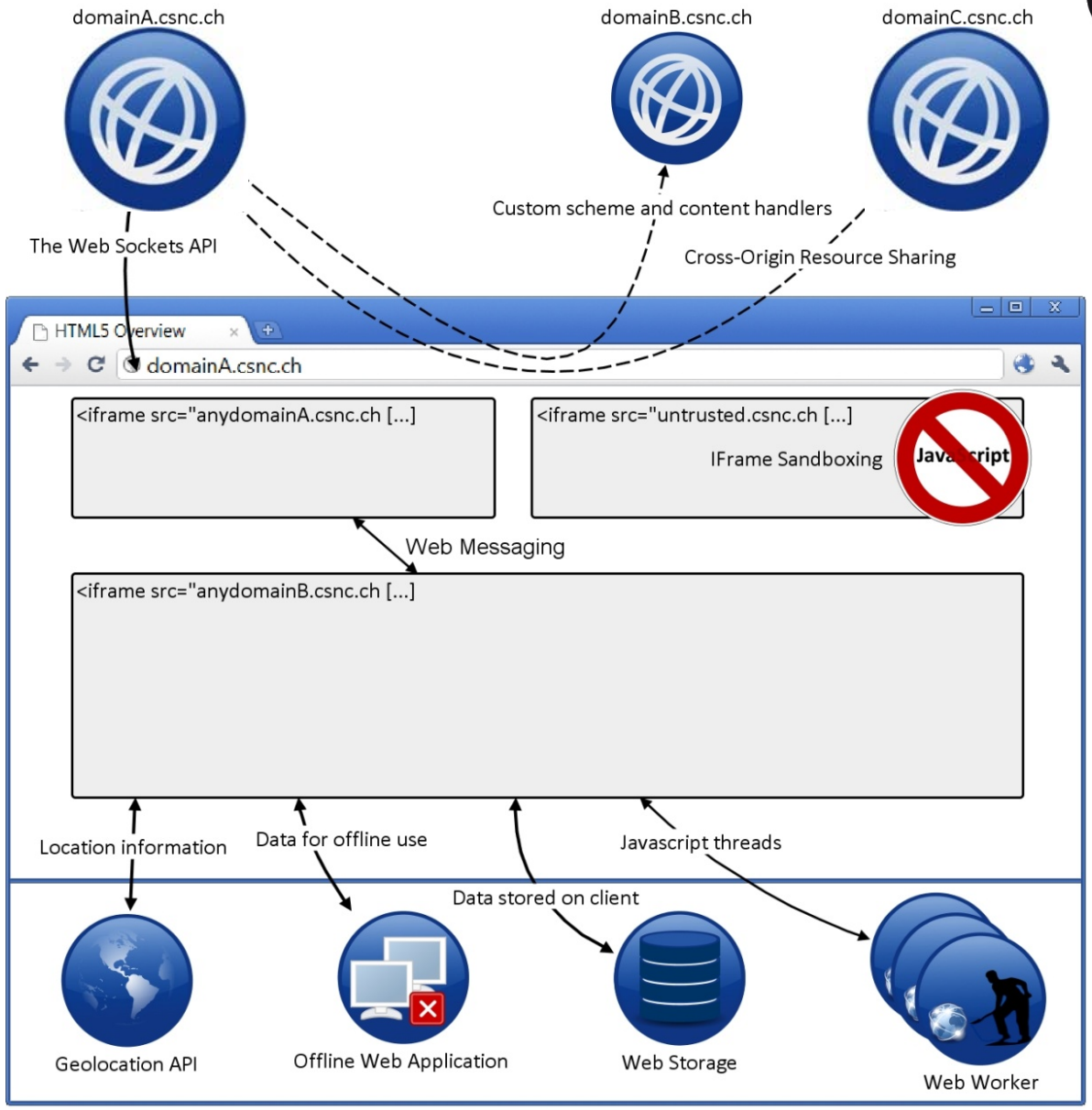
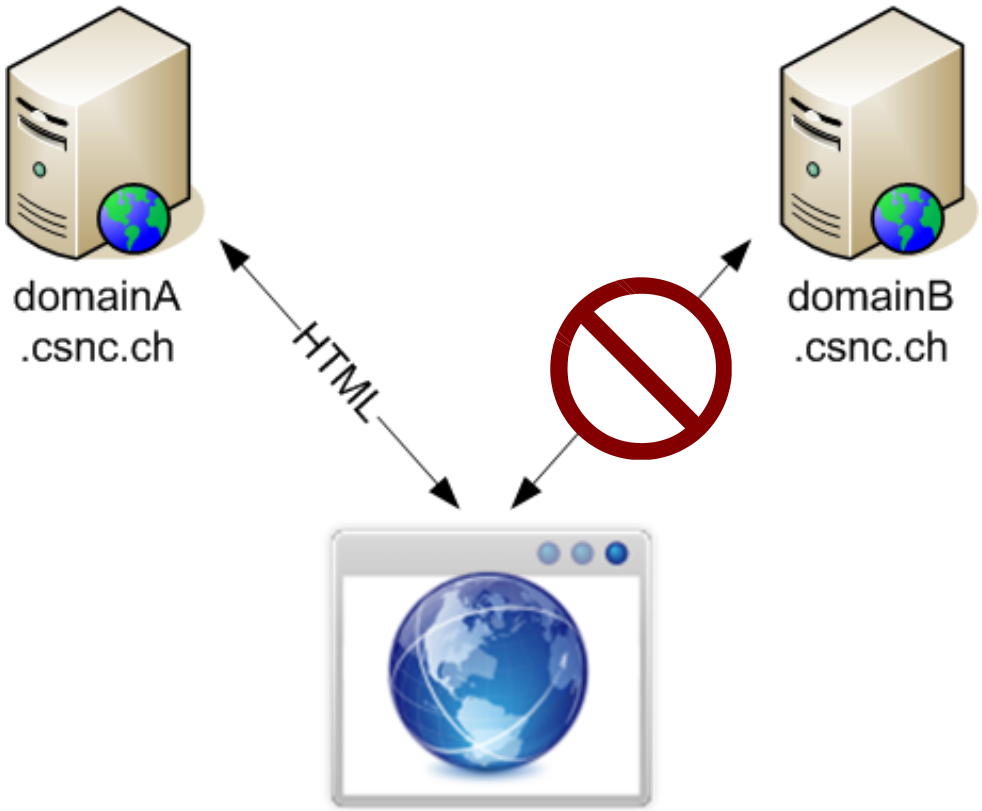
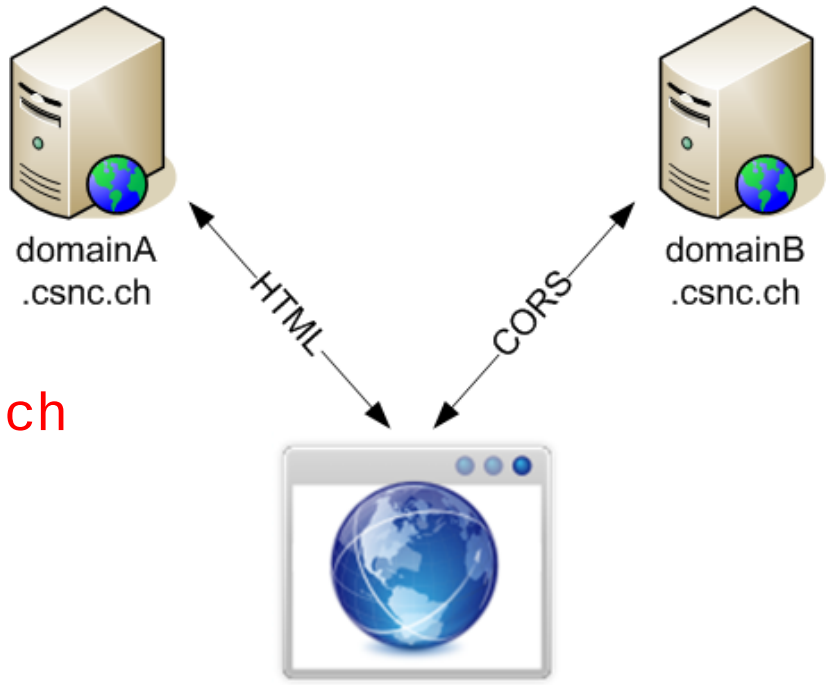
Cross-Origin Resource Sharing



