Deploying SAST on a Large Scale

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Has Sony been Hacked this Week?
http://hassonybeenhackedthisweek.com/

Time-line of the Sony Hack(s) (excerpt):

2011-04-20  Sony PSN goes down
2011-05-21  Sony BMG Greece: data 8300 users (SQL Injection)
2011-05-23  Sony Japanese database leaked (SQL Injection)
2011-05-24  Sony Canada: roughly 2,000 leaked (SQL Injection)
2011-06-05  Sony Pictures Russia (SQL Injection)
2011-06-06  Sony Portugal: SQL injection, iFrame injection and XSS
2011-06-20  20th breach within 2 months
             177k email addresses were grabbed via a SQL injection
             (http://hassonybeenhackedthisweek.com/history)

Consequences:

• account data of close to 100 million individuals exposed
• over 12 million credit and debit cards compromised
• more than 55 class-action lawsuits
• costs of $170 million only in 2011
A Bluffers Guide to SQL Injection

- Assume an SQL Statement for

  selecting all users with “userName” from table “user”
A Bluffers Guide to SQL Injection

- Assume an SQL Statement for

```sql
stmt = "SELECT * FROM 'users' WHERE 'name' = '" + userName + "';"
```

What happens if we choose the following `userName`:

`userName = ' or '1'='1`

Resulting in the following statement:

```sql
stmt = "SELECT * FROM 'users' WHERE 'name' = '"' or '1'='1" + userName + "';"
```

Which is equivalent to `stmt = "SELECT * FROM 'users';` selecting the information of all users stored in the table 'users'!
A Bluffers Guide to SQL Injection

• Assume an SQL Statement for

```sql
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```

• What happens if we choose the following `userName`:

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```
• **Assume an SQL Statement for**

\[
\text{stmt} = "\text{SELECT } * \text{ FROM 'users' WHERE 'name' = ''} + \text{userName} + "'\);"
\]

• **What happens if we choose the following userName:**

\[
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```

• Which is equivalent to

```sql
stmt = "SELECT * FROM 'users';"
```

selecting the information of **all users** stored in the table ‘users’!
Vulnerability types of CVE reports since 1999

- **Execute Code** 28%
- **Denial of Service** 17%
- **Overflow** 12%
- **XSS** 11%
- **SQL Injection** 8%
- **Gain Information** 5%
- **Bypass Something** 4%
- **Other** 15%

- **Causes for most vulnerabilities are**
  - programming errors
  - configuration errors
- **Patching is**
  - expensive
  - may introduce new bugs

**How can we ensure that no vulnerable code is shipped?**
Finding Security Vulnerabilities

Find Vulnerabilities Using the Running Application

- Manual Application Penetration Testing
- Automated Application Vulnerability Scanning

Find Vulnerabilities Using the Source Code

- Automated Static Code Analysis
Finding Security Vulnerabilities

Find Vulnerabilities Using the Running Application

- Manual Application Penetration Testing
- Automated Application Vulnerability Scanning

Find Vulnerabilities Using the Source Code

- Automated Static Code Analysis
Evolution of Source Code

- Increase in:
  - code size
  - code complexity
  - number of products
  - product versions
So Everything is Secure Now, Right?

“
Our tool reports all vulnerabilities in your software – you only need to fix them and you are secure.

Undisclosed sales engineer from a SAST tool vendor.
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Yes, this tools exists! It is called Code Assurance Tool (cat):
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Yes, this tools exists! It is called Code Assurance Tool (cat):

- The cat tool reports each line, that might contain a vulnerability:

```
brucker@fujikawa:/usr/src/modules/tp-smapi$ cat thinkpad_ec.c
#include <linux/kernel.h>
#include <linux/module.h>
#include <linux/dmi.h>

static int thinkpad_ec_request_row(const struct thinkpad_ec_row *args) {
    u8 str3;
    int i;

