Workshop:
Advanced Java Application Code Review

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44CON

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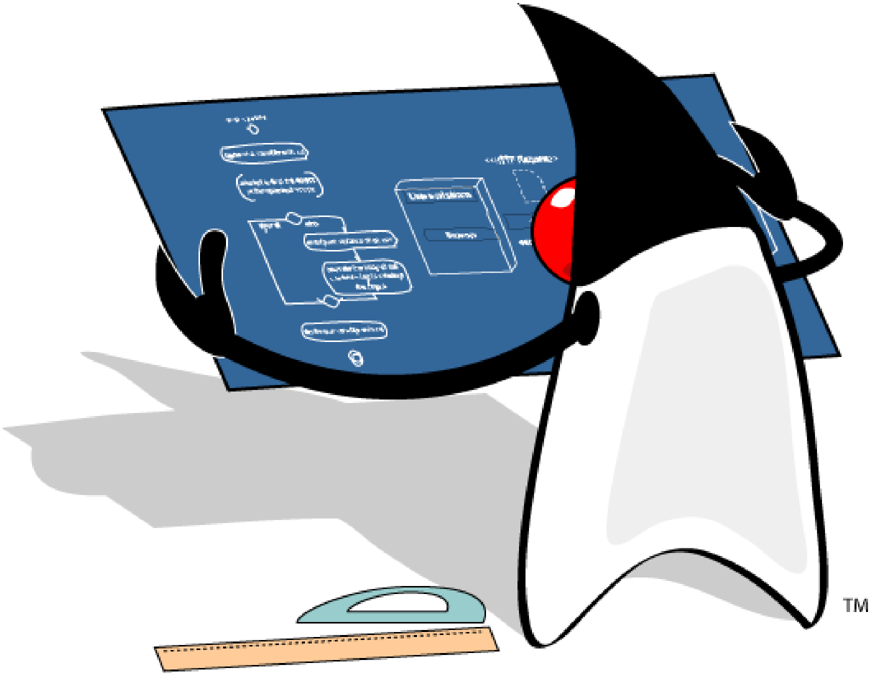
What is this training about?

- Agenda (2 hours training)
  - Introduction to SonarQube
  - **Code review** exercices divided in 4 modules
  - Some **exploitation**..

