DEPARTMENT OF INFORMATICS

TECHNISCHE UNIVERSITÄT MÜNCHEN

Secure Coding Phase 2

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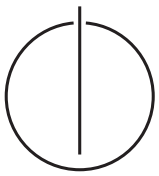

Executive Summary

Team2

We found several vulnerabilities, which could cause severe damage to the *Team2*. It is possible to get access to the admin page via stealing the session. Thus an attacker can register an arbitrary employee or customer and unlock the registered user. An attacker can also execute a brute force attack on known user ids as there is no lock mechanism to prevent this. Besides the security issues there is also a severe problem with regard to the business logic. In the current state this web application should not be used productively!

Team3 Online Banking

We found some issues, which potentially could cause damage to the *Team3 Online Banking*. However the detected issues are quite easy to fix. If an experienced attacker performs a man in the middle attack he'll be able to track session ids. The implications are severe, as the attacker can take over the role of the customer, but this attack requires advanced knowledge. With regard to the business logic there was only one issue with low risk detected.

Comparison

In summary we were able to clearly state out that the *Team3 Online Banking* web application has less and also less severe vulnerabilites then the *Team2* web application. Furthermore it has to be said that the detected issues of the *Team3 Online Banking* are easier to fix and will cost less money to implement.

Contents

1 Time Tracking Table

1 Time Tracking Table

Name	Task	Time
Aurel Roci	Test HTTP Methods	0.25
	Error Handling	1
	Testing for default credentials	0.25
	Testing for Reflected Cross Site Scripting	0.5
	Testing for Stored Cross Site Scripting	2
	Testing for HTTP Verb Tampering	0.5
	Testing for SQL Injection	2
	Test Number of Times a Function Can be Used Limits	0.75
	Test Business Logic Data Validation	1.5
	Executive Summary	0.5
	Testing Report	2
	Testing for Cross Site Request Forgery	0.5
	Testing for Privilege Escalation	1.5
	Presentation	0.25
Stefan Ch. Kofler	Test File Extensions Handling for Sensitive Information	2.0
	Test HTTP Strict Transport Security	0.5
	Test RIA cross domain policy	0.5
	Test Role Definitions	1.25
	Test User Registration Process	0.75
	Test Account Provisioning Process	0.5
	Testing for Account Enumeration and Guessable User Account	0.5
	Testing for Weak or unenforced username policy	0.5
	Testing for DOM based Cross Site Scripting	0.75
	Testing for JavaScript Execution	2.0
	Testing for HTML Injection	0.5
	Testing for Client Side URL Redirect	0.75
	Testing for CSS Injection	0.5
	Testing for Client Side Resource Manipulation	0.5
	Test Cross Origin Resource Sharing	1.25
	Testing for Cross Site Flashing	0.5
	Testing for Clickjacking	1.0
	Testing WebSockets	0.75
	Test Web Messaging	0.5
	Test Local Storage	0.5
Patrick Sattler	understanding w3af and configuration	2
	w3af testing overflow and format string	1.5
	Test bruteforce for password	0.5
	Test bruteforce for TAN	1
	Test Registration process	1
	Test password policy	0.5
	Test credentials transport	1
	Test bypassing authentication schema	1
	Test browser cache weakness	1
	Test weak password policy	0.5
	Testing Directory traversal/file include	1.75
	Testing bypassing session management	1
	Testing cookie attributes	0.75
	Testing session fixation	0.75
	Testing for Exposed Session Variables	0.5
	Testing for Cross Site Request Forgery	1
	Testing for logout functionality	0.5
	Test Session Timeout	0.75
	Testing for Session puzzling	0.25
	Testing for XML/SSI/XPATH Injection	2
	Testing for Code Injection, local or remote file inclusion	1
	Testing for Command Injection	0.5
	Testing for Format string	0.25
	Testing for incubated vulnerabilities	0.5

2 Vulnerabilities Overview

Based on our testing, we identified the following vulnerabilities for the Team2 Bank and the OnlineBanking Bank:

2.1 Team2

2.1.1 Static Session ID

- Likelihood: *high*
- Implication: *high*
- Risk: *high*
- Reference: OWASP OTG-SESS-003

The session id is saved in form of the (static) user id in a cookie. This cookie can be used on any machine to take over the account of a user. The lifetime of this cookie is only limited by the cookie lifetime field.

2.1.2 Stored XSS in Registration

- Likelihood: *medium*
- Implication: *high*
- Risk: *high*
- Reference: OWASP OTG-INPVAL-002

Using stored cross-site-scripting attacks, one can inject JavaScript code, that is run, when the Administrator/Employee logs in. Arbitrary code can be loaded from a third party page.

2.1.3 Brute Force Password

- Likelihood: *high*
- Implication: *medium*
- Risk: *medium*
- Reference: OWASP OTG-AUTHN-003

The application has no lock out mechanism, which allows brute force attacks on known usernames and testing for a valid password

2.1.4 Directory Traversal

- Likelihood: *high*
- Implication: *medium*
- Risk: *medium*
- Reference: OWASP OTG-AUTHN-001

It is possible to access *SQL* directory through the *url*.