Cross-Origin Resource Sharing I

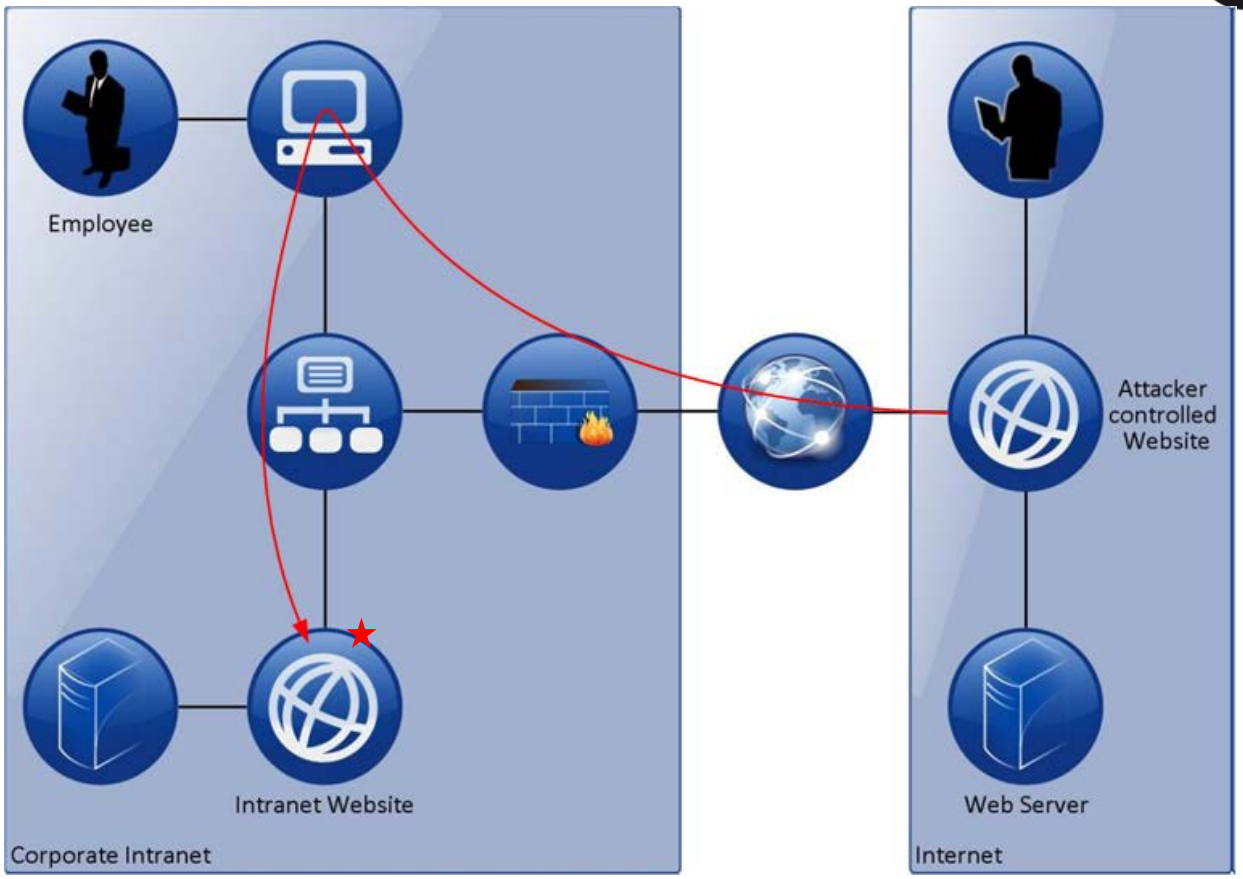


Cross-Origin Resource Sharing II



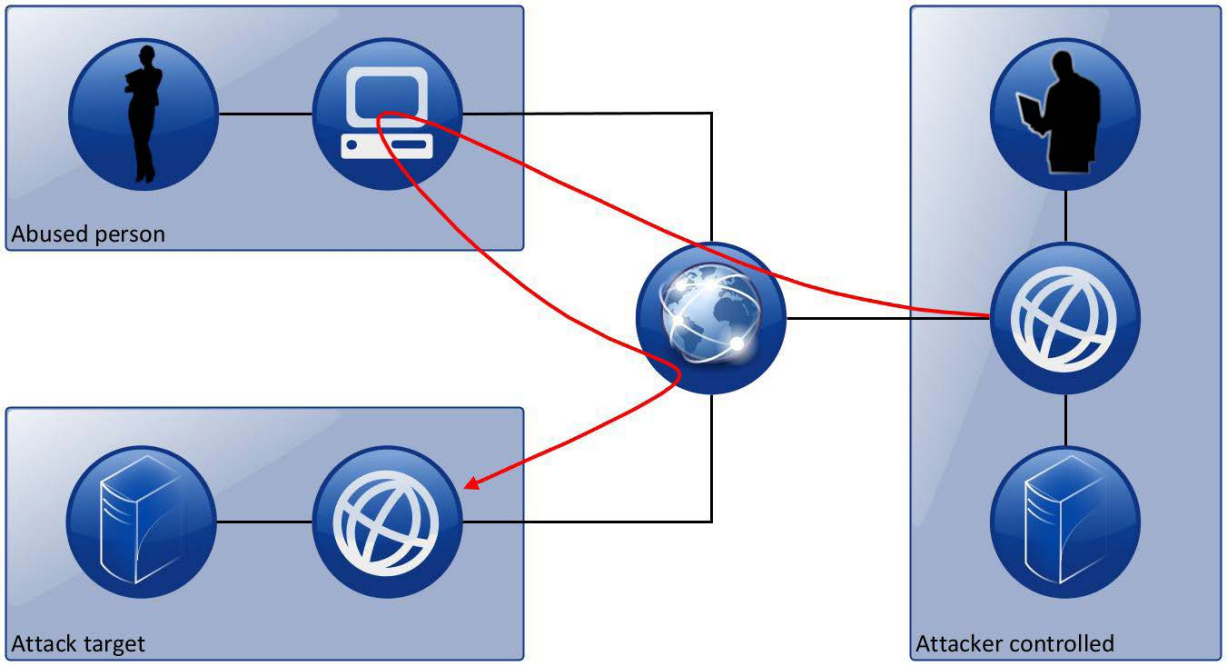

```
GET / HTTP/1.1
Host: domainB.csnc.ch
Origin: http://domainA.csnc.ch


HTTP/1.1 200 OK
Content-Type: text/html
Access-Control-Allow-Origin: http://domainA.csnc.ch
```

CORS – Vulnerabilities & Threats I



- Accessing internal websites
- Scanning the internal network

CORS – Vulnerabilities & Threats II



- Remote attacking a web server
- Easier exploiting of Cross-Site Request Forgery (XSRF)
- Establishing a remote shell *(DEMO)*

Countermeasures

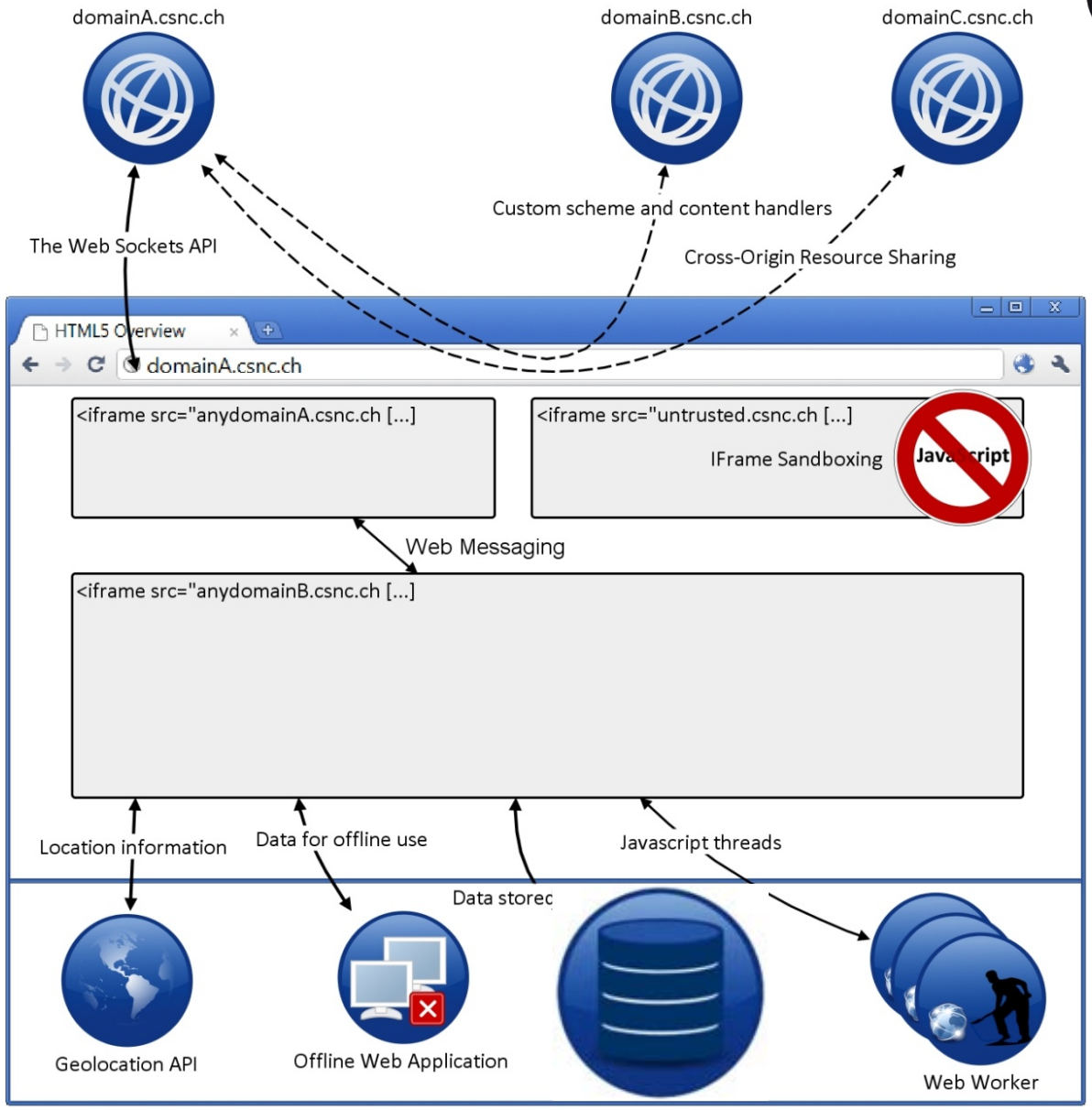
Use the `Access-Control-Allow-Origin` header to restrict the allowed domains.

Never set the header to `*`.

Do not base access control on the origin header.

To mitigate DDoS attacks the Web Application Firewall (WAF) needs to block CORS requests if they arrive in a high frequency.