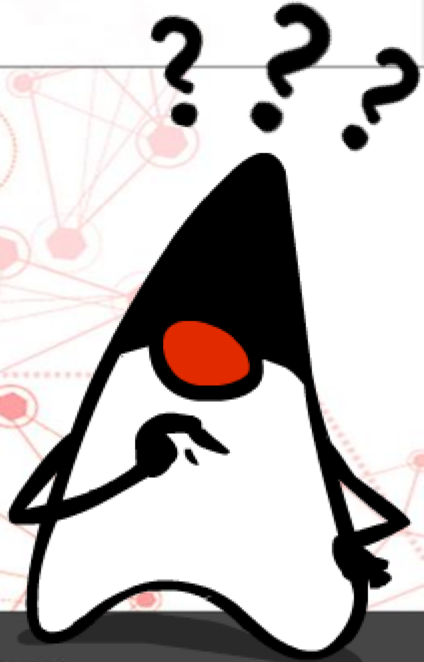


Agenda

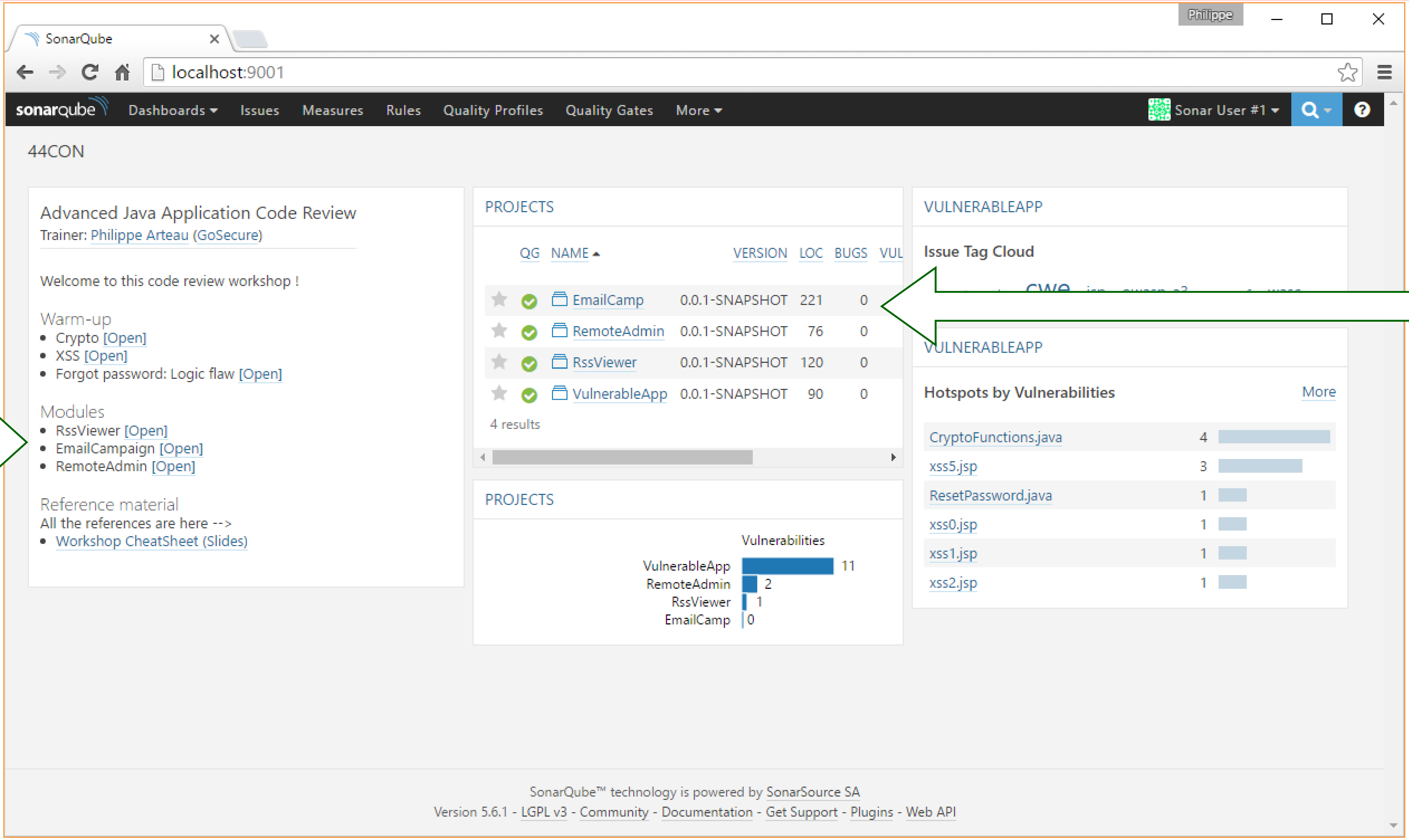
- Warm up (Path traversal, Cryptography, XSS)
- Xml eXternal Entity (XXE)
- Template injection
- Deserialisation vulnerabilities
- Expression Language (EL) injection
- Hibernate Query Language injection

Module 1

Warm up



SonarQube interface



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Advanced Java Application Code Review

Trainer: Philippe Arteau (GoSecure)

Welcome to this code review workshop !

