Sensitive Information and Privacy Testing

The following is what we will be covering in this lab:

- Automated sensitive information scanning in the source code
- Automated sensitive information scanning for the application and database

Case study -- weak encryption search

Let's still use the same project, the Python Vulnerable API, to search for weak encryption used in the source code. In this case, we will be looking for the uses of the vulnerable MD5 algorithm in the source code. The tool we introduce here is The Silver Searcher, which can do a fast recursive search based on a given keyword for all file contents, and indicate the results.

Step 1 -- installing The Silver Searcher

The Silver Searcher has been downlaoded in the lab environment: https://github.com/k-takata/the_silver_searcher-win32/releases

Step 2 -- executing the tool (using Windows as an example)

Use [ag -h] to display all the options and usage in the console. In this case, we will use [-w] to match the keyword, [md5]. The AG tool can be executed in the `cmd` terminal as follows:

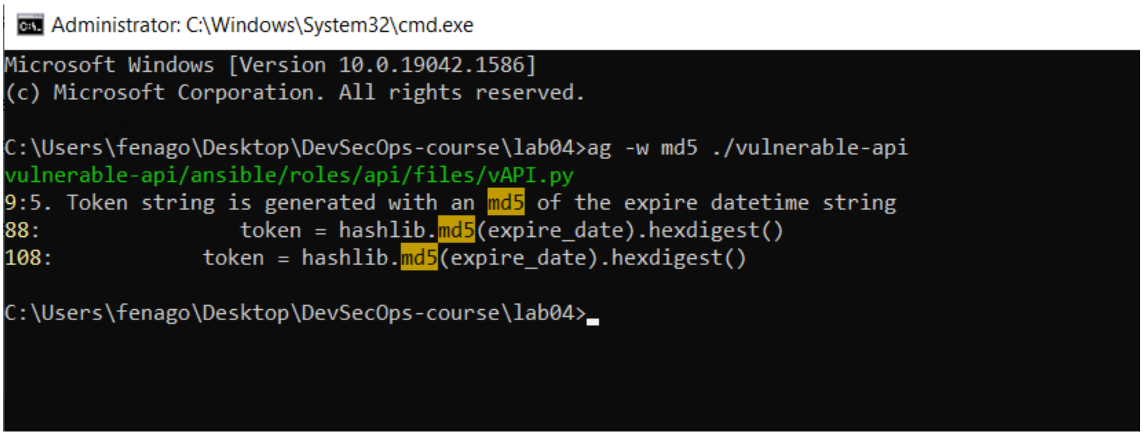
```
cd C:\Users\fenago\Desktop\DevSecOps-course\lab04

ag -w md5 ./vulnerable-api
```

Step 3 -- reviewing the results (using Windows as an example)

The following screenshot shows the output of the tool. It shows that the [vAPI.py] file contains the [md5] keyword in three lines.

There are also other options to support various kinds of search. Just type [ag] to see the output in the console:



```
Microsoft Windows [Version 10.0.19042.1586]
(c) Microsoft Corporation. All rights reserved.

C:\Users\fenago\Desktop\DevSecOps-course\lab04>ag -w md5 ./vulnerable-api
vulnerable-api/ansible/roles/api/files/vAPI.py
9:5. Token string is generated with an md5 of the expire datetime string
88:                 token = hashlib.md5(expire_date).hexdigest()
108:            token = hashlib.md5(expire_date).hexdigest()

C:\Users\fenago\Desktop\DevSecOps-course\lab04>
```

Case study -- searching for a private key

Let's take another case to look at searching for the compromise of API key information. An API key being hardcoded in the source code or a password being weakly encrypted in the source code are both common security vulnerabilities. To search for a private encryption key or hardcoded password requires the calculation of entropy which is a number to represent the level of randomness. A string with a high entropy value is normally an indicator of a potential API key, hash value, or encrypted message. In the following demonstration, we will also use the vulnerable Python API project to search for vulnerable API keys in the source code. The tools we will be using are [entropy.py] and [DumpsterDiver] https://github.com/securing/DumpsterDiver

Step 1 -- calculating the entropy

This step of entropy calculation is optional. However, an entropy value will help to improve the accuracy of the search result. For example, say we know of one other API key in the source code. Knowing the entropy value of that known API key will help to identify another unknown key with higher accuracy. In this case, we're assuming the known API key is [ZeXvRCRZ3LF]:

```
cd C:\Users\fenago\Desktop\DevSecOps-course\lab04\DumpsterDiver
python  entropy.py   ZeXvRCRZ3LF
```

The output of the entropy calculation will be done by DumpsterDiver. The entropy value of the known API key string is [3.095795255] bits. Once we have the exact entropy value of the known API key, we can search for the same entropy value of other API Keys.