Web Storage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domainB.csnc.ch
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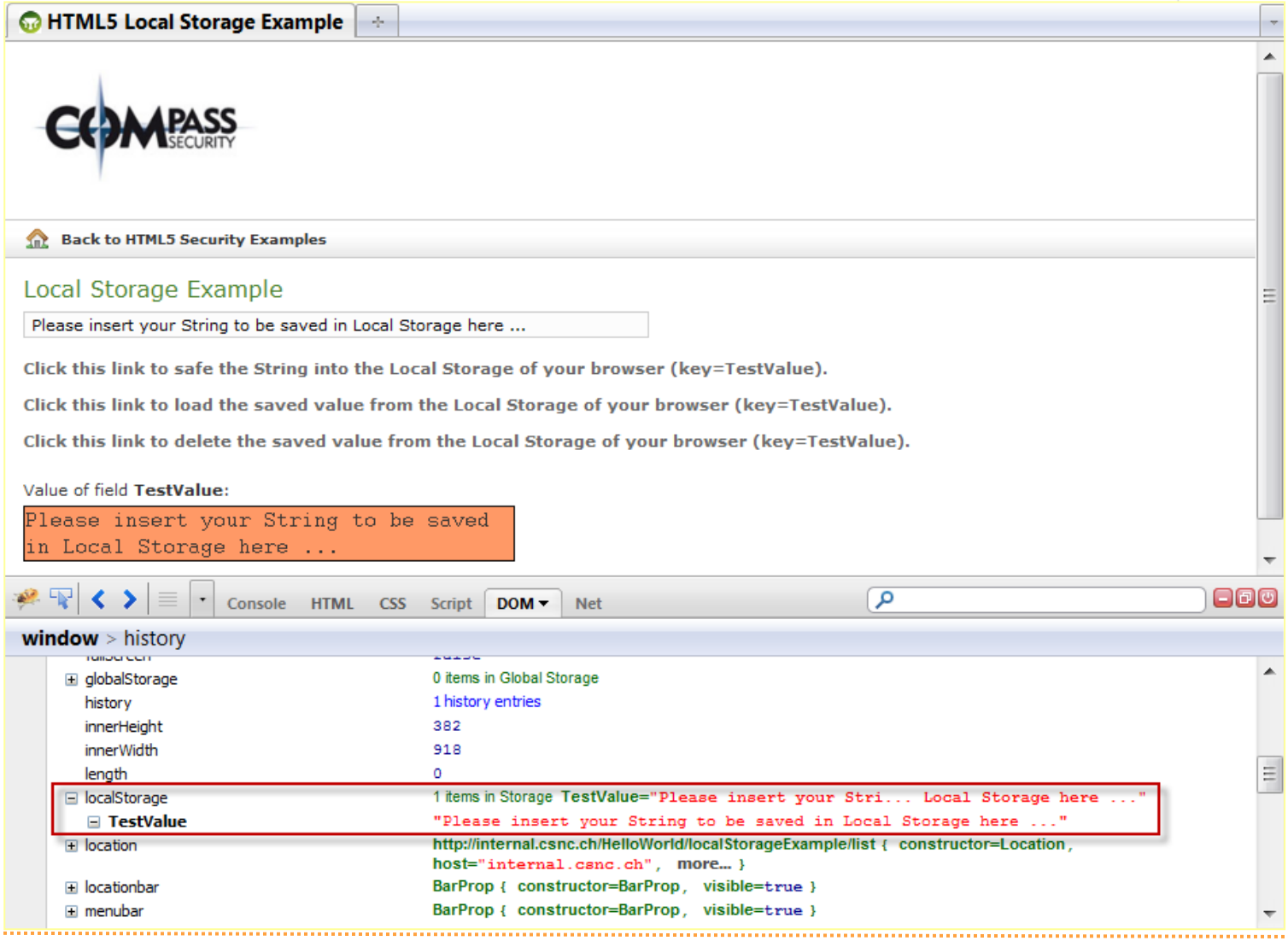
Javascript threads
Geolocation API
Offline Web Application
Web Worker

Web Storage


HTML5 Local Storage Example
Back to HTML5 Security Examples
Local Storage Example
Please insert your String to be saved in Local Storage here ...
Click this link to safe the String into the Local Storage of your browser (key=TestValue).
Click this link to load the saved value from the Local Storage of your browser (key=TestValue).
Click this link to delete the saved value from the Local Storage of your browser (key=TestValue).
Value of field TestValue:
Please insert your String to be saved in Local Storage here ...
Console
HTML
CSS
Script
DOM
Net
window > history
globalStorage
0 items in Global Storage
history
1 history entries
innerHeight
382
innerWidth
918
length
0
localStorage
1 items in Storage TestValue="Please insert your Stri... Local Storage here ..."
TestValue
"Please insert your String to be saved in Local Storage here ..."
location
http://internal.csnc.ch/HelloWorld/localStorageExample/list { constructor=Location, host="internal.csnc.ch", more... }
locationbar
BarProp { constructor=BarProp, visible=true }
menubar
BarProp { constructor=BarProp, visible=true }

Web Storage – Vuln. & Threats

Session Hijacking

- If session identifier is stored in local storage, it can be stolen with JavaScript.
- No *HTTPOnly* flag.

Disclosure of Confidential Data

- If sensitive data is stored in the local storage, it can be stolen with JavaScript.

User Tracking

- Additional possibility to identify a user.

Persistent attack vectors

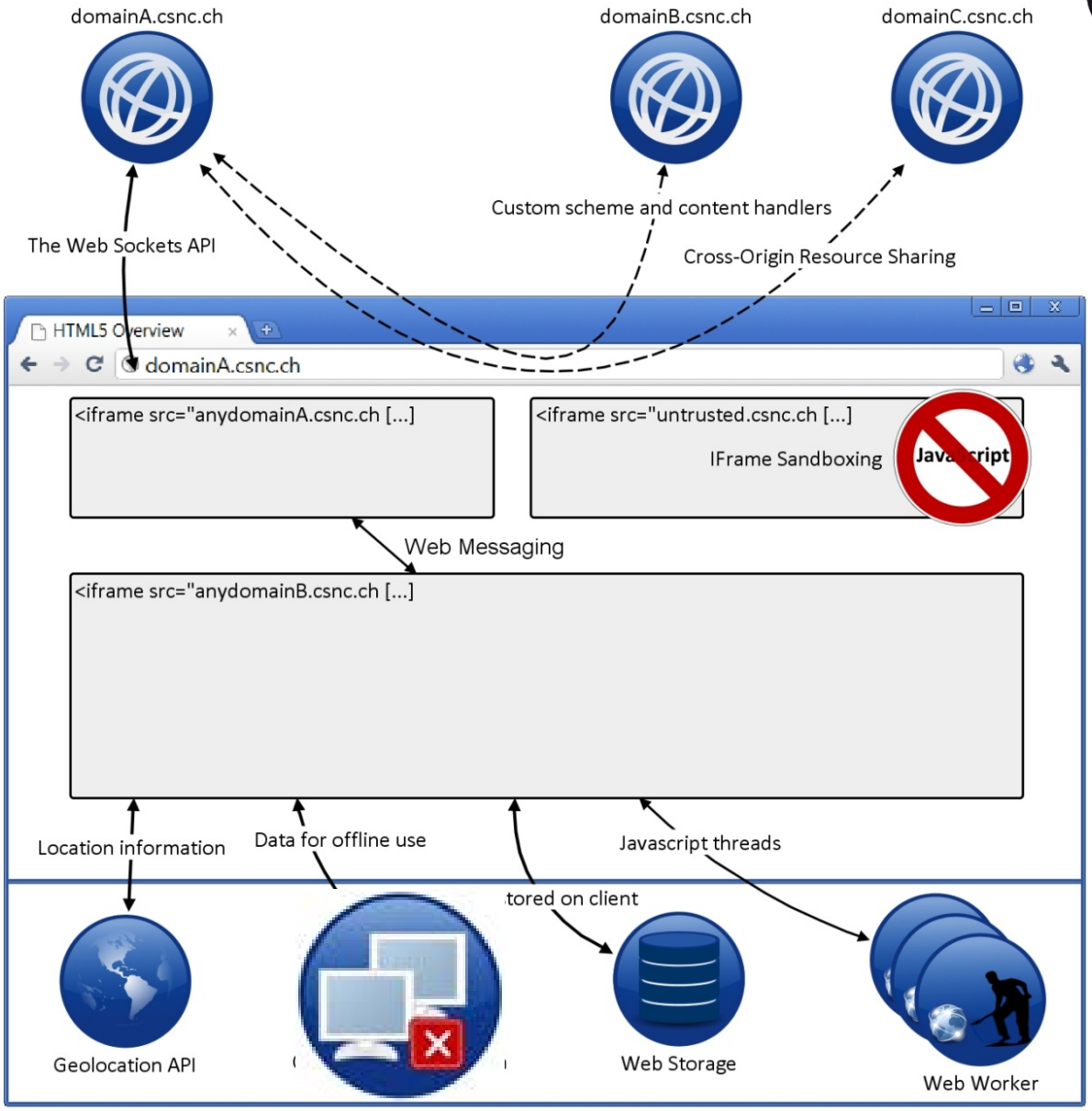
- Attack vectors can be stored persistently in the victim's browser.

Countermeasures

Use cookies instead of Local Storage for session handling.

Do not store sensitive data in Local Storage.

Offline Web Application



Offline Web Application

```
<!DOCTYPE HTML>
<html manifest="/cache.manifest">
<body>
...
```

Example cache.manifest

```
CACHE MANIFEST
/style.css
/helper.js
/csnc-logo.jpg
NETWORK:
/visitor_counter.jsp
FALLBACK:
/ /offline_Error_Message.html
```

OWA – Vulnerabilities & Threats

Cache Poisoning

- Caching of the root directory possible.
- HTTP and HTTPs caching possible.