    /* EC protocol requires write to TWRO (function code): */
    if (!((args->mask & 0x0001)) {
        printk(KERN_ERR MSG_FMT("bad args->mask=0x%02x", args->mask));
        return -EINVAL;
    }
```

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So Everything is Secure Now, Right?

Our tool reports all vulnerabilities in your software – you only need to fix them and you are secure.

Undisclosed sales engineer from a SAST tool vendor.

Yes, this tools exists! It is called Code Assurance Tool (cat):

- The cat tool reports each line, that might contain a vulnerability:
- It supports also a mode that reports no false positives:
Continuous Improvements

Further input channels:
- Development teams
- Internal research
- Scan reviews
- Code reviews
- ...
SAST Solutions Applied at SAP

- Mandatory for all products
- Multiple billions lines analyzed

<table>
<thead>
<tr>
<th>Language</th>
<th>Tool</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABAP</td>
<td>CVA (SLIN_SEC)</td>
<td>SAP</td>
</tr>
<tr>
<td>C/C++</td>
<td>Coverity</td>
<td>Coverity</td>
</tr>
<tr>
<td>Others</td>
<td>Fortify</td>
<td>HP</td>
</tr>
</tbody>
</table>

Other important pillars of SAP’s SDL:
- Secure programming training’s
- Pen tests on the final product

In addition:
- Own research (e.g., JS, Mobile)
- Ongoing evaluation of
  - alternative tools and
  - complementary techniques.
Open Issues

• Estimating the risk of not fixing security issues is hard
  • How to prioritize security vs. functionality
  • In case of doubt, functionality wins

• Pushing SAST across the software supply chain
  • Consumed software (OSS, third-party products)
  • SAP Customers, partners, and OEM products

• Huge and hybrid multi-language applications
  • Client-server applications
  • Web-frameworks

• Dynamic programming paradigms and languages
  • JavaScript, Ruby, etc.

• Lack of standardized regression test suites
  • Different tools
  • Different versions of the same tool
Lessons Learned: Recommendations (1/3)

Follow the recommendations given by Chandra et al:

- Start small
  - Start with one pilot
  - Succeed with pilot before larger roll-out
- Go for the throat
  - Start with the main security threat
- Appoint a champion
  - Identify a developer that knows all parts of the application
  - Make this developer your tool champion
- Measure the outcome
  - Track and measure the generated data
- Make it your own
  - Adapt the tool to your needs
  - SAST tools are not “off-the-shelf” products
Lessons Learned: Recommendations (2/3)

Based on our experiences, we add:

• Plan and invest enough resources
  • Introducing SAST requires significant resources
  • Integration, Analysis, Education, ...

• Plan and invest enough infrastructure
  • If the tools are slow, nobody will use them

• Do understand your developers as your friends
  • Do not follow the “security review” model
  • SAST tools should be understood as “debug tool”

• Execute scans regularly
  • SAST is not a one-time effort
Lessons Learned: Recommendations (3/3)

- Plan your changes and updates
  - All changes to the tools might change the results
- Do get support (and commitment) from your management
  - Introducing SAST will cost money and effort
  - Minimize the risk of discussing “security vs. features”
- Do not stop here.
  - Introducing SAST is only the first step
  - Use complementary techniques, e.g.,
    - Threat modeling
    - Dynamic testing tools
    - Penetration tests
    - ...

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You cannot pay people well enough, to do proper code audits. I tried it.

Yaron Minsky, Jane Street Capital

• We can confirm the results of Scandariato et al that show that SAST is the most effective and efficient security testing method
• Embed your SAST efforts into a holistic security testing strategy
Thank you!

http://xkcd.com/327/
Ruediger Bachmann and Achim D. Brucker.
Developing secure software: A holistic approach to security testing.
Datenschutz und Datensicherheit, March 2014.

Achim D. Brucker and Uwe Sodan.
Deploying static application security testing on a large scale.
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