Warm-up

- Crypto [Open]
- XSS [Open]
- Forgot password: Logic flaw [Open]

Modules

- RssViewer [Open]
- EmailCampaign [Open]
- RemoteAdmin [Open]

Reference material

All the references are here -->

- Workshop CheatSheet (Slides)

PROJECTS

	QG	NAME ▴	VERSION	LOC	BUGS	VUL
★	✓	EmailCamp	0.0.1-SNAPSHOT	221	0	
★	✓	RemoteAdmin	0.0.1-SNAPSHOT	76	0	
★	✓	RssViewer	0.0.1-SNAPSHOT	120	0	
★	✓	VulnerableApp	0.0.1-SNAPSHOT	90	0	

4 results

PROJECTS

Vulnerabilities

	Vulnerabilities
VulnerableApp	11
RemoteAdmin	2
RssViewer	1
EmailCamp	0

VULNERABLEAPP

Issue Tag Cloud

cwe jsp owasp-a3 wasc

VULNERABLEAPP

Hotspots by Vulnerabilities — More

CryptoFunctions.java	4
xss5.jsp	3
ResetPassword.java	1
xss0.jsp	1
xss1.jsp	1
xss2.jsp	1

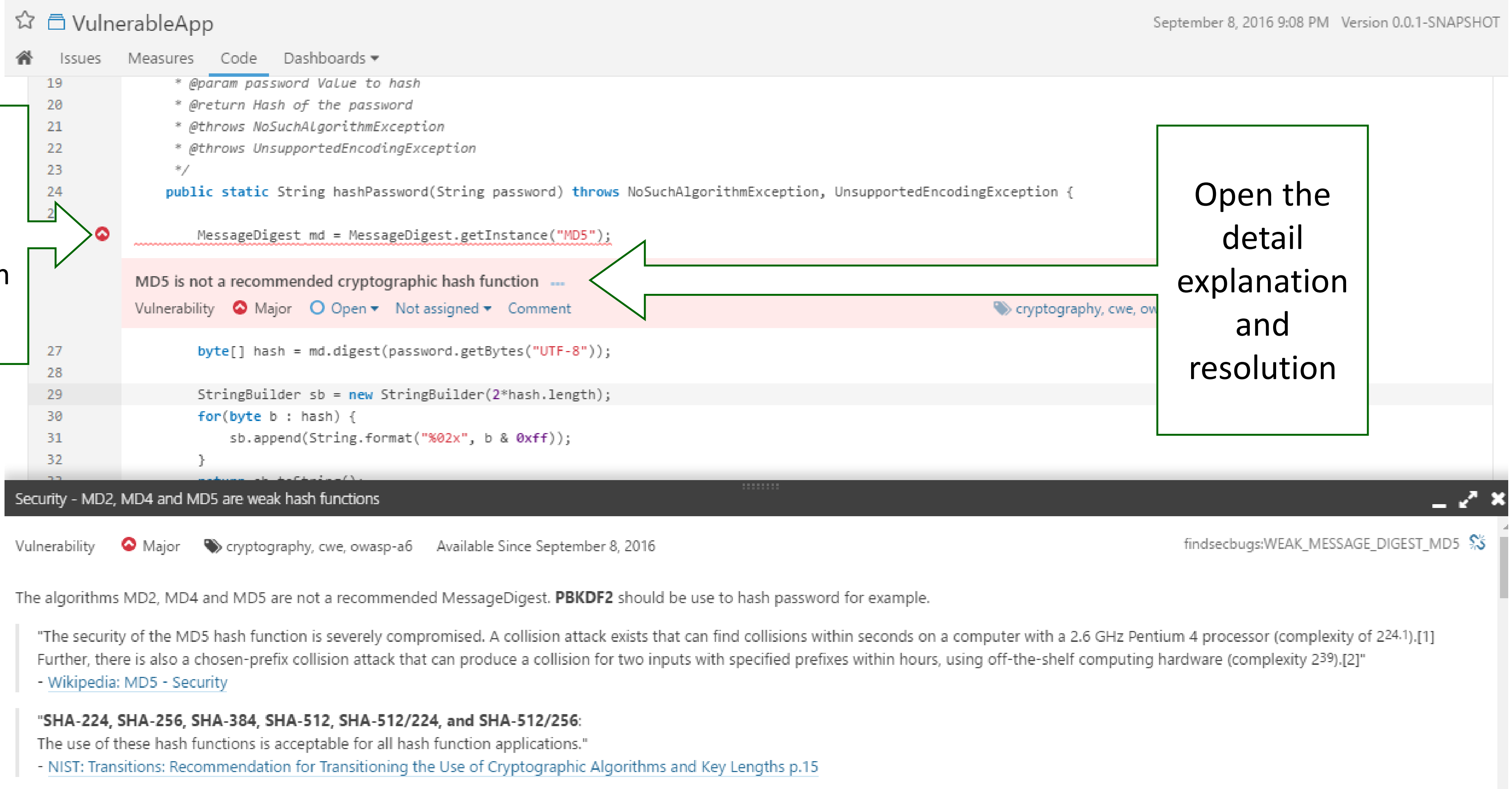
SonarQube™ technology is powered by SonarSource SA