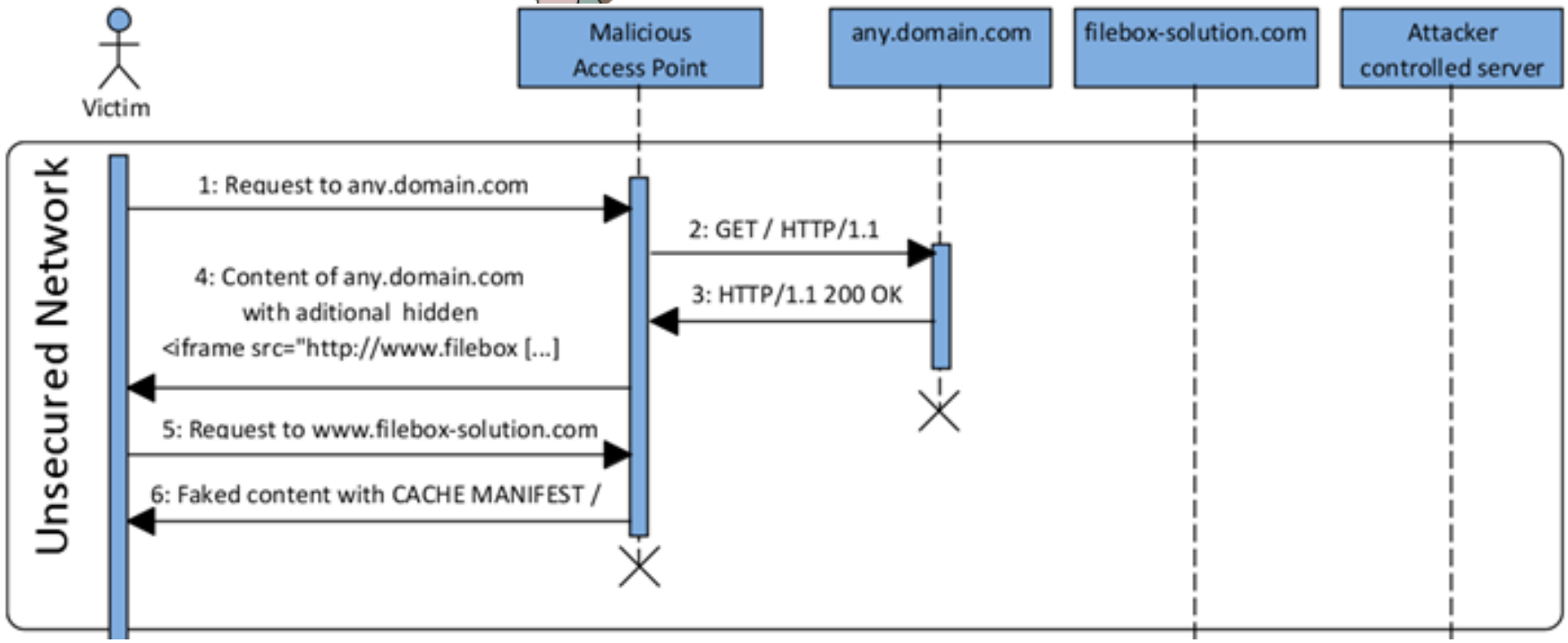
Persistent attack vectors

- Attack vectors can be stored persistently in the victim's browser.

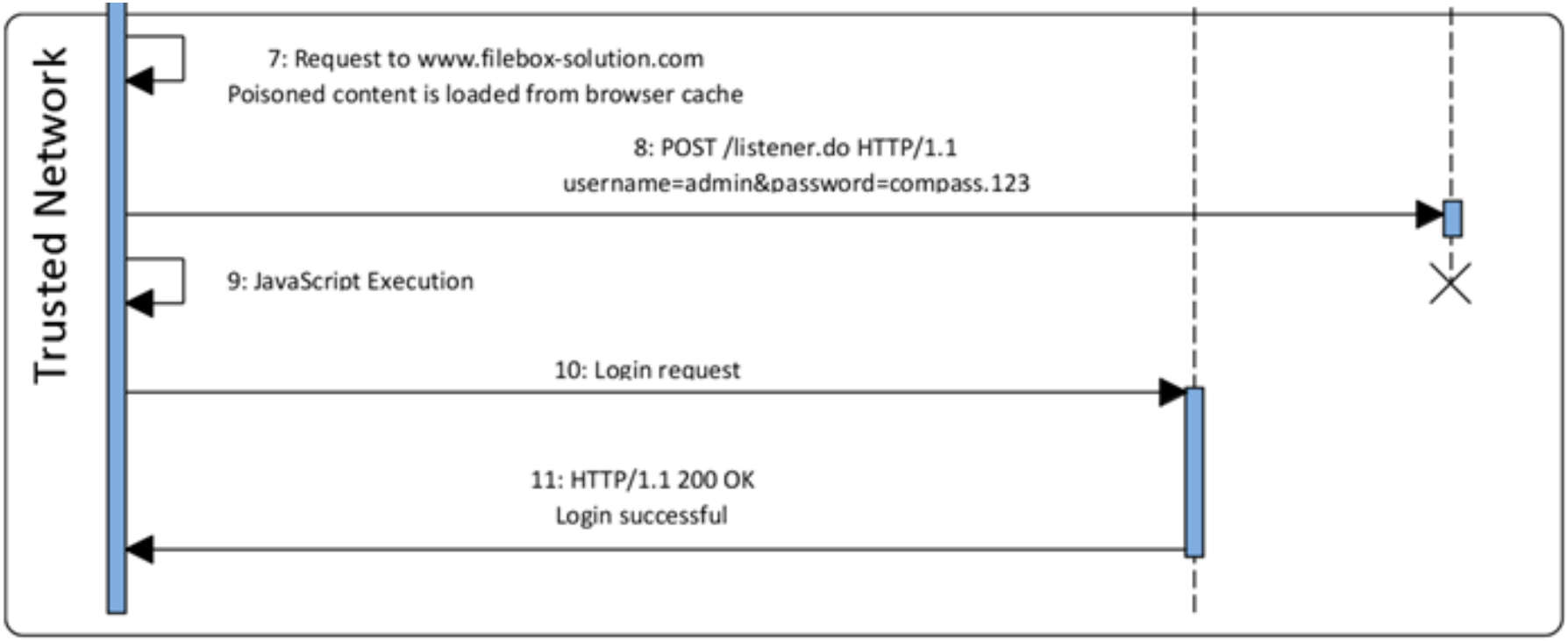
User Tracking

- Additional possibility to identify a user.
- Unique identifiers could be stored along with the cached files.

Offline Web Application – Attack 1/2



Offline Web Application – Attack 2/2

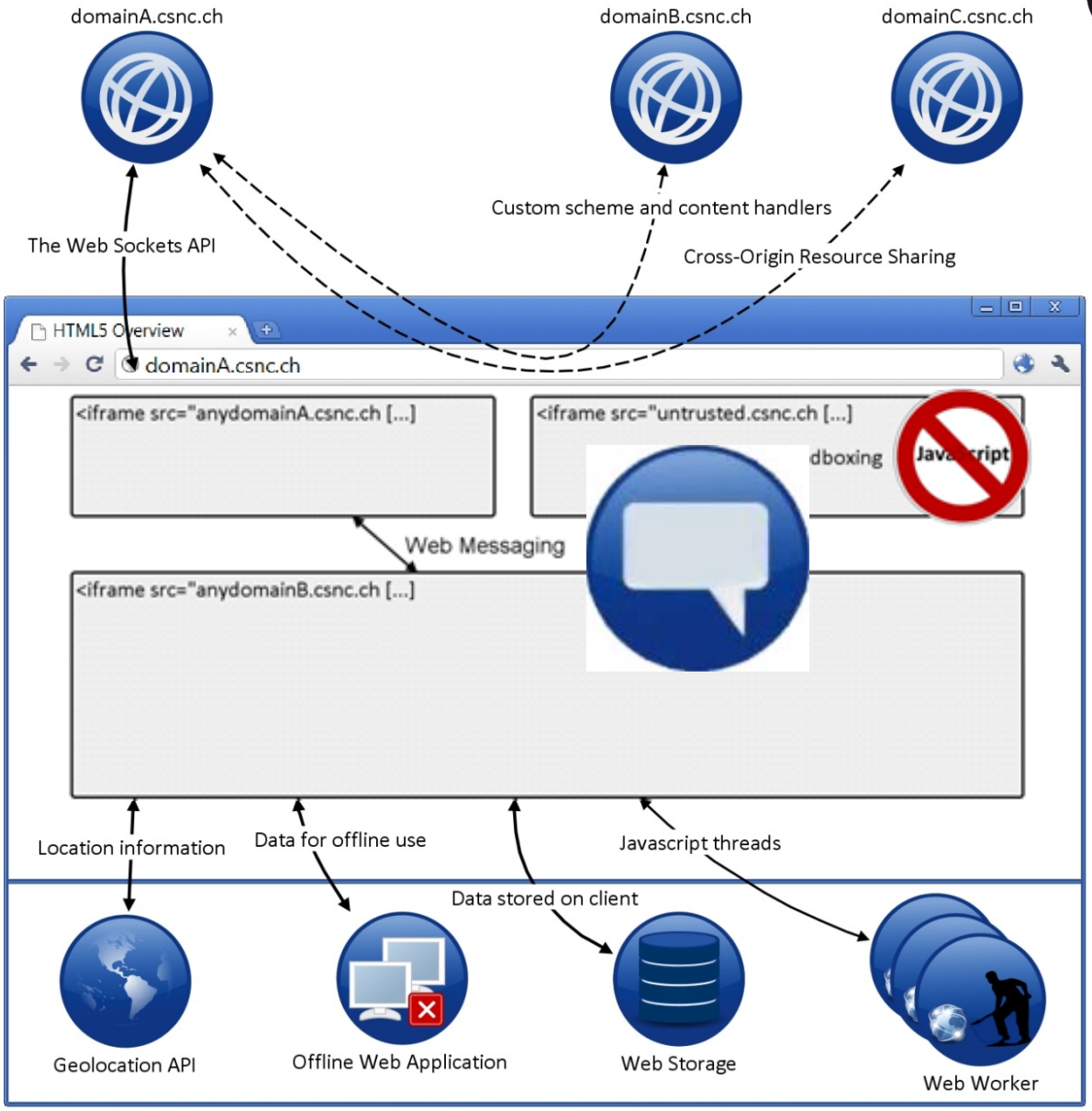


User Training

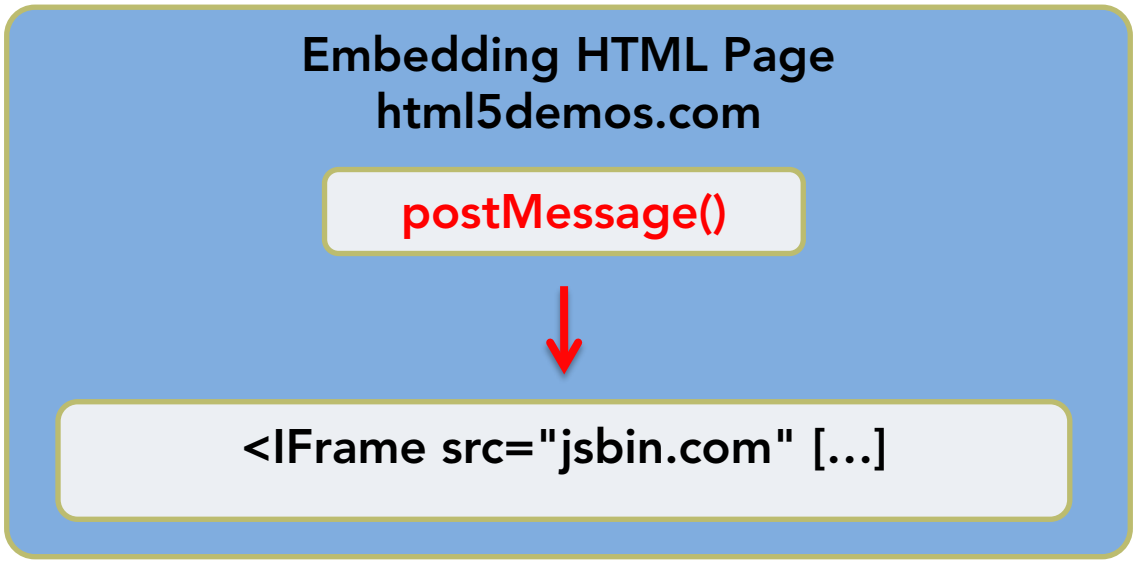
=> Do not accept caching of web applications!