2.2 Team3 Online Banking

2.2.1 Static Session ID

- Likelihood: *high*
- Implication: *high*
- Risk: *high*
- Reference: OWASP OTG-SESS-003

The session id is saved in form of the (static) user id in a cookie. This cookie can be used on any machine to take over the account of a user. The lifetime of this cookie is only limited by the cookie lifetime field.

2.2.2 Stored XSS in Registration

- Likelihood: *medium*
- Implication: *high*
- Risk: *high*
- Reference: OWASP OTG-INPVAL-002

Using stored cross-site-scripting attacks, one can inject JavaScript code, that is run, when the Administrator/Employee logs in. Arbitrary code can be loaded from a third party page.

2.2.3 Brute Force Password

- Likelihood: *high*
- Implication: *medium*
- Risk: *medium*
- Reference: OWASP OTG-AUTHN-003

The application has no lock out mechanism, which allows brute force attacks on known usernames and testing for a valid password

2.3 Vulnerability Overview

3 Tools used

3.1 sqlmap

3.2 RIPS

3.3 FindBugs

4 Detailed Report

The following pages describe for each test how both applications Team2 and Online Banking Bank performed. The test is divided in different sections following the OWASP Testing Guide v4.

4.1 Configuration and Deploy Management Testing

4.1.1 Test File Extensions Handling for Sensitive Information (OTG-CONFIG-003)

Team2

Likelihood: 8
Impact: 9
Risk: 3

Team2	
Observation	File extensions are handled correctly but while testing we found folders which we could access.
Discovery	TODO
Likelihood	The likelihood is quite high that someone tries a tool to find these kind of vulnerabilities. There is no need for special knowledge because the tools work quite automatically without much configuration.
Impact	There is no impact the folders do not contain sensitive information.
Recommendations	Block the access to files and to those folders, or remove them from the directory since they are not needed there.

Metric	Value : 9.8
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	H

Team3

Likelihood: 8
Impact: 0
Risk: 1

Team2	
Observation	File extensions are handled correctly but while testing we found folders which we could access smart-card simulator folder.
Discovery	TODO
Likelihood	The likelihood is quite high that someone tries a tool to find these kind of vulnerabilities. There is no need for special knowledge because the tools work quite automatically without much configuration.
Impact	There is no impact since there is nothing important hard-coded in the jave file.
Recommendations	Block the access to files and to those folders.

Metric	Value : 0
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	N
Integrity Impact	N
Availability Impact	N

4.1.2 Test HTTP Methods (OTG-CONFIG-006)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The application is not accessable over HTTP. HTTPS is enforced.
Discovery	We also tried to connect via *netcat* using the following command: *nc IP_ADDRESS 80* , which did not work. We also used *nmap* for testing which returned the methods used by the webapp.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same applies for our web application.

```
samurai@samurai-wtf:~$ nmap -p 80 127.0.0.1 --script http-methods

Starting Nmap 6.25 ( http://nmap.org ) at 2016-01-01 11:04 CET
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000036s latency).
PORT   STATE SERVICE
80/tcp open  http
|_http-methods: GET HEAD POST OPTIONS

Nmap done: 1 IP address (1 host up) scanned in 0.33 seconds
```

Figure 4.1: RIPS

4.1.3 Test HTTP Strict Transport Security (OTG-CONFIG-007)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The webapp is not using Strict Transport Security.
Discovery	We found this using *Curl*.
Likelihood	It is not complicated to perform a MitM attack to exploit this vulnerability.
Impact	A man-in-the-middle attacker attempts to intercept traffic from a victim user using an invalid certificate and hopes the user will accept the bad certificate.
Recommendations	Enable Strict Transport Security.
Comparison	Our webapp has Strict Transport Security enabled.

```
samurai@samurai-wtf:~$ curl -s -D- 127.0.0.1
HTTP/1.1 200 OK
Date: Fri, 01 Jan 2016 10:06:28 GMT
Server: Apache/2.2.22 (Ubuntu)
Last-Modified: Tue, 26 Jun 2012 09:23:08 GMT
ETag: "a1940-4f-4c35ca5889f57"
Accept-Ranges: bytes
Content-Length: 79
Vary: Accept-Encoding
Content-Type: text/html
```

Figure 4.2: RIPS

4.1.4 Test RIA cross domain policy (OTG-CONFIG-008)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	There are no RIA applications on the system and therefore is no crossdomain.xml file provided.
Discovery	Using *wget* we tried to find a *crossdomain.xml* or *clientaccesspolicy.xml* file and couldn't find it.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same results applies for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.2 Identity Management Testing

4.2.1 Test Role Definitions (OTG-IDENT-001)

Team2

Likelihood: 10
Impact: 0
Risk: 0

Team2	
Observation	We found out that there exist two different roles in the system. There is the role of a normal customer and the role of an banker. Employees have the additional functionality to view account and transaction details of all the customers. Transactions over 10000 euro and new user registrations can be accepted by the employee.
Discovery	No special tools except a browser were needed because all the roles and their available functions can be seen on the webapp. All the roles have the functinalities they are supposed to have.
Likelihood	It is very likely that people find this information.
Impact	There is no direct implication.
Recommendations	N/A
Comparison	Our web application provides the same roles, but the roles are not described on the web page.

