Secure Software Development on the Enterprise Level

Achim D. Brucker

a.brucker@sheffield.ac.uk https://www.brucker.ch/

Software Assurance & Security Research
Department of Computer Science, The University of Sheffield, Sheffield, UK
https://logicalhacking.com/

Shift Left: The Incredible Impact Early Security Testing Makes
January 19, 2017, London, UK

{*LogicalHacking*}.com

CHECKMARX SHIFTLEFT

Outline

1. Background
2. Motivation
3. Secure Software Development
4. From (Mild) Pain to Success: My Experiences at SAP
5. Lesson's Learned

Personal Background

- Eight year of enterprise secure software development:
  - Member of the central security team, SAP SE (Germany)
    - (Global) Security Testing Strategist
    - Security Research Expert/Architect
  - Work areas:
    - Defining the risk-based Security Testing Strategy of SAP
    - Introducing security testing tools (e.g., SAST, DAST) at SAP
    - Identify white spots and evaluate and improve tools/methods
    - Secure Software Development Life Cycle integration
    - Applied security research
    - …
- Since 12/2015:
  - Senior Lecturer, The University of Sheffield, UK
  - Head of the Software Assurance & Security Research Team
  - Available as consultant & (research) collaborations

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SAP SE

- Leader in Business Software
  - Cloud
  - Mobile
  - On premise
- Many different technologies and platforms, e.g.,
  - In-memory database and application server (Hana)
  - Netweaver for ABAP and Java
- More than 25 industries
- 63% of the world's transaction revenue touches an SAP system
- over 68 000 employees worldwide over 25 000 software developers
- Headquarters: Walldorf (Heidelberg), Germany

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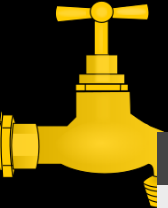
TESCO
TalkTalk
moneybookers.com
FOXY BINGO.COM
SUMO TORRENT
THISHABBO
SONY
QNB
truckersMP
NETELLER
Yandex
SPY
NAUGHTY AMERICA
TRAI
Dominos Pizza
The Lord of the Rings Online
StarVet
PLEX
<?php
Forbes
Win 7
Vista
XSplit
PSX-SCENE



Example (LinkedIn, May 2016)

- 164 million email addresses and passwords
- from an attack in 2012, offered for sale May 2016
- Compromised data:
  - email addresses
  - passwords

Example (TalkTalk, October 2015)

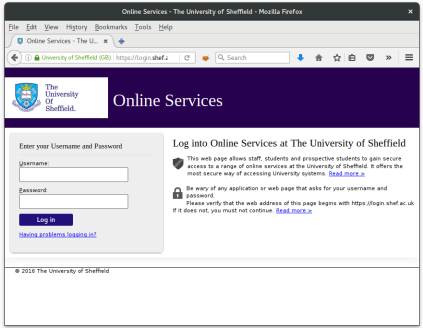
- nearly 157,000 customer records leaked
- nearly 16,000 records included bank details
- more than 150,000 customers lost
  (home services market share fall by 4.4 percent
  in terms of new customers)
- Costs for TalkTalk: around any £60 million

Example (Ashley Madison, July 2015)

- more than 30 million email addresses & much more
- Compromised data:
  - Dates of birth
  - Email addresses
  - Ethnicities, Genders
  - Sexual preferences
  - Home addresses, Phone numbers
  - Payment histories
  - Passwords, Usernames, Security questions and answers
  - Website activity
- Similar Leak: Mate1 in February 2016:
  27 million records with even more personal details (e.g., drinking/drug habits, political views)

What's the Problem?

Authenticate without a password using "SQL Injection"



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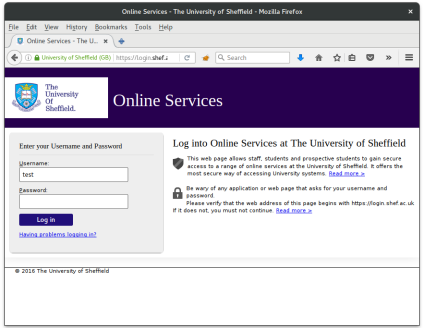

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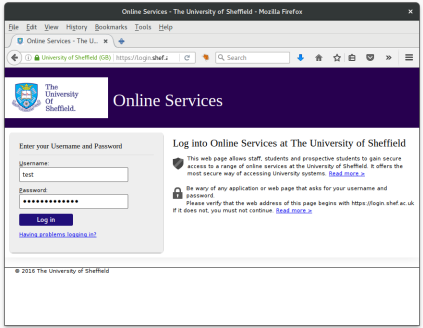

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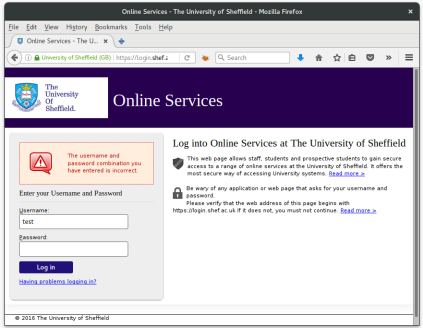