=> Clear the cache including Local Storage and Offline Web Applications!

Web Messaging



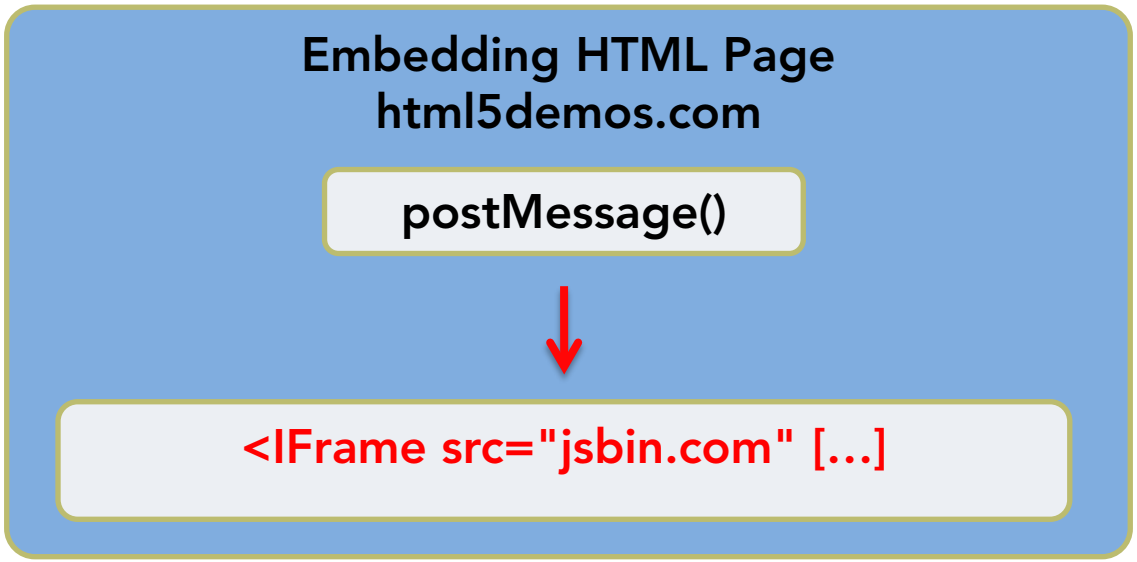
Web Messaging



Send Message:

```
var win =
document.getElementById("iframe").contentWindow;
win.postMessage(
     document.getElementById("message").value,
     "http://jsbin.com"
     );
```

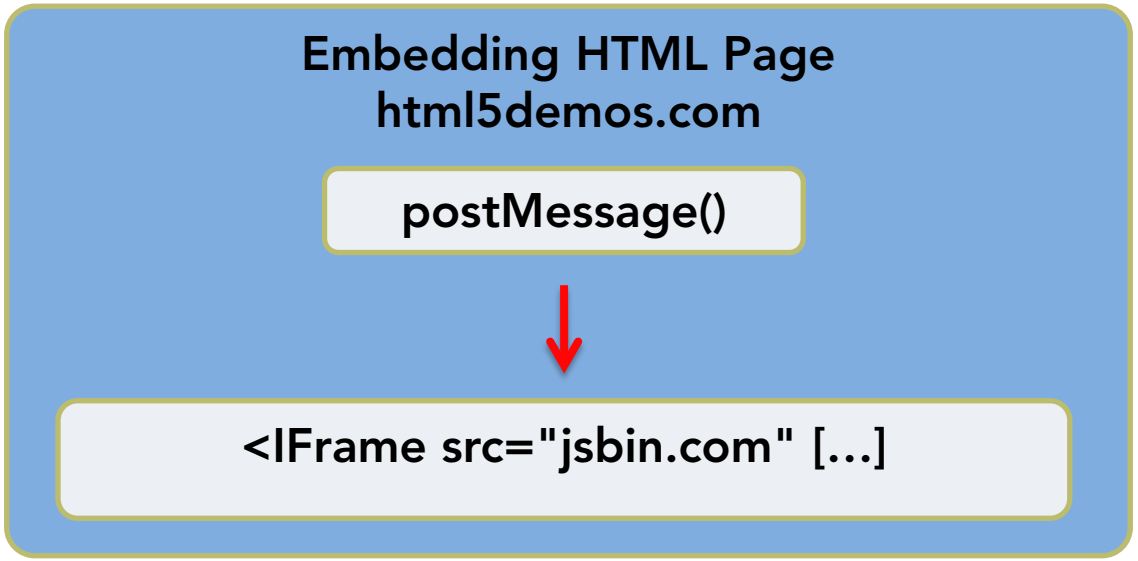
Web Messaging



Receive Message:

```
window.onmessage = function(e){
    if ( e.origin !== "http://html5demos.com" ) {
        return;
    }
    document.getElementById("test").innerHTML =
e.origin + " said: " + e.data;
};
```

Web Messaging



Stealing confidential data

- Sensitive data may be sent accidently to a malicious IFrame.

Expands attack surface to the client

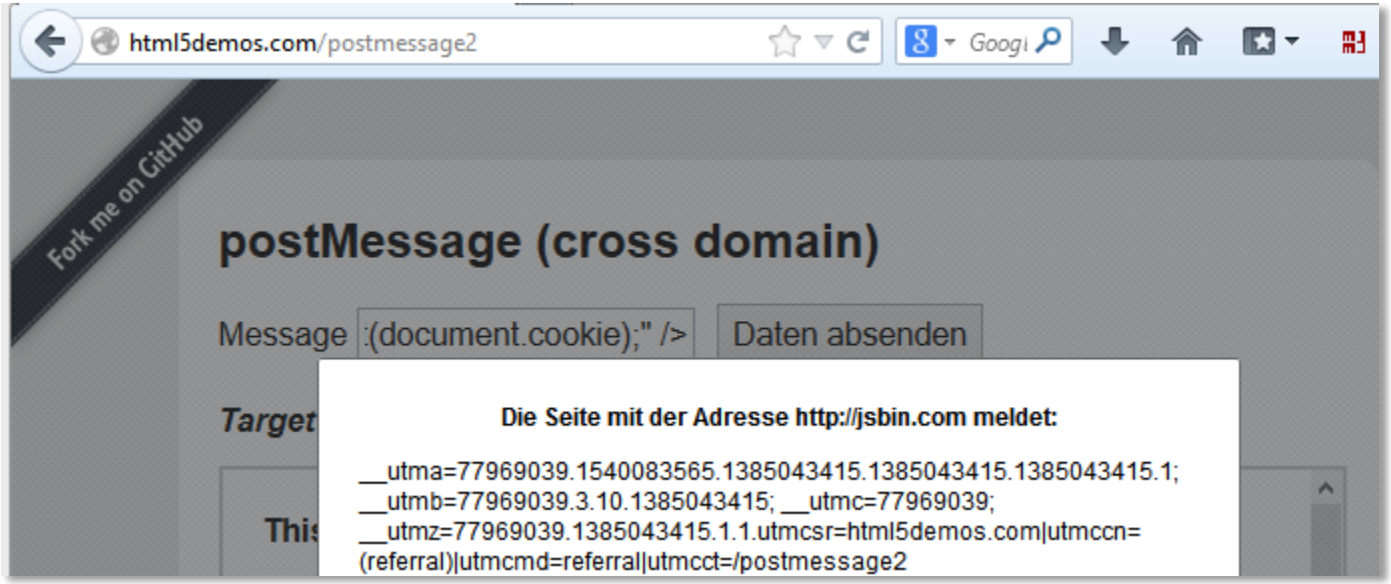
- IFrames can send malicious content to other IFrames.
- Input validation on the server is not longer sufficient.

Web Messaging - DEMO

Embedding HTML Page
html5demos.com

postMessage()

<IFrame src="jsbin.com" [...]