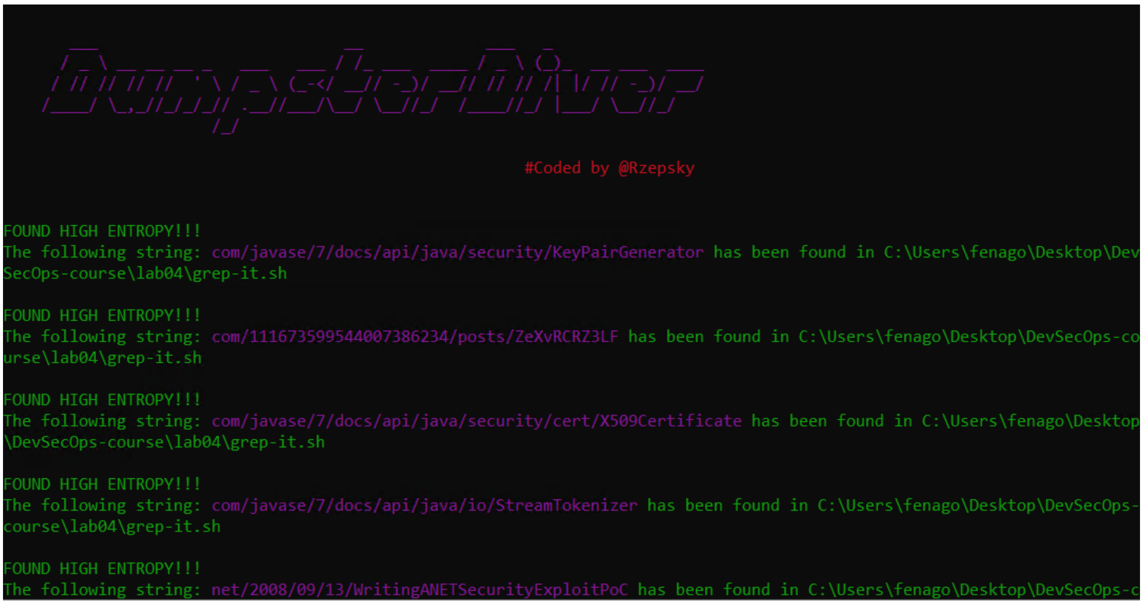
Step 2 -- Searching for high-entropy strings

Based on the entropy value, we can search all the projects for similar entropy values of [3.095]. Again, this is optional; it just helps us to locate what we are looking for more accurately. If the entropy value is not specified, DumpsterDiver will just list all the high-entropy value strings:

```
python  DumpsterDiver.py   --entropy  3.095  -p  ../grep-it.sh
```

Step 3 -- Reviewing the results

DumpsterDiver will list all the identified entropy strings. Then, it may need to check whether any of them indicate private API key leakage. For example, the following screenshot shows three strings with the same entropy value having been identified. We can further review whether these are exposed API keys:



```
                                                       #Coded by @Rzepsky


FOUND HIGH ENTROPY!!!
The following string: com/javase/7/docs/api/java/security/KeyPairGenerator has been found in C:\Users\fenago\Desktop\Dev
SecOps-course\lab04\grep-it.sh

FOUND HIGH ENTROPY!!!
The following string: com/111673599544007386234/posts/ZeXvRCRZ3LF has been found in C:\Users\fenago\Desktop\DevSecOps-co
urse\lab04\grep-it.sh

FOUND HIGH ENTROPY!!!
The following string: com/javase/7/docs/api/java/security/cert/X509Certificate has been found in C:\Users\fenago\Desktop
\DevSecOps-course\lab04\grep-it.sh

FOUND HIGH ENTROPY!!!
The following string: com/javase/7/docs/api/java/io/StreamTokenizer has been found in C:\Users\fenago\Desktop\DevSecOps-
course\lab04\grep-it.sh

FOUND HIGH ENTROPY!!!
The following string: net/2008/09/13/WritingANETSecurityExploitPoC has been found in C:\Users\fenago\Desktop\DevSecOps-c
```

Case study -- website privacy inspection

Here we will look at how to identify vulnerabilities in private information when a web service goes live.