4.2.2 Test User Registration Process (OTG-IDENT-002)

Team2

Likelihood: 5
Impact: 5
Risk: 5

	Team2
Observation	Any person can register themselves as an user and this registration than gets validated by an employee. One person can register multiple times and with different roles. There is no proof of the identity of a user possible. The identification requirements include the email address and username, but only two of these can be verified.
Discovery	No special tools are needed to get this information. A browser and multiple registration tests provided the necessary results.
Likelihood	It is quite likely that this information can be retrieved by any user with minimal experience.
Implication	User could try to register multiple times and with wrong information to get access to user accounts with more permissions or to create multiple bank accounts.
Recommendations	The information passed in the registration form should be validated. The name can be validated by hand if a customer would go to the bank and the employee would than accept his registration.
Comparison	Our web application doesn't require a phone number for the registration an the role of the user can be selected in the registration form. It doesn't make our application less secure, because the registration has still to be accepted by an employee.

Metric	Value
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	N
Integrity Impact	N
Availability Impact	N

4.2.3 Test Account Provisioning Process (OTG-IDENT-003)

Team2

Likelihood: N/A
Impact: N/A
Risk: N/A

Team2	
Observation	Our observation showed us that employees can accept customer registrations.
Discovery	All the observations were made with the *Chrome* web browser.
Impact	If an employee account gets hacked you can accept new registrations.
Recommendations	N/A
Comparison	In our web application the employee accepts new registration. It makes no difference in the security.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.2.4 Testing for Account Enumeration and Guessable User Account (OTG-IDENT-004)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We found out that the web application makes no difference between existing usernames and non existing usernames when trying to login with wrong credentials. The same html response and the same response headers are provided by the system.
Discovery	We used the *Charles Web Proxy* to analyze the web application responses.
Implication	N/A
Recommendations	N/A
Comparison	Our web application makes no difference between login tries with existing usernames and non existing ones. Both web applications aren't vulnerable here.

4.2.5 Testing for Weak or unenforced username policy (OTG-IDENT-005)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The usernames should be more than 2 characters.
Discovery	No tool is used here. Trying to sign up with short usernames gave us the warning.
Impact	N/A
Recommendations	N/A
Comparison	Our application has no username restriction.

4.3 Authentication Testing

4.3.1 Testing for Credentials Transported over an Encrypted Channel(OTG-AUTHN-001)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The webapp uses HTTPS protocol, so all the information is sent encrypted through the channel therefore we cannot sniff the data.
Discovery	The website s using an SSL certificate
Likelihood	NA
Impact	NA
Recommendations	
Comparison	Our webapp is using HTTPS, so the data is transported over an encrypted channel.

4.3.2 Testing for default credentials(OTG-AUTHN-002)

Team2

Likelihood: 10
Impact: 4
Risk: 6

Team2	
Observation	There are no default credentials for the webapp.
Discovery	We saw the credentials text file that was given by the other team.
Likelihood	N/A
Impact	N/A
Recommendations	N/A
Comparison	The same goes for our webapp.

4.3.3 Testing for bypassing authentication schema (OTG-AUTHN-004)

Team2

Likelihood: NA
Impact: NA
Risk: NA

	Team2
Observation	We did not find any possibility to bypass the authentication schema.
Discovery	N/A
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	Neither we found a possibility in our web app

Metric	Value
Access Vector	NA
Attack Complexity	NA
Privileges Required	NA
User Interaction	NA
Scope	NA
Confidentiality Impact	NA
Integrity Impact	NA
Availability Impact	NA

4.3.4 Testing for Browser cache weakness (OTG-AUTHN-006)

Team2

Likelihood: 0
Impact: NA
Risk: NA

Team2	
Observation	The web app set the cache-control to no-cache an no-store and Pragma to no-cache
Discovery	By checking the *about:cache* in Firefox we saw the Headers
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same goes for our webapp

Metric	Value
Access Vector	NA
Attack Complexity	NA
Privileges Required	NA
User Interaction	NA
Scope	NA
Confidentiality Impact	NA
Integrity Impact	NA
Availability Impact	NA

4.3.5 Testing for Weak password policy (OTG-AUTHN-007)

Team2

Likelihood: 6
Impact: 5
Risk: 5

Team2	
Observation	The registration process does not have a restriction for weak passwords. Furthermore the password can contain the username
Discovery	Tested manually the registration process with a one character password and the username as password
Likelihood	For every registration process the user has the possibility to choose a weak password
Implication	Brute Force is to easy for simple passwords
Recommendations	Introduce password restrictions
Comparison	The same problem we encountered in our webapp

Metric	Value
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	L
Integrity Impact	L
Availability Impact	N

4.3.6 Testing for weak password change or reset functionalities (OTG-AUTHN-009)

Team2

Likelihood: 10
Impact: 8
Risk: 5

Team2	
Observation	The password reset functionality can cause unwanted password change or the user to loose access to their account. Since the functionality changes the current password to a random one and sends an email to the user with the new password.
Discovery	Tested manually to reset the password. An error occurred and the email was not send but the password was changed.
Likelihood	It is very high that someone can enter an email address of another user and cause change their password without the users request.
Impact	The impact can be quite high especially in case when the email with the new password fails to send, the user can loose access to his account.
Recommendations	Instead of setting a new random password, sending an email with a link where the user can set a new password himself will be the best solution.
Comparison	Our webapp sends an email with link to change the password. The random number generated for the link is long, so trying to brute force it will take a very long time.