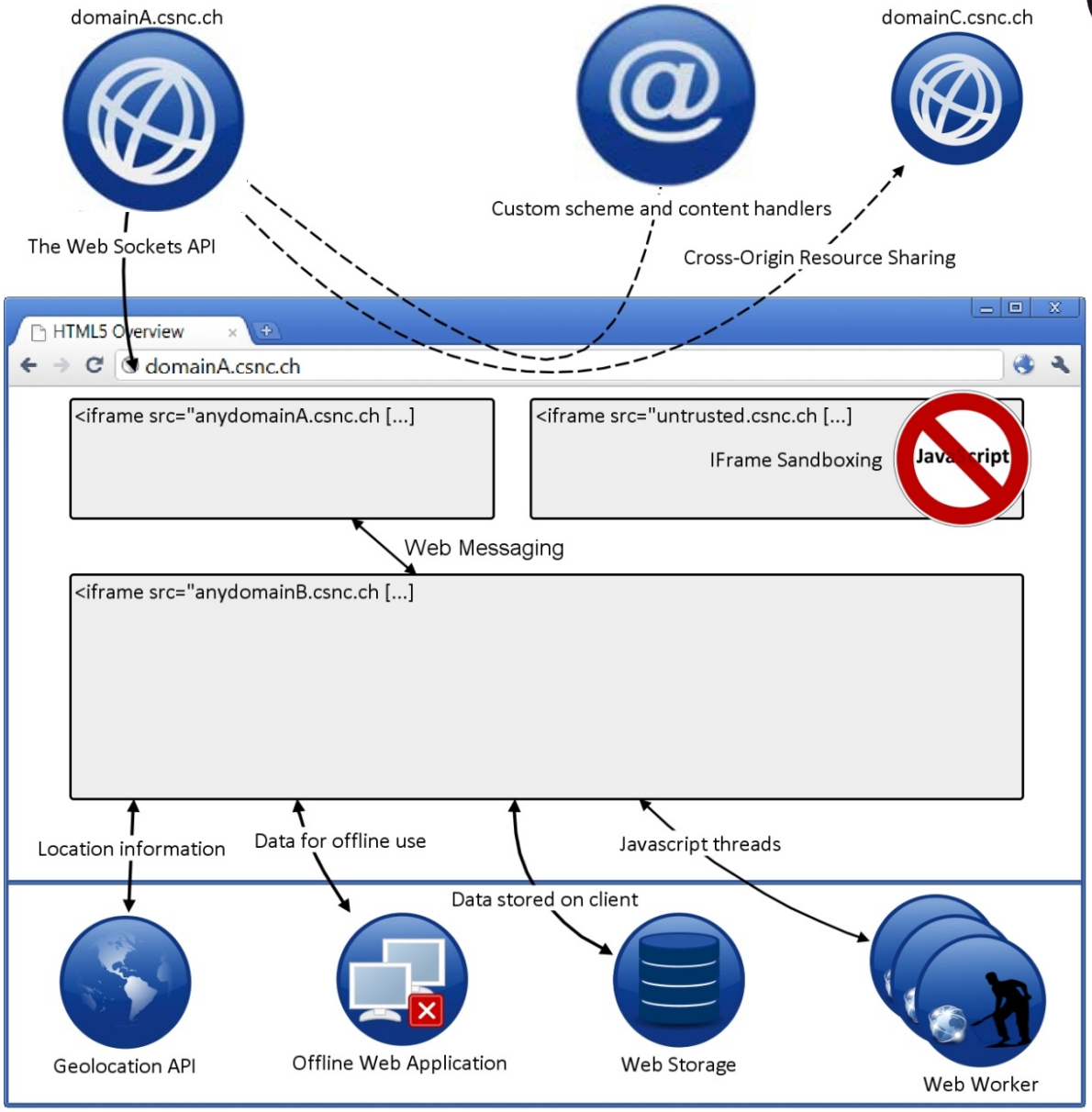
Countermeasures

The target in postMessage() should be defined explicitly and not set to `*`.

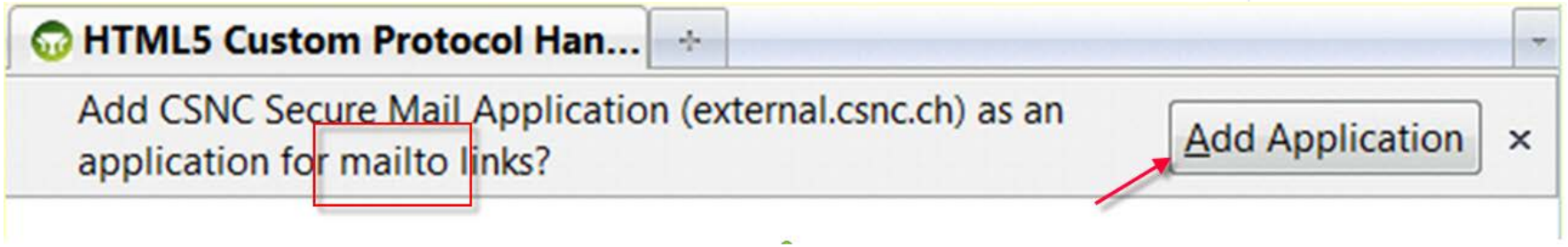
The receiving IFrame should not accept messages from any domain. E.g. `e.origin == "http://internal.csnc.ch"`

The received message needs to be validated on the client to avoid malicious content being executed.

Custom scheme and content handlers



Custom scheme and content handlers



Stealing confidential data

- An attacker tricks the user to register a malicious website as the e-mail protocol handler.
- Sending e-mails through this web application gives the attacker access to the content of the e-mail.

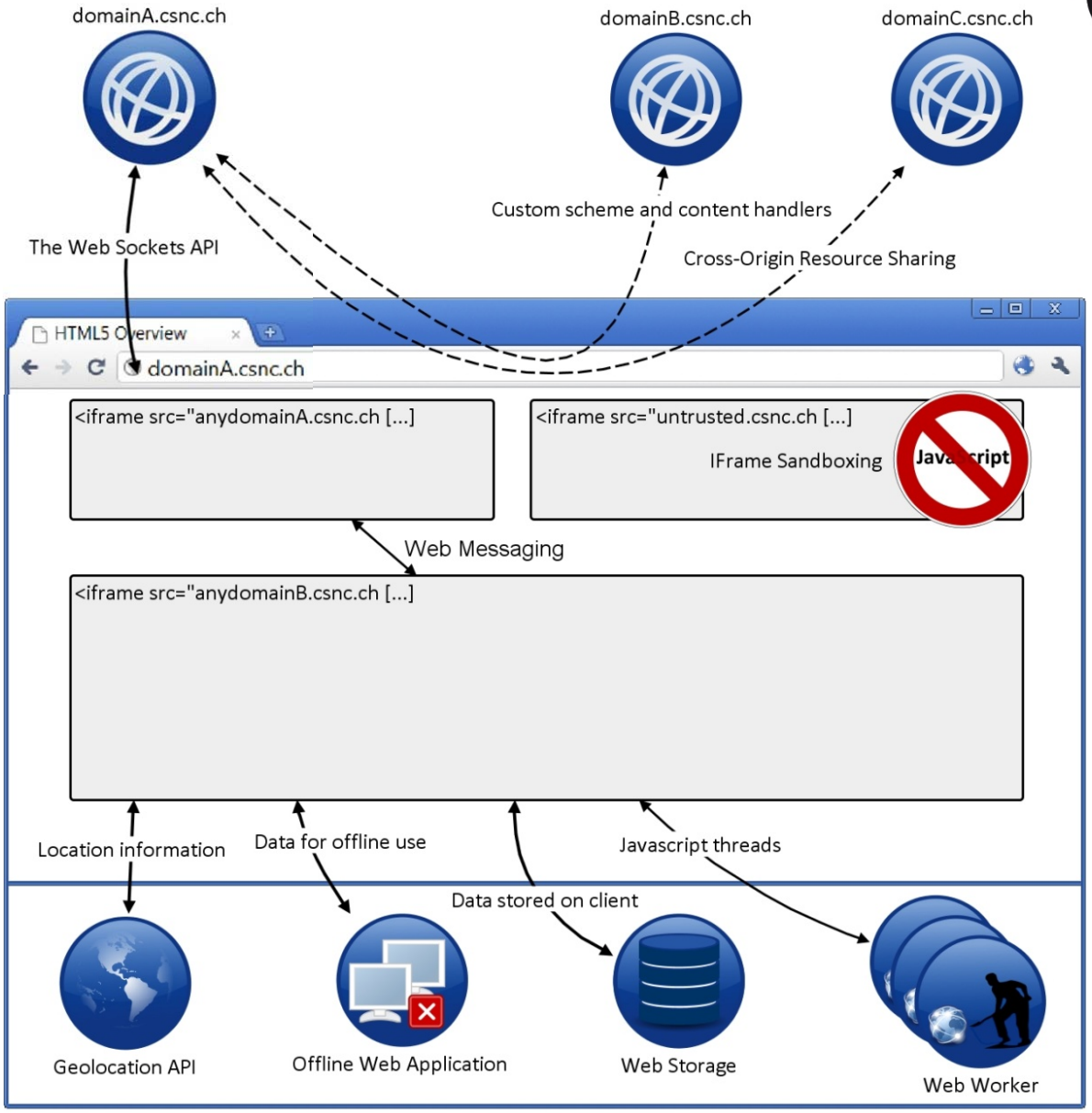
User Tracking

- Additional possibility to identify a user.
- Unique identifiers could be stored along with the protocol handler.

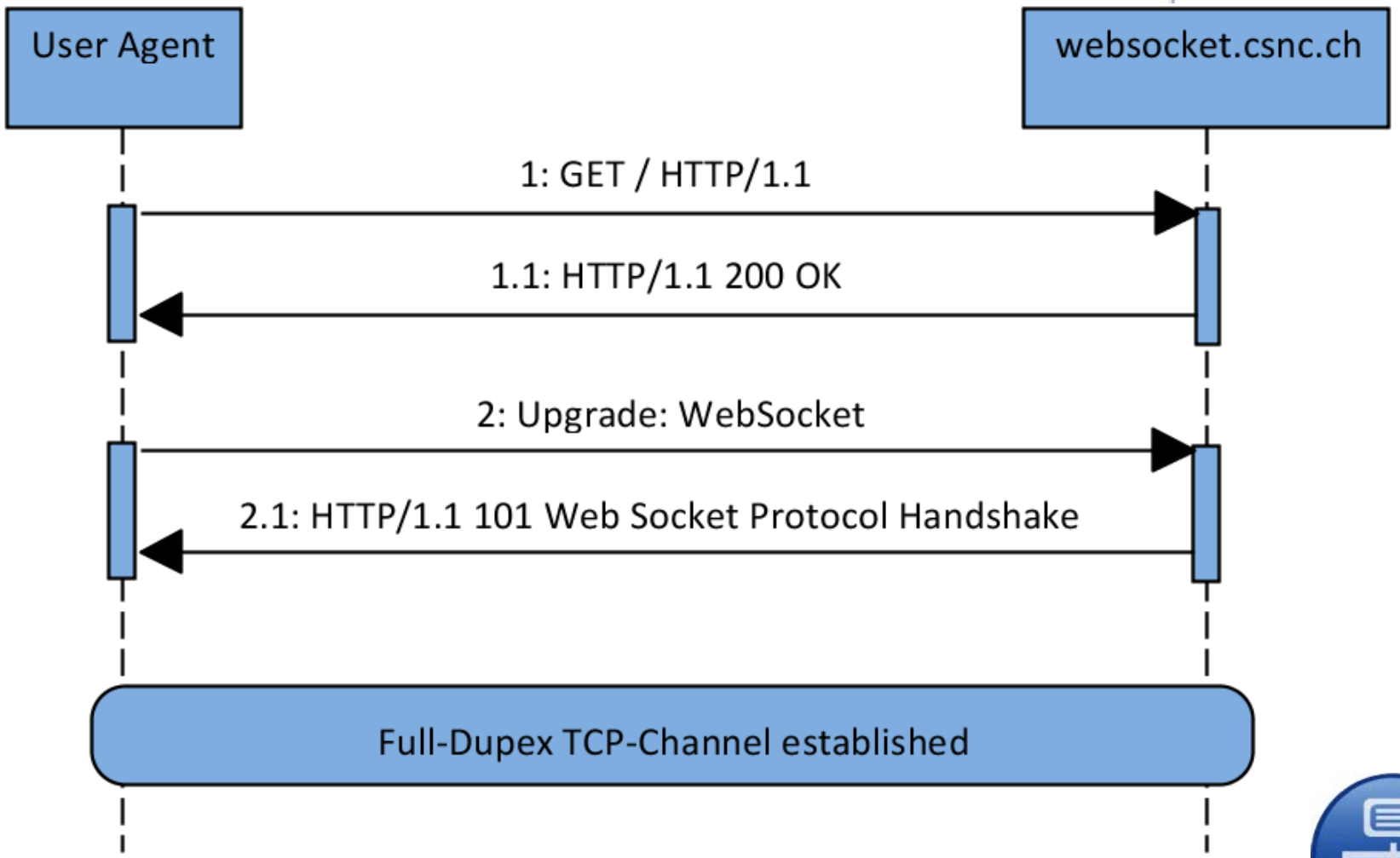
User Training

=> Do not accept registration of protocol handlers!

