Pentests – more than just using the proper tools

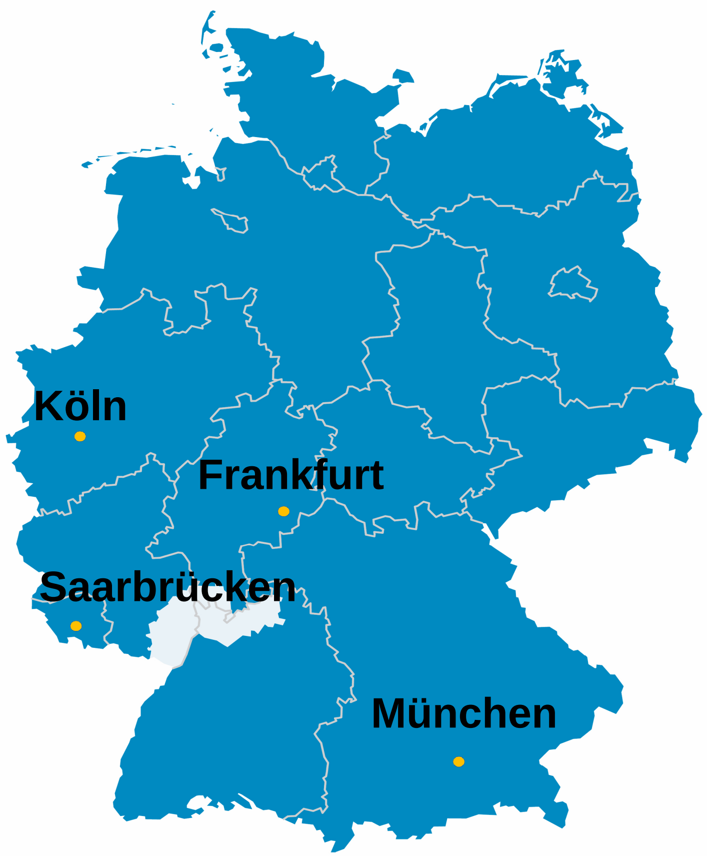
TÜVRheinland®
Precisely Right.

Agenda

1. **Information Security @ TÜV Rheinland**

2. **Penetration testing**
   - **Introduction**
   - **Evaluation scheme**
   - **Security Analyses of web applications**
   - **Internal Security Analyses (optional)**

Information security @TÜV Rheinland.



- Providing information security services worldwide (Europe, North America, Asia, Middle East)
- Germany‘s leading vendor independent service provider for information security
- Over 500 security experts worldwide – 150 in Germany and growing
- For the 7th time:

top® ARBEITGEBER DEUTSCHLAND 2014
CERTIFIED EXCELLENCE IN EMPLOYEE CONDITIONS

What about you?

- Economical vs. technical studies?
- Basic knowledge of web applications (HTML, Script languages, SQL)?
- Knowledge of penetration testing?
- What does OWASP stand for?
- Any questions so far?

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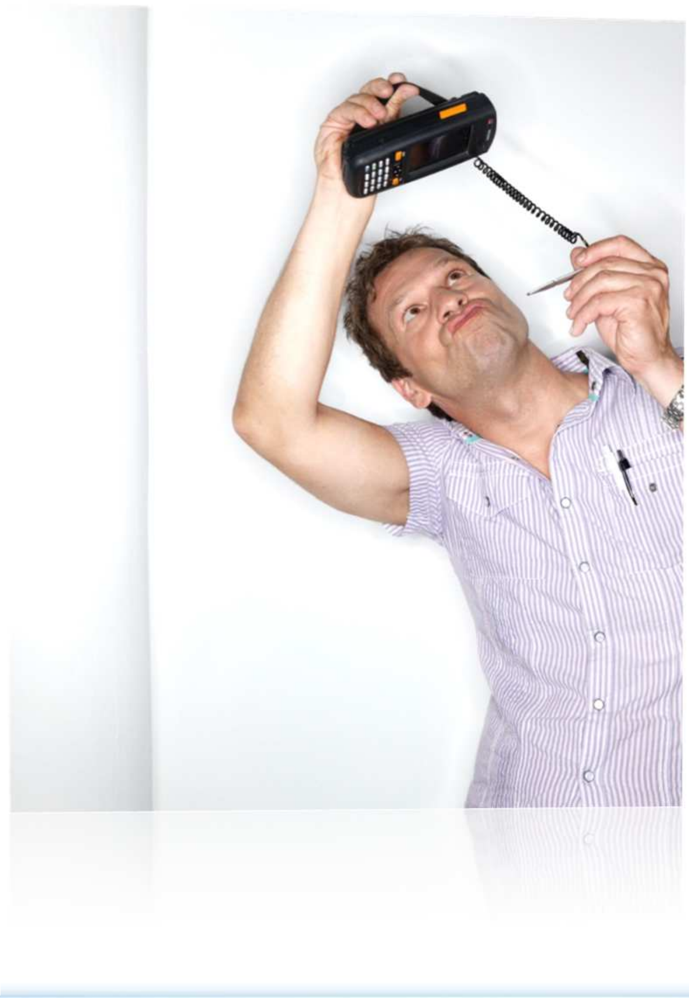
Penetration Tests. Definition. Variations. Goals.