Metric	Value : 7.5
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	N
Integrity Impact	N
Availability Impact	H

4.4 Authorization Testing

4.4.1 Testing Directory traversal/file include (OTG-AUTHZ-001)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We could not find any path traversals .
Discovery	We used the *dotdotpwn* tool to find such traversals with the following command: `sudo ./dotdotpwn.pl -O -m http -h IP_ADDRESS` -O is to get the operating system; -m is to indicate that the protocol is http and -h for the server ip; which gave no results. Afterwards we tried *w3af* and it did not find anything.
Likelihood	This is more an additional information for other attacks but it is a good help for attackers to find vulnerabilities faster
Impact	N/A
Recommendations	N/A
Comparison	The results were the same for our webapp.

4.4.2 Testing for Bypassing Session Management Schema(OTG-SESS-001)

4.4.3 Testing for Privilege Escalation (OTG-AUTHZ-003)

Team2

Likelihood: 0
Impact: 0
Risk: 0

	Team2
Observation	It is not possible to escalate privileges of the user.
Discovery	We tried to change the user privilege by changing the user id after we saw that they are generated by incrementing from the first user ID, using *Burp*.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same results apply for our web application.

4.4.4 Testing for Insecure Direct Object References (OTG-AUTHZ-004)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	It is not possible to retrieve objects belonging to other users or otherwise bypass authorization.
Discovery	We tried to change the user privilege by changing the user id after we saw that they are generated by incrementing from the first user ID, using *Burp*.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same results apply for our web application.

4.5 Session Management Testing

4.5.1 Testing for Bypassing Session Management Schema(OTG-SESS-001)

Team2

Likelihood: 10
Impact: 7
Risk: 7

Team2	
Observation	There is no Random Session Token generated, nor any Session Time-out functionality. Also there is no cookie configuration.
Discovery	We observed the php code which we were given.
Likelihood	It is very likely that an attacker notices this, since the SessionID does not change.
Impact	This can cause a Session Hijack.
Recommendations	Generate random SessionIDs and create a Session Time-out functionality.
Comparison	Our web app generates random SessionIDs creates a session time-out, also set the cookie parameters.

Metric	Value : 6.7
Access Vector	L
Attack Complexity	H
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	N

4.5.2 Testing for Cookies attributes(OTG-SESS-002)

Team2

Likelihood: 10
Impact: 6
Risk: 3

Team2	
Observation	The cookie for the PHP session id has a to general path ("//"). So the application is vulnerable to other web application on the same server. They will also get the cookie from the user. The HttpOnly is not set also there is no expiration time for the cookie.
Discovery	We used the Firefox Web developer toolbar to analyze the cookie attributes.
Likelihood	It is vary easy and straight forward to use this tool so it is highly likely for someone to find that out.
Impact	The cookies can be read and used by other web applications that match the path value.
Recommendations	Set the path as tight as possible.
Comparison	Our web app has the all the cookie parameters set, and the timeout of the cookie is set to 10 minutes.

Metric	Value : 6.1
Access Vector	L
Attack Complexity	L
Privileges Required	N
User Interaction	R
Scope	U
Confidentiality Impact	H
Integrity Impact	L
Availability Impact	N

4.5.3 Testing for Session Fixation(OTG-SESS-003)

Team2

Likelihood: 9
Impact: 5
Risk: 5

Team2	
Observation	The session id is not invalidated and therefore does not change after the user is authenticated. This means an attacker can force a known session id on a user. Once the user is authenticated the attacker can access also as authenticated user
Discovery	We used *ZAP* proxy to intercept the traffic.
Likelihood	This attack is pretty easy and can also be performed by low skilled people
Implication	The attacker can do everything the user can
Recommendations	Change the session id after logging in
Comparison	Our web app generates a new random SessionID after the user logs in.

Metric	Value : 8.1
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	R
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	N

4.5.4 Testing for Exposed Session Variables (OTG-SESS-004)

Team2

Likelihood: 10
Impact: 6
Risk: 6

Team2	
Observation	The application from Team 2 use SSL certificate and therefore the session variables are not accessible during transport. But the Session variable is not destroyed after the user logs out.
Discovery	We used the *Firefox web developer tools* to analyze the cookies. Also the *Firebug* tool and we got the same outcome.
Likelihood	This attack is pretty easy and can also be performed by low skilled people
Impact	The attacker can read the session variables and depending on the information in them
Recommendations	Remove the cookie after logout.
Comparison	Our application destroys the session after the user logs out.