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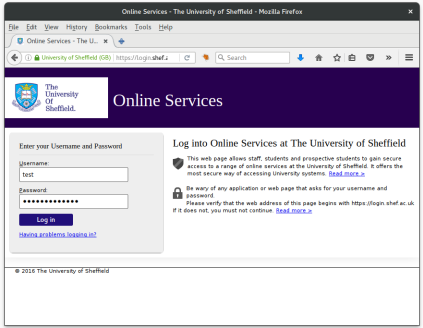

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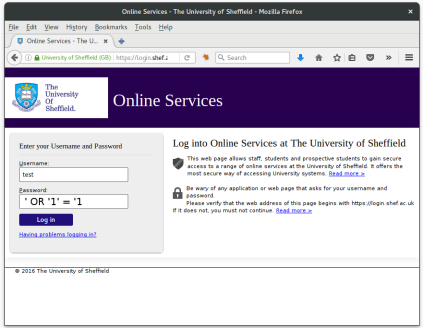

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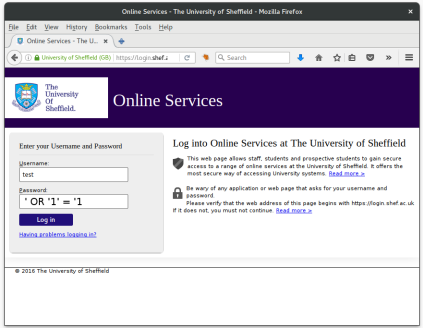

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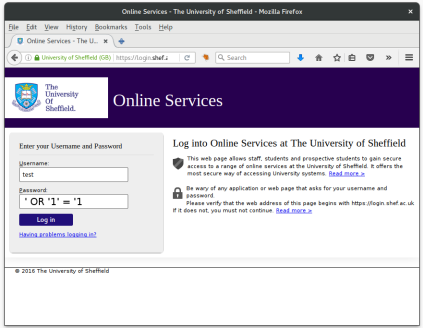

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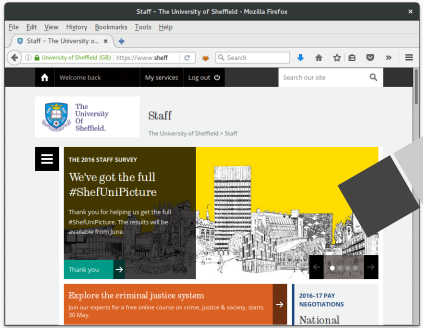

Root cause: a bug.

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SELECT * FROM ‘users‘ WHERE
 TRUE;
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- No password check!

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A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Training

- Security awareness
- Secure programming
- Threat modelling
- Security testing
- Data protection and privacy
- Security expert curriculum ("Masters")

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Risk Identification

- Risk identification ("high-level threat modelling")
- Threat modelling
- Data privacy impact assessment

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Plan Security Measures

- Plan product standard compliance
- Plan security features
- Plan security tests
- Plan security response

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Secure Development

- Secure Programming
- Static code analysis (SAST)
- Code review

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Security Testing

- Dynamic Testing (e.g., IAST, DAST)
- Manual testing
- External security assessment

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Security Validation ("First Customer")

- Check for "flaws" in the implementation of the S^2DL
- Ideally, security validation finds:
- No issues that can be fixed/detected earlier
- Only issues that cannot be detect earlier
  (e.g., insecure default configurations, missing security documentation)

Penetration tests in productive environments are different:

- They test the actual configuration
- They test the productive environment (e.g., cloud/hosting)

A Path Towards (More) Secure Software

SAP's Secure Software Development Lifecycle (S^2DL)

Security Response

- Execute the security response plan
- Security related external communication
- Incident handling
- Security patches
- Monitoring of third party components

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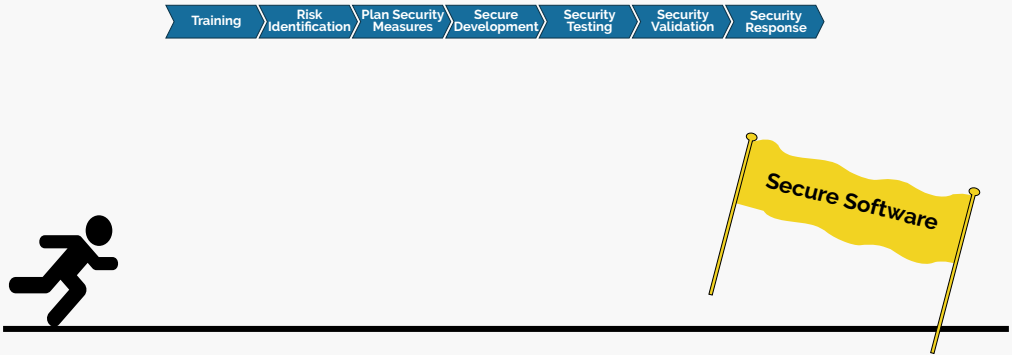