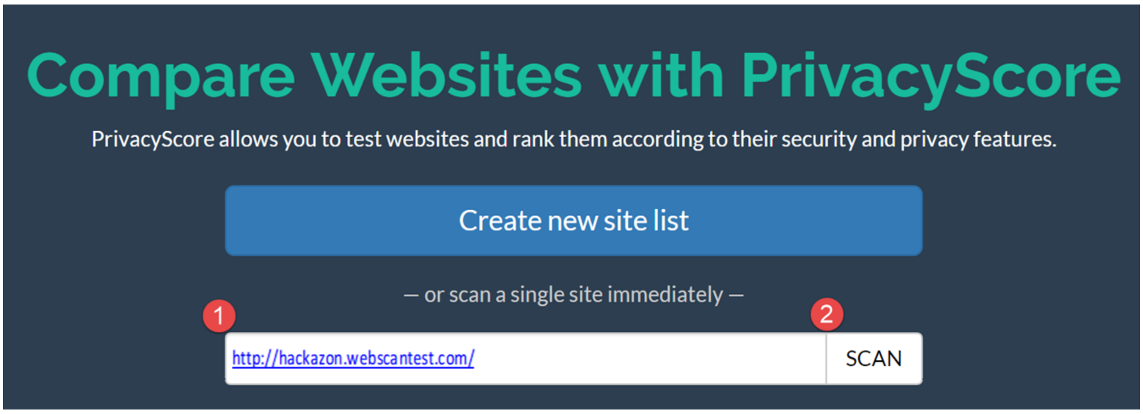
For a quick demo of how to use PrivacyScore, you can use the online version to scan a vulnerable website. If the web service you are developing can't be reached over the internet, PrivacyScore also provides a standalone version that you can set up in house.

Step 1 -- visiting PrivacyScore or setting it up locally

For the online version of PrivacyScore, please visit https://privacyscore.org/.

To set up PrivacyScore locally, refer to https://github.com/PrivacyScore/PrivacyScore/.

Input the target vulnerable website, [http://demo.testfire.net/], and click [SCAN], as shown in the following screenshot. The scanning will be triggered and will run on the cloud:



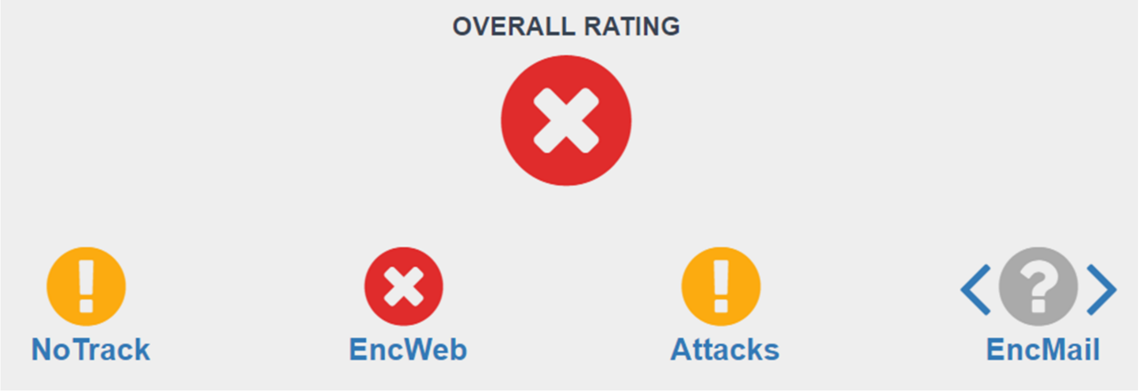
Compare Websites with PrivacyScore

PrivacyScore allows you to test websites and rank them according to their security and privacy features.

Create new site list
— or scan a single site immediately —
1
http://hackazon.webscantest.com/
2
SCAN

Step 2 -- reviewing the results

After the scanning is done, you will see the scanning results as follows. In our example, the website shows potential risks for the NoTrack and Attacks categories. It suggests that the web administrator take further actions to review the third-party embeds, the uses of HTTPS everywhere, and also the secure configuration of HTTP security headers:



Summary

In this lab, we looked at three case studies. The first case study was about searching for weak encryption using The Silver Searcher. The second case was about identifying potential API key leakage in the source code by using DumpsterDiver. The final case was about examining website privacy, looking specifically at the use of PrivacyScore to scan the target website.

We have practiced various kinds of white-box source code review techniques for sensitive information.