Metric	Value : 5.9
Access Vector	P
Attack Complexity	L
Privileges Required	N
User Interaction	R
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	N

4.5.5 Testing for logout functionality(OTG-SESS-006)

Team2

Likelihood: 4
Impact: 6
Risk: 5

Team2	
Observation	The logout functionallity has been tested an works without any problems. The user gets correctly logged out and pages where authentication is needed can't be accessed afterwards. Also reusing the session id does not work. But the application seems to have no automatic logout after a certain amount of time.
Discovery	We tested the functionallity manually and used the Chrome extension "Advanced Rest Client" to reuse the session cookie
Likelihood	The only problem is that user sometimes only close the browser tab and than the session continues to exist.
Impact	An attacker would be logged in if he can access afterwards the computer. Possible scenario Internet cafe or something similar
Recommendations	implement an automatic server side logout
Comparison	Our webapp has the same problem that it does not log out after the web browser is closed, but it does log out after 10 minutes of inactivity.

Metric	Value : 4.6
Access Vector	P
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	N
Integrity Impact	H
Availability Impact	N

4.5.6 Test Session Timeout(OTG-SESS-007)

Team2

Likelihood: 4
Impact: 6
Risk: 7

Team2	
Observation	The application has the timeout of the session set to the browsers session lifetime.
Discovery	We tested the functionallity manually and used the Chrome developertools to check the cookies.
Likelihood	The same as for OTG-SESS-006. Public computers are here the biggest problem
Impact	An attacker is directly authenticated if the session is not ended
Recommendations	Implement a server side session invalidation and delete the stored data on the client
Comparison	Our webapp has a session timeout of 10 minutes, which invalidates the session after 10 minutes of inactivity.

Metric	Value : 4.6
Access Vector	P
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	N
Integrity Impact	H
Availability Impact	N

4.5.7 Testing for Session puzzling(OTG-SESS-008)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The application has only one authorization method so a session puzzling is not applicable.
Discovery	Manually searched
Likelihood	NA
Implication	NA
Recommendations	NA
Comparison	We provide also only one possibility to login so session puzzling is not possible

4.6 Data Validation Testing

4.6.1 Testing for Reflected Cross Site Scripting(OTG-INPVAL-001)

Team2	Likelihood: 8 Impact: 5 Risk:5

Team2	
Observation	We observed no reflected cross site scripting vulnerability.
Discovery	It seems that all parameters are stored in the database before inserting the values in the HTML.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	The same results apply for our web application.

4.6.2 Testing for Stored Cross Site Scripting(OTG-INPVAL-002)

Team2	Likelihood: 8 Impact: 5 Risk:5

Team2	
Observation	We cannot insert javascript code in the webapp.
Discovery	We tried to insert the following javascript code in the username of the sign up page but there is a restriction in the length of the username to 23 characters therefore it failed. `<script>alert("1");</script>`
Likelihood	N/A
Impact	N/A
Recommendations	N/A
Comparison	Our web app does not allow XSS but because we sanitize the input of the user.

4.6.3 Testing for HTTP Verb Tampering(OTG-INPVAL-003)

Team2

Likelihood: 0
Impact: 0
Risk: 0

	Team2
Observation	We did not observe any notable behavior.
Discovery	We used a script to automatically test the HTTP methods. Methods that were allowed • OPTIONS • GET • POST Methods that were rejected • TRACE • PUT • PROPFIND
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	Both webapps have the same allowed methods.

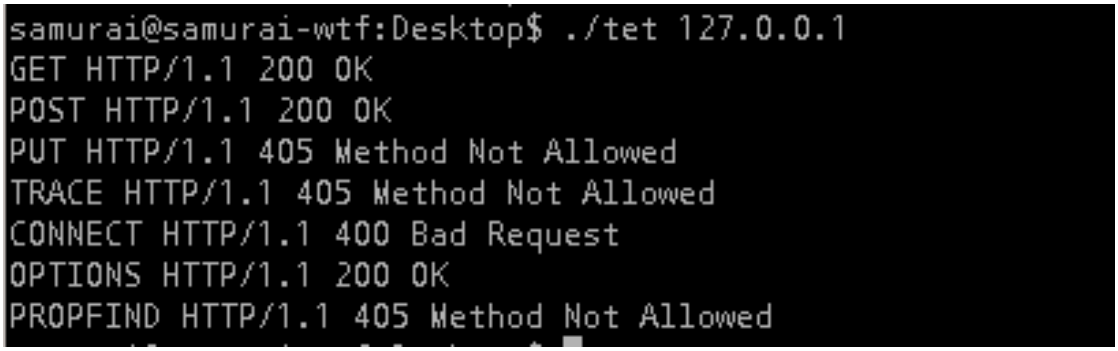

Figure 4.3: Results

```
#!/bin/bash

for webservmethod in GET POST PUT TRACE CONNECT OPTIONS PROPFIND;

do
printf "$webservmethod " ;
printf "$webservmethod / HTTP/1.1\nHost: $1\n\n" | nc -q 1 $1 80 | grep "HTTP/1.1"

done
```

Figure 4.4: Script used for testing

4.6.4 Testing for SQL Injection (OTG-INPVAL-005) and Mysql testing (OTG-INPVAL-005)

Team2

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We observed that no SQL Injection was possible. Since we knew that the other team had to use Mysql we tested also specifically for Mysql
Discovery	We tried inserting various SQL statements in the fields of using *sqlmap* tool and failed, also we did static test of the PHP code using *RIPS* which did not find any.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	Our web application is also immune to SQL Injections

Using *RIPS* with verbosity level 1 and vulnerability all server-side we get the above results. The 3 cases of *SQL Injection* are *false-positives*. The input in the query is already set and is not affected by the user input.