Definition

"… an attack on a computer system with the intention of finding security weaknesses, potentially gaining access to it, its functionality and data." (Wikipedia)

Goals

- Detection of security vulnerabilites
- Demonstrate vulnerability of systems
- Identify the potential damage caused by real attacks

➔ Increase overall security level

Variations

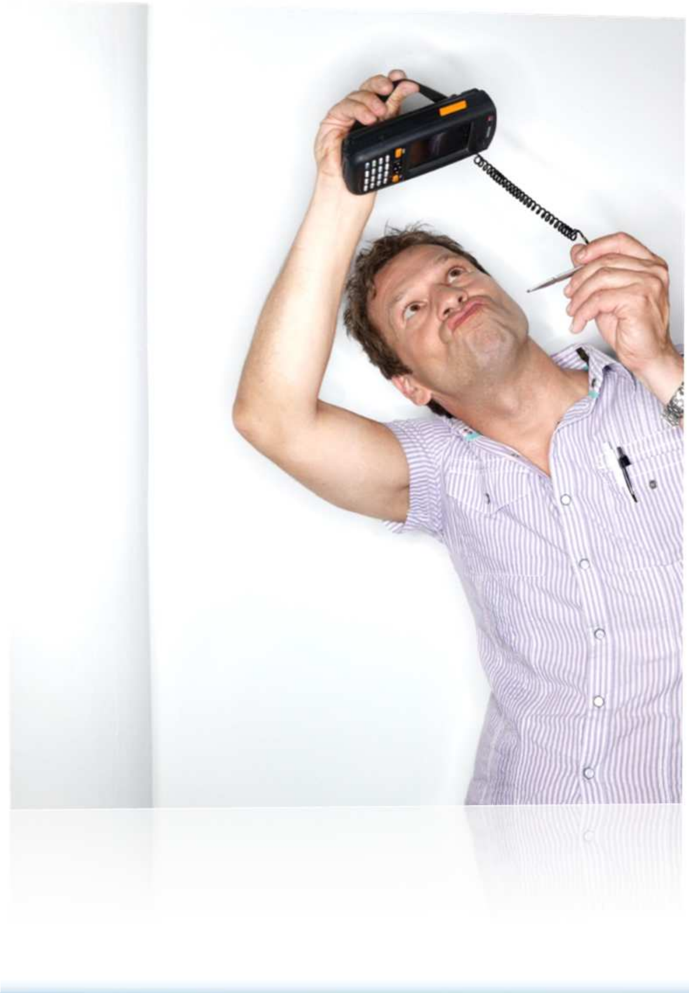
- Black Box
- White Box
- any other color in between
- Vulnerability scans

Penetration Tests. Targets.

Evaluation Targets

- Applications
  - Web
  - Client-Server
  - Mainframe
  - Mobile
- Infrastructure
  - Server
  - DMZ
  - Intranet
- Special purpose hardware

Penetration Tests. Pros and Cons.



Pros

- + Verification of the security of complex systems including multiple security layers
- + Dynamical testing including tester's creativity, e.g. combination of low impact vulnerabilities
- + Using up-to-date attack vectors
- + Verify attack detection

Cons

- – Security Snap-shot - Results valid for a limited time
- – Quality of results depend upon tester's quality
- – Very high complexity of finding previously unknown vulnerabilities

➔ Penetration testing is one important mechanism for security quality assurance

Penetration Test. Workflow.