Web Sockets API



Web Sockets API



Web Sockets API – Vuln. & Threats

Cache Poisoning

- A misunderstanding proxy could lead to a cache poisoning vulnerability.

→ **Fixed** by introducing masking of the web socket data frames.

Scanning the internal network

- The browser of a victim can be used for port scanning of internal networks.

Establishing a remote shell

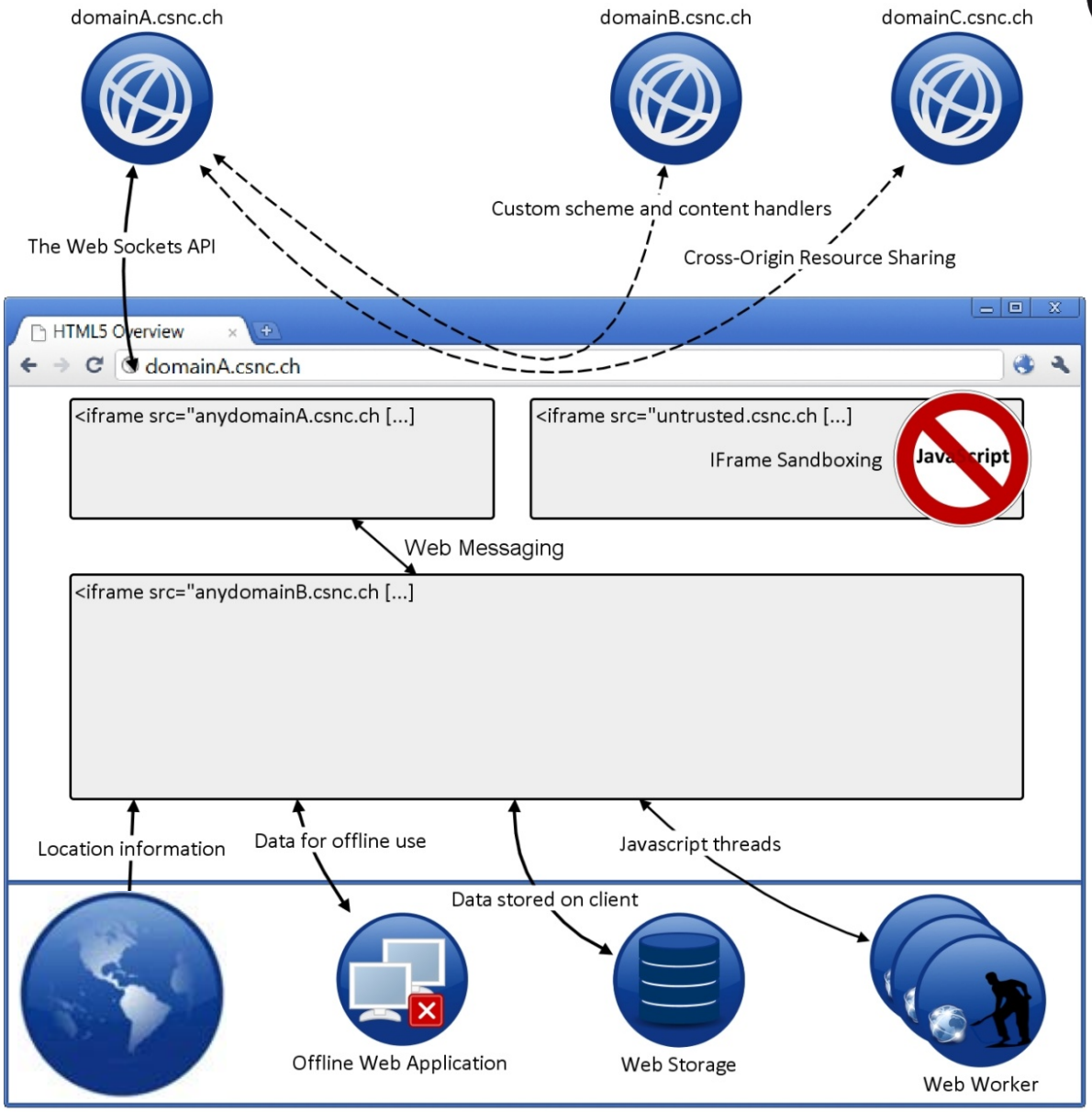
- Web Sockets can be used to establish a remote shell to a victim's browser.

Countermeasures

The risks of the Web Sockets API needs to be accepted.

The user could disable it in the browser.

Geolocation API



Geolocation API

Finding your location: found you!

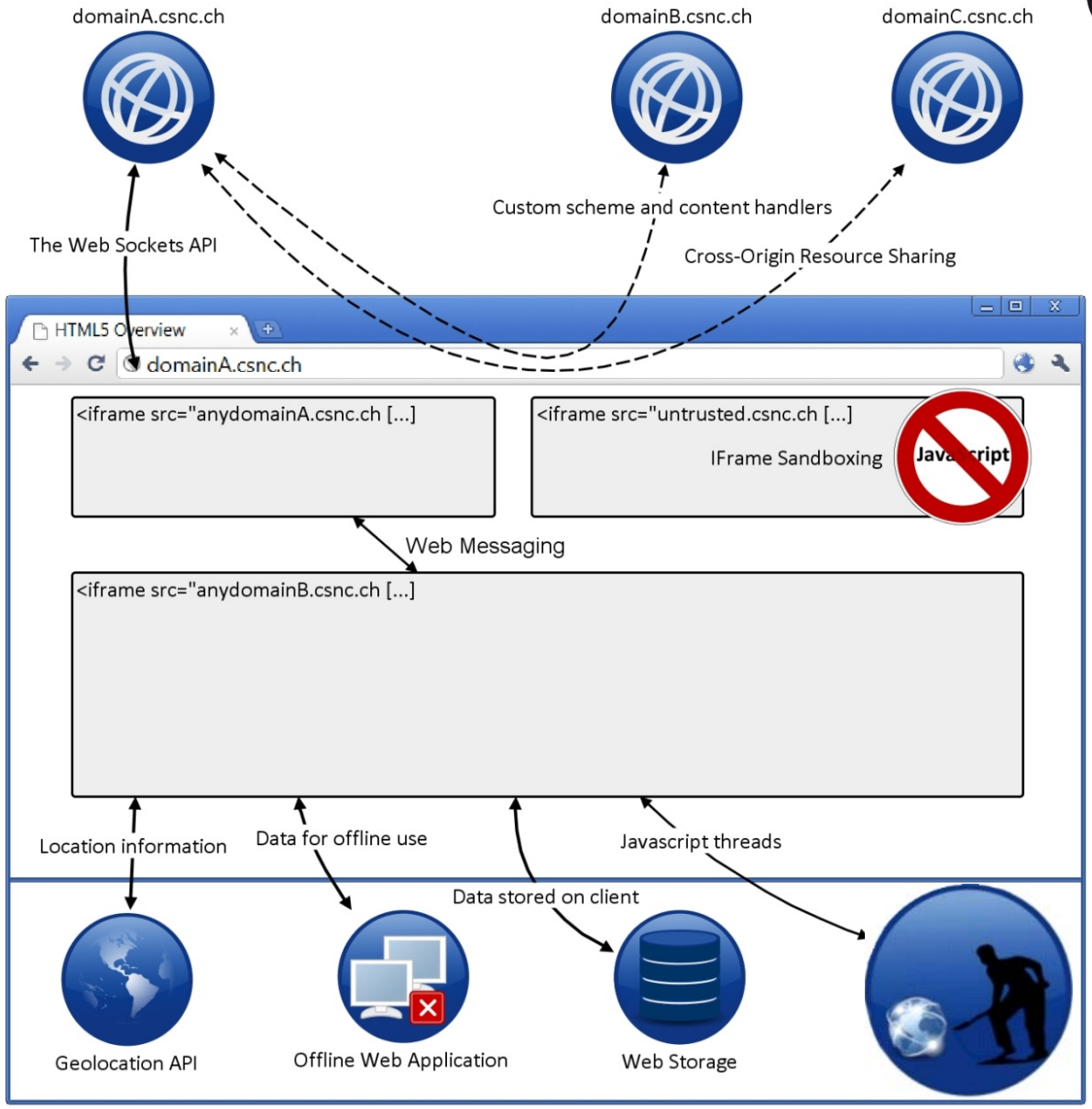
User Tracking

- User tracking based on the location of a user.
- If users are registered, their physical movement profile could be tracked.
- The anonymity of users could be broken.

User Training

=> Do not accept to share location information!

Web Workers


domainA.csnc.ch
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Offline Web Application
Web Storage

Web Workers

Web Workers provide the possibility for JavaScript to run in the background

Prior to Web Workers using JavaScript for long processing jobs was not feasible because

- it is slower than native code and
- the browsers freezes till the processing is completed

Web Workers alone are not a security issue.

But they can be used indirectly for launching work intensive attacks without the user noticing it.

Worst Case Scenarios

Web Workers = *Feature!*

Cracking Hashes in JS Cloud *(DEMO).*

Web Workers + Cross-Origin Resource Sharing =

Powerful DDoS attacks.