The case of file manipulation is *false-positive* since the variables passed as parameters here have nothing to do with user input.

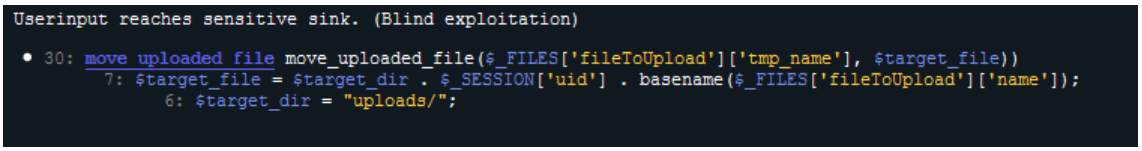

Figure 4.7: RIPS

Also using the following *sqlmap* command we did not find any SQL Injection possible.

```
sqlmap -u https://localhost/ex1/securecoding/
```

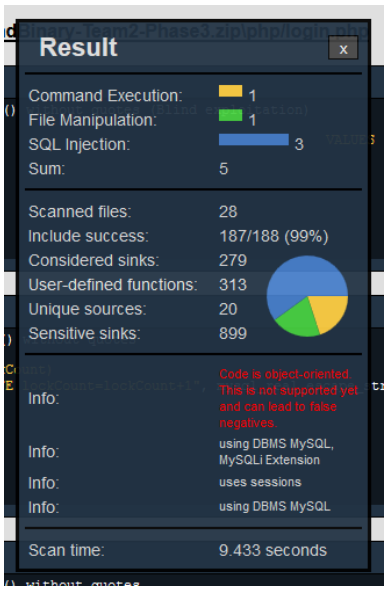

Figure 4.5: RIPS

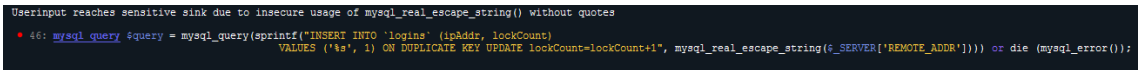

Figure 4.6: RIPS

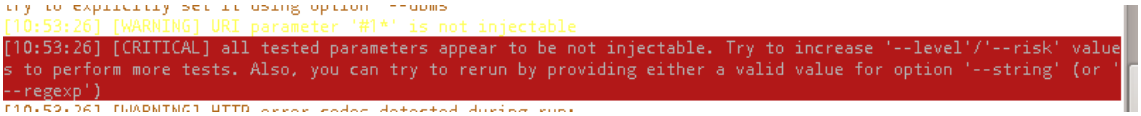

Figure 4.8: RIPS

Team3

Using *RIPS* with verbosity level 1 and vulnerability all server-side we get the above results.

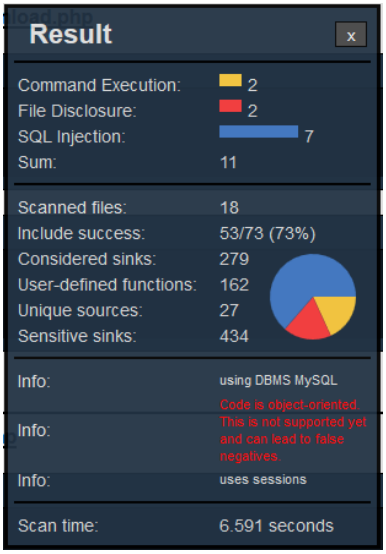

Figure 4.9: RIPS

For the *SQL Injection* cases the input data is sanitized before being executed into the queries. So the warnings given by *RIPS* are *false-positive*.

Also using the following *sqlmap* command we did not find any SQL Injection possible.

```
sqlmap -u https://localhost/SecureCoding-Group3/online_banking/
```

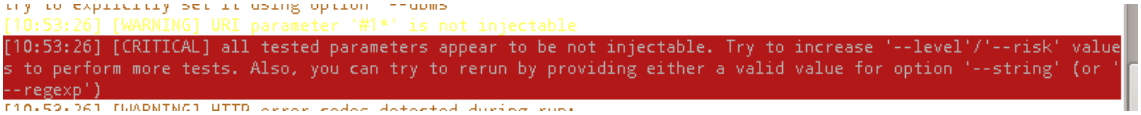

Figure 4.10: RIPS

4.6.5 Testing for Code Injection, Testing for Local File Inclusion, Testing for Remote File Inclusion(OTG-INPVAL-012)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We did not find any vulnerability regarding code injection and local or remote file inclusion in our web app. Team 2 did not implemented that feature
Discovery	Tried to perform a command execution via the backticks (‘) and also the semicolon (;) in the filename but our webapp correctly handled the files without injections
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	NA

4.6.6 Testing for Command Injection(OTG-INPVAL-013)

Team2

The case of command execution is yet again a *false-positive* since the variable entered into the *exec* function is a file. If the file contains malicious user input is another problem, and we have to do the check for that elsewhere.