1. **Kick-Off / Preparation**
2. **Information gathering and -analysis (manually and automated)**
   - Online search engines
   - Scanning Tools (port-, vulnerability-scanner, etc.)
3. **Information evaluation / risk analysis**
   - Based on results of phase 1 and information of phase 2
   - Identification of vulnerabilities
4. **Active Intrusion**
   - Exploitation of vulnerabilities (mostly manually)
   - Use of exploit code
5. **Finalization**
   - Result evaluation
   - Report generation

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DREAD Risk assessment model

DREAD risk evaluation model

Damage - how bad would an attack be?

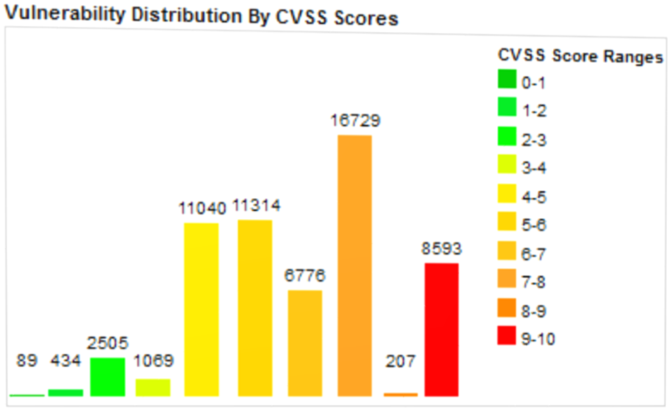
Reproducibility - how easy is it to reproduce the attack?

Exploitability - how much work is it to launch the attack?

Affected users - how many people will be impacted?

Discoverability - how easy is it to discover the threat?

Common Vulnerability Scoring System (CVSS)



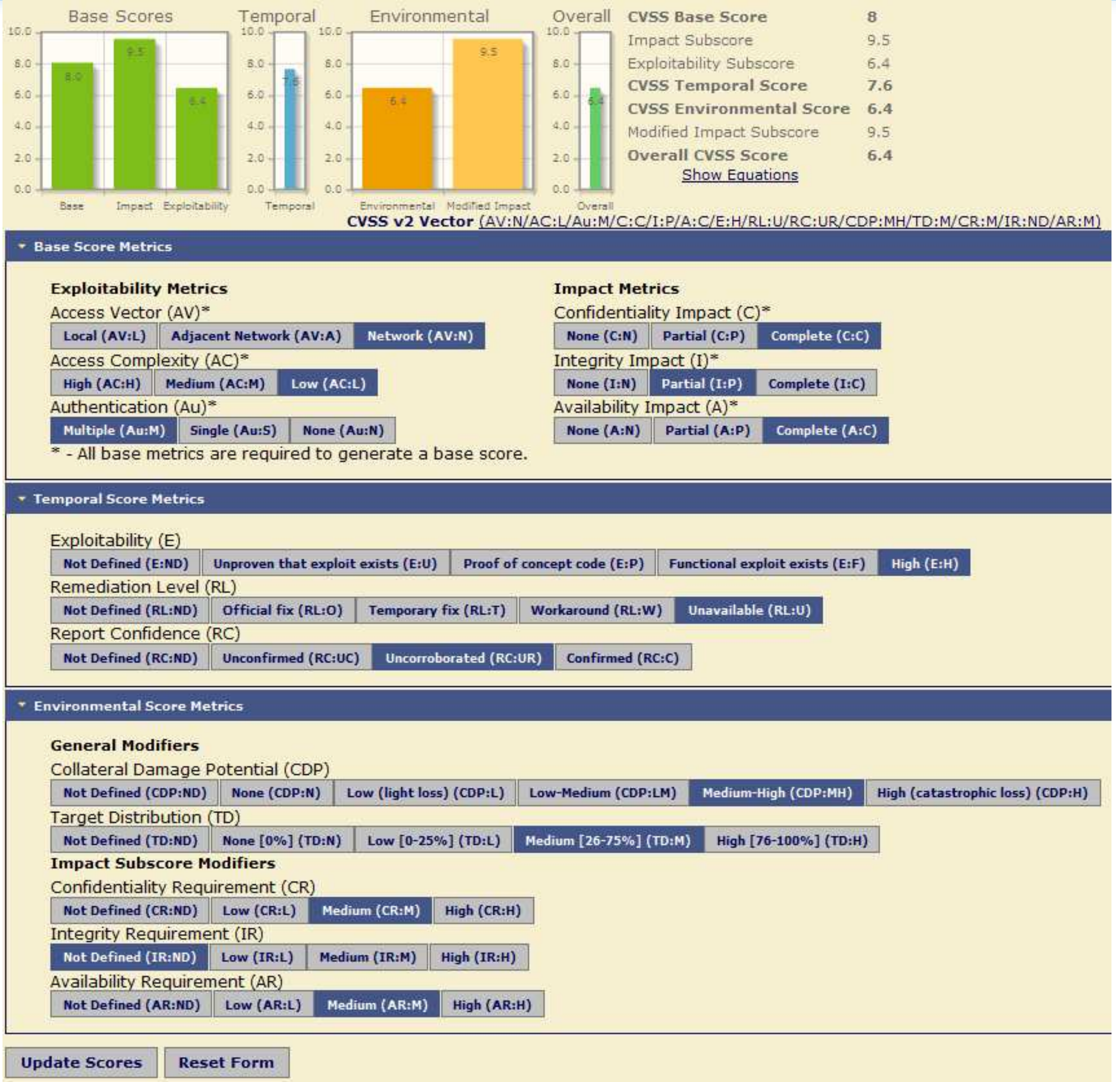
Common Vulnerability Scoring System (CVSS)