Web Workers + Cross-Origin Resource Sharing + Web Sockets =

Web-based Botnet.

Conclusion

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Some HTML5 features are the vulnerabilities themselves.

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Not all issues can be mitigated through secure server-side implementation.

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Cross-Site Scripting (XSS) becomes even worse.

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USE IE 6

;)

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DEMO – Exploiting Cross-Origin Resource Sharing

Shell of the Future

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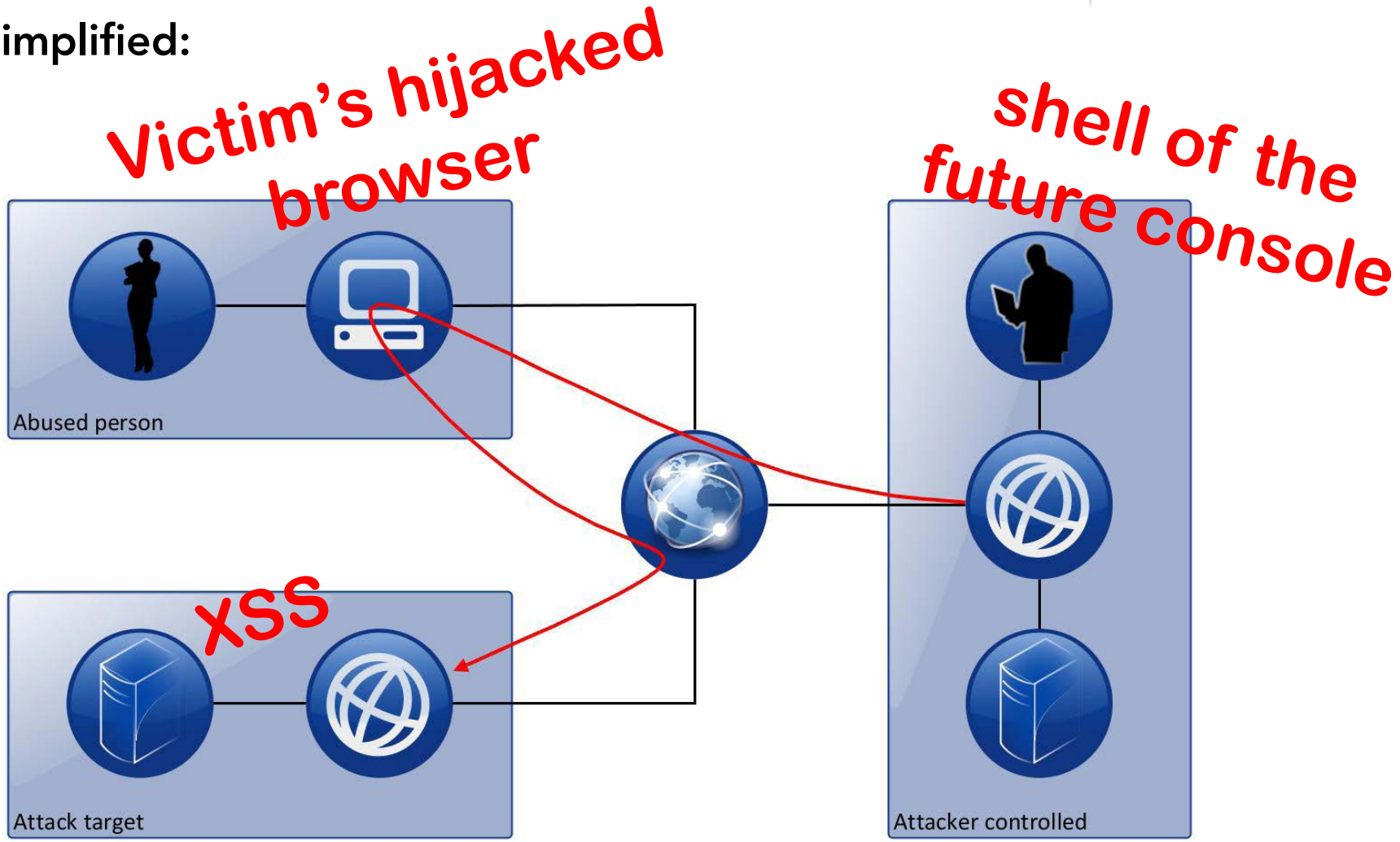
DEMO – CORS – Shell of the Future

Simplified:



DEMO – Exploiting Web Workers

Ravan

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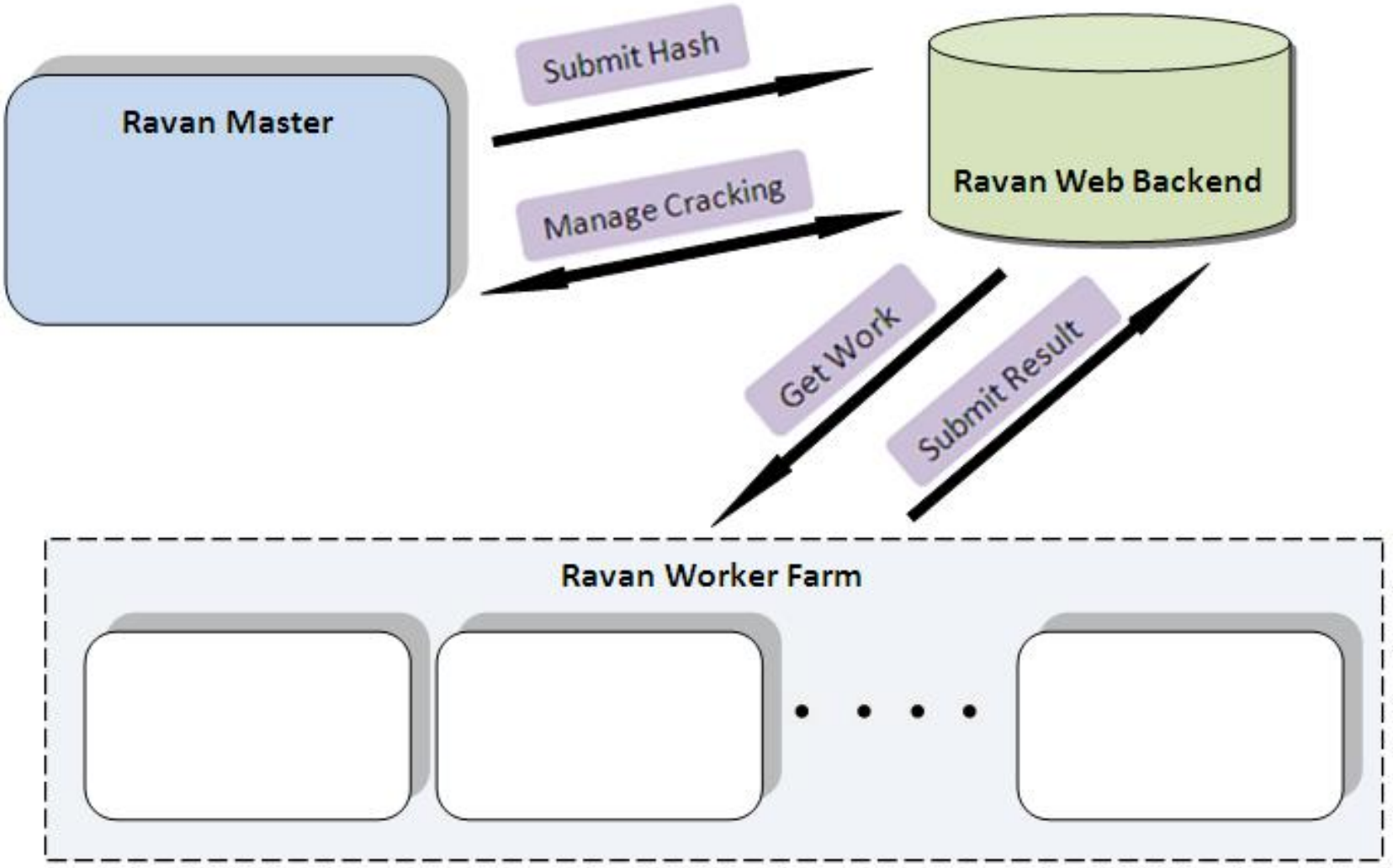
DEMO – Web Workers – Ravan

http://www.andlabs.org/tools/ravan.html



DEMO – Web Workers – Ravan

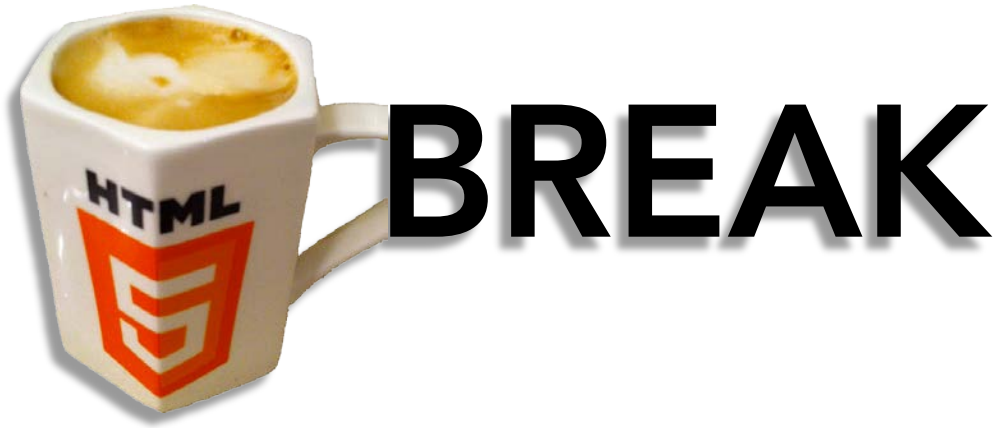
http://www.andlabs.org/tools/ravan.html

14d6a3e0201f58bfe7c01e775973e80e

Quiz and Q&A

DEMO – Web Workers – Ravan

http://www.andlabs.org/tools/ravan.html



HTML5 Web Security Video (May 2011):
http://www.youtube.com/watch?v=Eju4e5mhEN0

Test HTML5 security yourself:
https://www.hacking-lab.com/sh/Gb5VF4q

References

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  6 August 2013
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