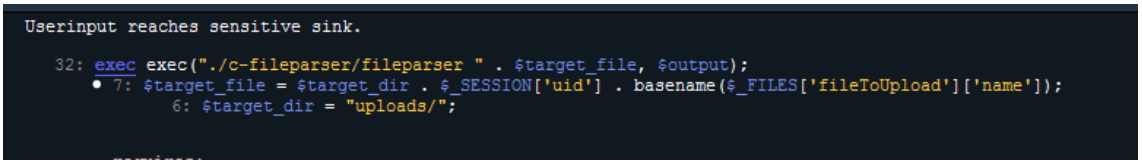

Figure 4.11: RIPS

Team3

RIPS finds two vulnerabilities for file disclosure and command execution in *application-Download.php*, which are *false-positive* since the variable is taken from the database, the user does not input it directly.

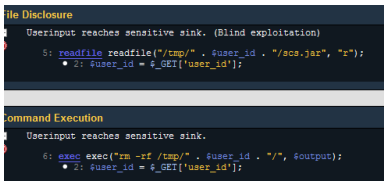

Figure 4.12: RIPS

RIPS finds two vulnerabilities for file disclosure and command execution in *customer.inc.php*, the same case applies here, they are *false-positive* the variables passed on the sensitive functions are not user input.

Figure 4.13: RIPS

4.6.7 Testing for Buffer overflow, Testing for Heap overflow, Testing for Stack overflow, Testing for Format string (OTG-INPVAL-014)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We did not find any vulnerability regarding buffer overflow, heap overflow, stack overflow or string formatting
Discovery	We used w3af to locate such vilnerabilities.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	Our web application is also immune to buffer overflow, heap overflow, stack overflow and string formatting

4.6.8 Testing for incubated vulnerabilities(OTG-INPVAL-015)

Team2

Likelihood: 7
Impact: 7
Risk: 5

Team2	
Observation	A part of the XSS injection counts also to this vulnerability thats possible on the web app of team 21. Code like the example on the owasp page for OTG-INPVAL-015 could exploit the web app
Discovery	We knew that stored XSS is possible so also this attack works and someone could hijack an admins account simply by creating an user
Likelihood	The attack is pretty easy and the employee only has to view the accounts page and if the attacker is a bit skilled the employee does not even discover that something was wrong
Implication	The attacker can hijack the session and do all the other things possible with XSS
Recommendations	Validate and escape the user input
Comparison	Our web application has the same vulnerability but there it is a lot more restricted. Only really short injection code can be used so the possibilities are limited.

4.7 Error Handling

Team21

Team21 does not provide a lot of error messages for incorrect inputs (e.g. incorrect TAN length, wrong TAN, TAN used).
Based on the client side input validation, there are also no messages for manipulated input via proxy or by removing the validation patterns, which can lead to problems. Examples would be a malformated email which results in a not working account or a longer input then expected, which cuts off the end of the input. There are some cases when the page returns the path of the file where the error occurred.

4.8 Business Logic Testing

4.8.1 Test Business Logic Data Validation(OTG-BUSLOGIC-001)

Team2	Likelihood: 0 Impact: 0 Risk:0

Team2	
Observation	Tests show that data validation is both: client side and server side.
Discovery	We intercepted the input before it gets send to the server using *Burp* and manipulated the data, and we received an error message.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	We got the same result with our application.

4.8.2 Test Number of Times a Function Can be Used Limits(OTG-BUSLOGIC-005)

Team2	Likelihood: 0 Impact: 0 Risk:0

Team2	
Observation	We tried inserting the same tan multiple times.
Discovery	The web application did not accept requests with a TAN that was already used.
Likelihood	N/A
Implication	N/A
Recommendations	N/A
Comparison	We got the same result with our application.

4.9 Client Side Testing

4.9.1 Testing for DOM based Cross Site Scripting (OTG-CLIENT-001)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	Observing the HTML source code showed us that they don't use javascript and therefore there can't be any DOM XSS vulnerabilities.
Discovery	We used *Chrome* and its developer tools to take a look at the HTML source code.
Likelihood	N/A
Implication	N/A
Comparison	Our web application uses javascript in many different cases, but we couldn't find any DOM XSS vulnerabilities.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.2 Testing for JavaScript Execution (OTG-CLIENT-002)

Team2

Likelihood: 9
Impact: 10
Risk: 9

Team2	
Observation	We found several XSS vulnerabilities allowing the execution of arbitrary javascript code in the clients browser.
Discovery	We used the tools *w3af* and *ZED Attack Proxy* to find some XSS vulnerabilities and found enough of them.
Likelihood	It is very likely that these vulnerabilities are found and you don't need much experience to use them.
Implication	The vulnerabilities found can be used to hijack the session of an user, accept user registrations or even making user accounts to employee accounts.
Comparison	Our app is also vulnerable against XSS attacks but the difficulty is higher as in their web application. More experienced people are necessary to exploit them.