- Common standard
- Description of vulnerability‘s severity
- Evaluation based on „Metrics“
  - Base (Access Vector, Access Complexity, Authentication, Confidentiality, Integrity, Availability)
  - Environmental (Confidentiality Requirement, Integrity Requirement, Availability Requirement, Collateral Damage Potential, Target Distribution)
  - Temporal (Exploitability, Remediation Level, Report Confidence)
- Allows to compare vulnerabilities

CVSS-calculator:

http://nvd.nist.gov/cvss.cfm?calculator&version=2

Common Vulnerability Scoring System (CVSS)



CVSS Base Score	**8**
Impact Subscore	9.5
Exploitability Subscore	6.4
CVSS Temporal Score	**7.6**
CVSS Environmental Score	**6.4**
Modified Impact Subscore	9.5
Overall CVSS Score	**6.4**

Show Equations

CVSS v2 Vector (AV:N/AC:L/Au:M/C:C/I:P/A:C/E:H/RL:U/RC:UR/CDP:MH/TD:M/CR:M/IR:ND/AR:M)

Base Score Metrics

Exploitability Metrics

Access Vector (AV)*

Local (AV:L) | Adjacent Network (AV:A) | [✓ Network (AV:N)]

Access Complexity (AC)*

High (AC:H) | Medium (AC:M) | [✓ Low (AC:L)]

Authentication (Au)*

[✓ Multiple (Au:M)] | Single (Au:S) | None (Au:N)

* - All base metrics are required to generate a base score.

Impact Metrics

Confidentiality Impact (C)*

None (C:N) | Partial (C:P) | [✓ Complete (C:C)]

Integrity Impact (I)*

None (I:N) | [✓ Partial (I:P)] | Complete (I:C)

Availability Impact (A)*

None (A:N) | Partial (A:P) | [✓ Complete (A:C)]

Temporal Score Metrics

Exploitability (E)

Not Defined (E:ND) | Unproven that exploit exists (E:U) | Proof of concept code (E:P) | Functional exploit exists (E:F) | [✓ High (E:H)]

Remediation Level (RL)

Not Defined (RL:ND) | Official fix (RL:O) | Temporary fix (RL:T) | Workaround (RL:W) | [✓ Unavailable (RL:U)]

Report Confidence (RC)

Not Defined (RC:ND) | Unconfirmed (RC:UC) | [✓ Uncorroborated (RC:UR)] | Confirmed (RC:C)

Environmental Score Metrics

General Modifiers

Collateral Damage Potential (CDP)

Not Defined (CDP:ND) | None (CDP:N) | Low (light loss) (CDP:L) | Low-Medium (CDP:LM) | [✓ Medium-High (CDP:MH)] | High (catastrophic loss) (CDP:H)

Target Distribution (TD)

Not Defined (TD:ND) | None [0%] (TD:N) | Low [0-25%] (TD:L) | [✓ Medium [26-75%] (TD:M)] | High [76-100%] (TD:H)

Impact Subscore Modifiers

Confidentiality Requirement (CR)

Not Defined (CR:ND) | Low (CR:L) | [✓ Medium (CR:M)] | High (CR:H)

Integrity Requirement (IR)

[✓ Not Defined (IR:ND)] | Low (IR:L) | Medium (IR:M) | High (IR:H)

Availability Requirement (AR)

Not Defined (AR:ND) | Low (AR:L) | [✓ Medium (AR:M)] | High (AR:H)

TÜV Rheinland evaluation and risk classification.