Version 5.6.1 - LGPL v3 - Community - Documentation - Get Support - Plugins - Web API

Quick links

Applications analyzed

SonarQube interface



```
     * @param password Value to hash
     * @return Hash of the password
     * @throws NoSuchAlgorithmException
     * @throws UnsupportedEncodingException
     */
    public static String hashPassword(String password) throws NoSuchAlgorithmException, UnsupportedEncodingException {

        MessageDigest md = MessageDigest.getInstance("MD5");
```

MD5 is not a recommended cryptographic hash function

Vulnerability · Major · Open ▾ · Not assigned ▾ · Comment · cryptography, cwe, ow

```
        byte[] hash = md.digest(password.getBytes("UTF-8"));

        StringBuilder sb = new StringBuilder(2*hash.length);
        for(byte b : hash) {
            sb.append(String.format("%02x", b & 0xff));
        }
        return sb.toString();
```

Security - MD2, MD4 and MD5 are weak hash functions

Vulnerability · Major · cryptography, cwe, owasp-a6 · Available Since September 8, 2016 · findsecbugs:WEAK_MESSAGE_DIGEST_MD5

The algorithms MD2, MD4 and MD5 are not a recommended MessageDigest. **PBKDF2** should be use to hash password for example.

> "The security of the MD5 hash function is severely compromised. A collision attack exists that can find collisions within seconds on a computer with a 2.6 GHz Pentium 4 processor (complexity of $2^{24.1}$).[1] Further, there is also a chosen-prefix collision attack that can produce a collision for two inputs with specified prefixes within hours, using off-the-shelf computing hardware (complexity 2^{39}).[2]"
> - Wikipedia: MD5 - Security

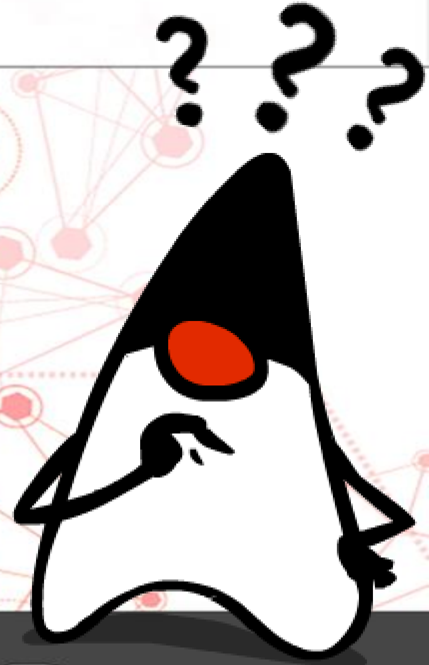
> "**SHA-224, SHA-256, SHA-384, SHA-512, SHA-512/224, and SHA-512/256**:
> The use of these hash functions is acceptable for all hash function applications."
> - NIST: Transitions: Recommendation for Transitioning the Use of Cryptographic Algorithms and Key Lengths p.15

Open the short description

Open the detail explanation and resolution

Module 2

Xml eXternal Entity (XXE)