Metric	Value
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	L

4.9.3 Testing for HTML Injection (OTG-CLIENT-003)

Team2

Likelihood: 8
Impact: 7
Risk: 7

	Team2
Observation	The HTML injection vulnerability exists
Discovery	The vulnerability was found by the tools *w3af* and *ZED Attack Proxy*.
Likelihood	It is quite likely that this vulnerability is found and can be used very easily.
Implication	vulnerability can have many consequences, like disclosure of a user's session cookies that could be used to impersonate the victim, or, more generally, it can allow the attacker to modify the page content seen by the victims.
Comparison	Our web application is vulnerable as well, but javascript validations and text length restrictions of the input fields make it more difficult to exploit these vulnerabilities.

Metric	Value
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	N
Scope	U
Confidentiality Impact	L
Integrity Impact	L
Availability Impact	L

4.9.4 Testing for Client Side URL Redirect (OTG-CLIENT-004)

Team2

Likelihood: 0
Impact: 0
Risk: 0

	Team2
Observation	We couldn't find any client side redirections in the html source code of the web application and therefore exists no client side url redirect vulnerability.
Discovery	We used *Chrome* and its web inspector to look at the html code.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.5 Testing for CSS Injection (OTG-CLIENT-005)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	Our search didn't find any spots in the html source code where there is user generated input used to change some css attributes.
Discovery	*Chrome* and its web inspector were used to read the html code.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.6 Testing for Client Side Resource Manipulation (OTG-CLIENT-006)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We couldn't find any vulnerability here, but we could only check if such a vulnerability exists in the javascript code and not in the php code, because we had no access to the php source code.
Discovery	We used *Chrome* and its developer tools to inspect the html/-javascript code.
Likelihood	N/A
Implication	N/A
Comparison	Our web application uses javascript more often, but user controlled input which specifies the path of a resource was not found.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.7 Test Cross Origin Resource Sharing (OTG-CLIENT-007)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The inspected web application doesn't make use of XMLHttpRequests and therefor no cross origin resource sharing vulnerabilities exist.
Discovery	We used *Chrome* and its developer tools to inspect the html/-javascript code and *Charles Web Proxy* to make sure that no request is executed.
Likelihood	N/A
Implication	N/A
Comparison	Our web application uses XMLHttpRequests but sends the requests to the same origin and therefor there exist no cross origin resource sharing vulnerabilities.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.8 Testing for Cross Site Flashing (OTG-CLIENT-008)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	*ActionScript* and *Flash* are never used in this web application.
Discovery	We tried to use the web application on a pc with no *Adobe Flash* installed and got no request to install it. Additionally the html code was inspected with *Chrome* and no reference to *Adobe Flash* was found.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.9 Testing for Clickjacking (OTG-CLIENT-009)

Team2

Likelihood: 8
Impact: 9
Risk: 8

	Team2
Observation	We found a vulnerability in the web application that allows attackers to make clickjacking attacks by bundling the website inside an iframe to give the user the feeling of interacting with the target website but being instead on a malicious web page.
Discovery	The tool *w3af* found out that the web application does not make use of protection techniques to prevent click jacking attacks. The use of *X-Frame-Options* header would help on the server side to prevent against this type of attacks, but is never used by this web application.
Likelihood	It is quite likely that someone would use this kind of exploits on an online banking website, because the people trust these websites. It is not very difficult to use this vulnerability to attack the users.
Implication	The user would think he would interact with the secure online banking system, but in reality he is on a malicious website that can record his interaction and filter out sensitive information.
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N
Attack Complexity	L
Privileges Required	N
User Interaction	R
Scope	U
Confidentiality Impact	H
Integrity Impact	H
Availability Impact	N

4.9.10 Testing WebSockets (OTG-CLIENT-010)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	We inspected the html/javascript source code to find an use of WebSockets but could't find any of them. That means also, that there are no WebSockets vulnerabilities applicable.
Discovery	*Chrome* and its developer tools can show the source code of the web page and can show you if WebSockets are used to communicate with other resources.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.11 Test Web Messaging (OTG-CLIENT-011)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The web application makes doesn't use the Web Messaging technology (aka Cross Document Messaging) and therefor we couldn't find any vulnerability.
Discovery	We used *Charles Web Proxy* and *Chrome* and its developer tools to see if any other requests are executed from the web application.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A

4.9.12 Test Local Storage (OTG-CLIENT-012)

Team2

Likelihood: 0
Impact: 0
Risk: 0

Team2	
Observation	The web application make no use of the local storage functionality of the browsers.
Discovery	We tested the web application with a browser and tested all the functionality and *Chromes* web inspector didn't show any use of the local storage functionality of the browser.
Likelihood	N/A
Implication	N/A
Comparison	The same results apply for our web application.

Metric	Value
Access Vector	N/A
Attack Complexity	N/A
Privileges Required	N/A
User Interaction	N/A
Scope	N/A
Confidentiality Impact	N/A
Integrity Impact	N/A
Availability Impact	N/A