Risk classification is performed from an IT security perspective in relation to infrastructure, systems, services and processes in the area of observation

→ Risk Rating for the business processes is done by the internal risk management of our customer.

Recommendation	Suggestions to improve the overall security situation, though a concrete threat is not present. Includes i.e. out-of-scope-observations.	🟦
Low **Risk**	The implemented security mechanisms to ensure • confidentiality and integrity of sensible data • availability of necessary systems has a **minor deficit**.	🟨
Medium **Risk**	The implemented security mechanisms to ensure • confidentiality and integrity of sensible data • availability of necessary systems has a **deficit**.	🟧
High **Risk**	The implemented security mechanisms to ensure • confidentiality and integrity of sensible data • availability of necessary systems has a **severe deficit**.	🟥

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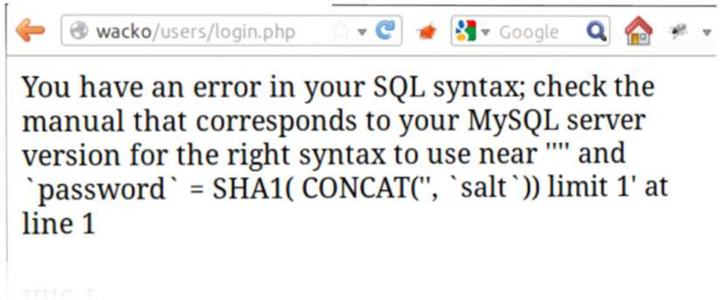
Open Web Application Security Project (OWASP) – Top 10

1. Injection
2. Cross Site Scripting
3. Broken Authentication and Session Management
4. Insecure Direct Object References
5. Cross Site Request Forgery
6. Security Misconfiguration
7. Insecure Cryptographic Storage
8. Failure to Restrict URL Access
9. Insufficient Transport Layer Protection
10. Unvalidated Redirects and Forwards

Top 1. Injection.



```
You have an error in your SQL syntax; check the
manual that corresponds to your MySQL server
version for the right syntax to use near "" and
`password` = SHA1( CONCAT('', `salt`)) limit 1' at
line 1
```

1. **Injection**
2. Cross Site Scripting
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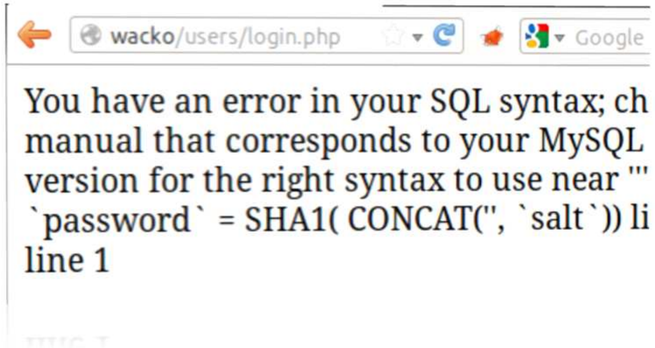
Injections. Basics.

Fundamental Trouble

- Input is not completely validated
- Data provided by the user is interpreted:
  - Data base (SQL-Injection)
  - Operation system calls (Command Injection)
  - XML-Tags and Entities (XML Injection)
  - Scriptcode (i.e. Ruby, PHP) gets executed (Code-Injection)

SQL-Injection. Description.