Xml eXternal Entity (XXE)

Exemple of simple payload and out-of-bound:

- http://blog.h3xstream.com/2014/06/identifying-xml-external-entity.html

Example with jar: procotol trick

- http://www.agarri.fr/kom/archives/2013/11/27/compromising_an_unreachable_solr_server_with_cve-2013-6397/index.html

XML Schema, DTD, and Entity Attacks

- http://vsecurity.com/download/papers/XMLDTDEntityAttacks.pdf

More examples

- http://web-in-security.blogspot.com/2016/03/xxe-cheat-sheet.html

Module 3

Template injection

Template Injection

Server-Side Template Injection

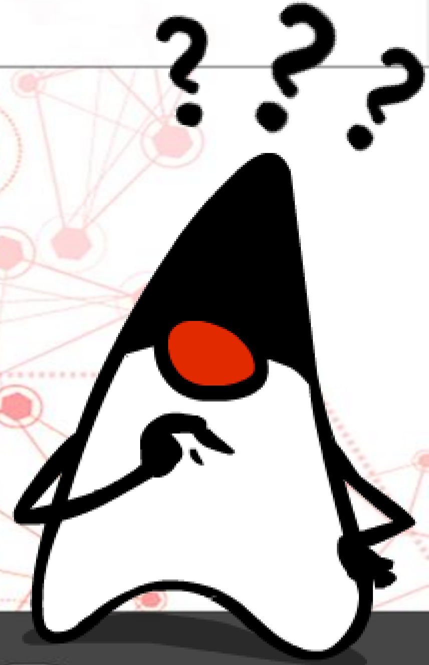
- http://blog.portswigger.net/2015/08/server-side-template-injection.html

Server-Side Template Injection (White-paper version)

- https://www.blackhat.com/docs/us-15/materials/us-15-Kettle-Server-Side-Template-Injection-RCE-For-The-Modern-Web-App-wp.pdf

Module 4

Deserialization vulnerabilities



Deserialization vulnerabilities

Proof of concept for WebLogic, WebSphere, JBoss, …

- https://foxglovesecurity.com/2015/11/06/what-do-weblogic-websphere-jboss-jenkins-opennms-and-your-application-have-in-common-this-vulnerability/

AppSecCali first presentation on the subject with working gadget demo

- http://frohoff.github.io/appseccali-marshalling-pickles/

Great article to understand the risk and differentiate safe and unsafe implementations

- http://www.ibm.com/developerworks/library/se-lookahead/

YSoSerial (tool needed for the exercise)

- https://github.com/frohoff/ysoserial

Deserialization vulnerabilities

YSoSerial

- List the gadgets available
  - java -jar ysoserial-0.0.5-all.jar
- Generate a payload
  - java -jar ysoserial-0.0.5-all.jar **[GADGET_NAME]** "YOUR_COMMAND" > payload.bin

Module 5

Expression Language (EL) injection

Expression Language Injection

Spring Expression Language (SpEL) and ScriptEngine/Rhino examples

- http://blog.h3xstream.com/2014/11/remote-code-execution-by-design.html

Java EL Injection (Mostly used in JSP)

- http://sectooladdict.blogspot.com/2014/12/el-30-injection-java-is-getting-hacker.html

Java EL Injection (Mostly used in JSP)

- http://blog.mindedsecurity.com/2015/11/reliable-os-shell-with-el-expression.html

Spring Expression Language (SpEL)

- http://danamodio.com/appsec/research/spring-remote-code-with-expression-language-injection/

Module 6

Hibernate Query Language (HQL)

Hibernate Query Language

Introduction to HQL

- http://blog.h3xstream.com/2014/02/hql-for-pentesters.html

Reference for “advanced” exploitation (Zeronights 2015)

- http://www.slideshare.net/0ang3el/orm2pwn-exploiting-injections-in-hibernate-orm

HQLmap: tool for automation

- https://github.com/PaulSec/HQLmap

Questions?

Contact

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