You have an error in your SQL syntax; ch
manual that corresponds to your MySQL
version for the right syntax to use near '''
`password` = SHA1(CONCAT('', `salt`)) li
line 1

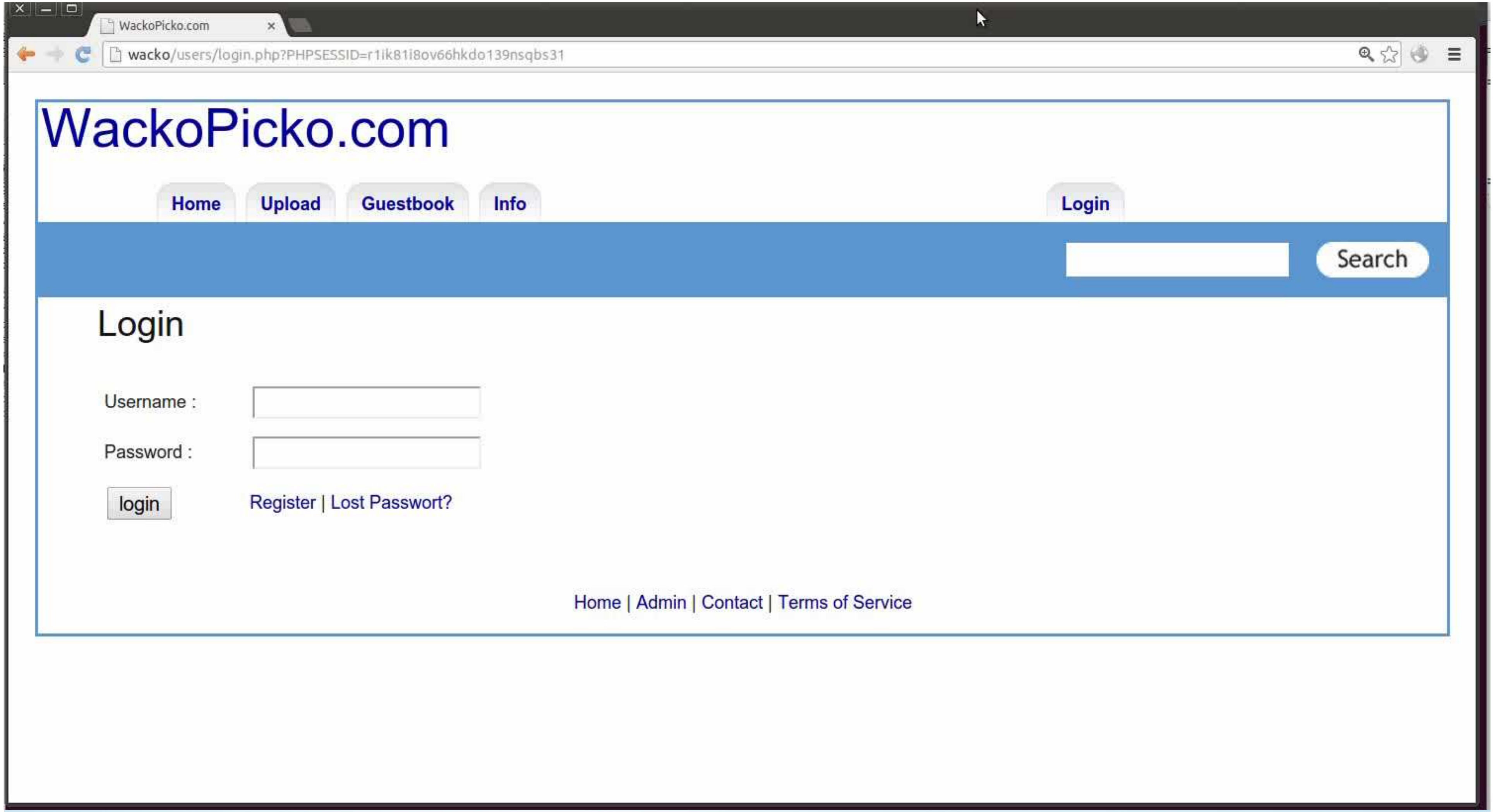
Issue

- Data provided by the user is not validated completely
- User can execute SQL queries

Consequences

- An Attacker can execute almost arbitrary SQL queries
  - Login without password
- Attacker can extract data from the database

SQL-Injection. Demo.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wacko/users/login.php?PHPSESSID=r1ik81i8ov66hkdo139nsqbs31
WackoPicko.com
Home
Upload
Guestbook
Info
Login
Search

Login

Username :

Password :

login
Register | Lost Passwort?
Home | Admin | Contact | Terms of Service

Thank you for your attention and questions!

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