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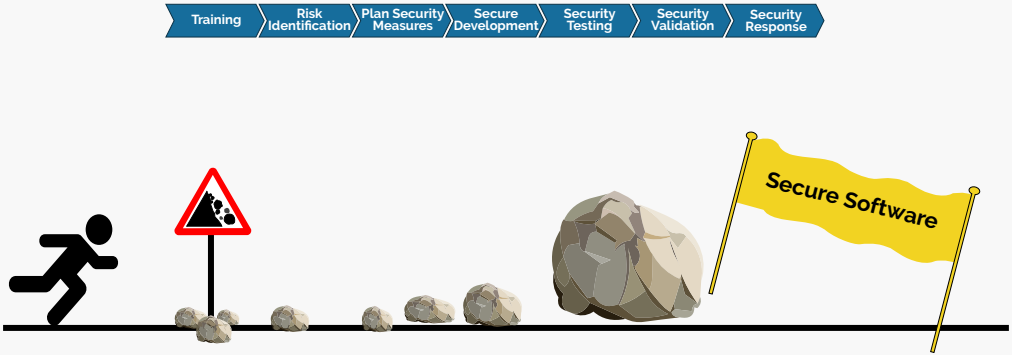

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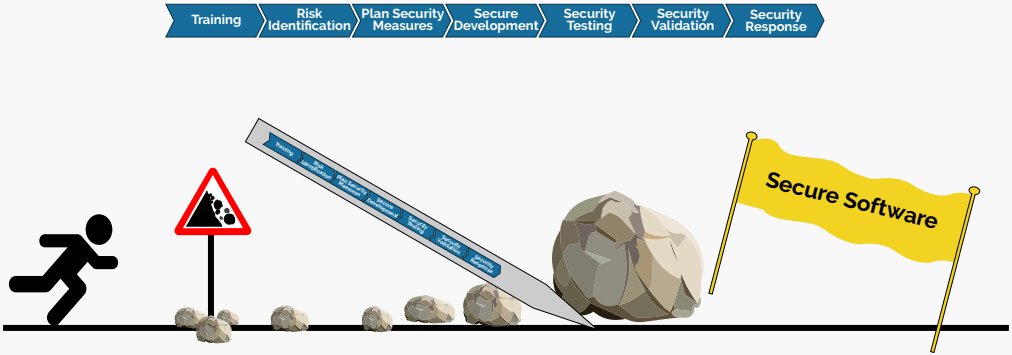

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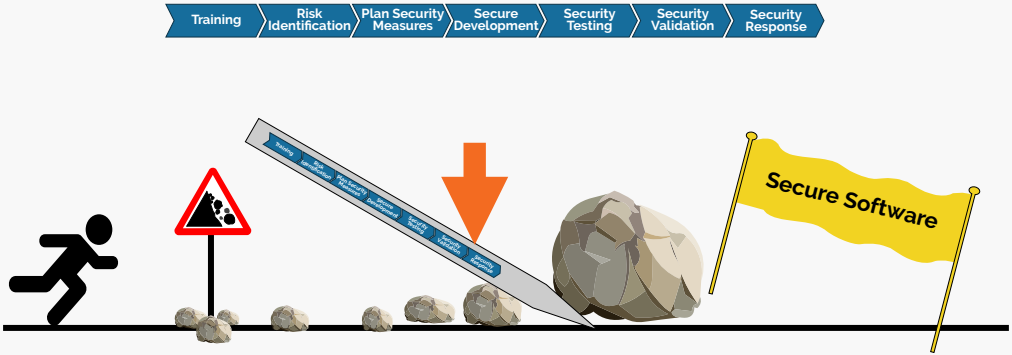

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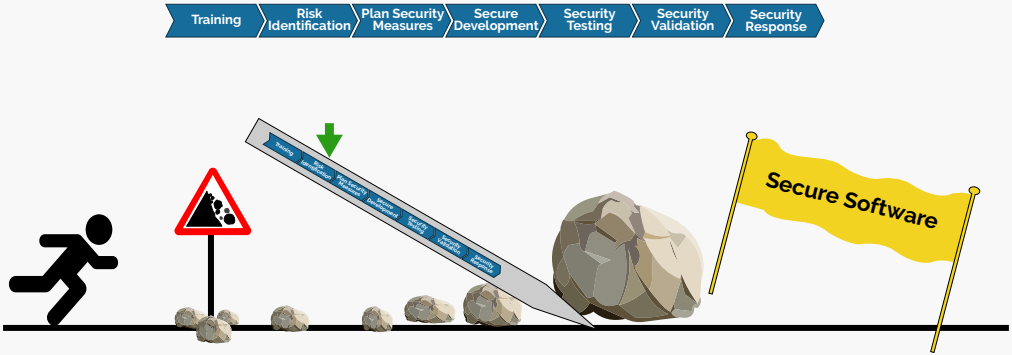

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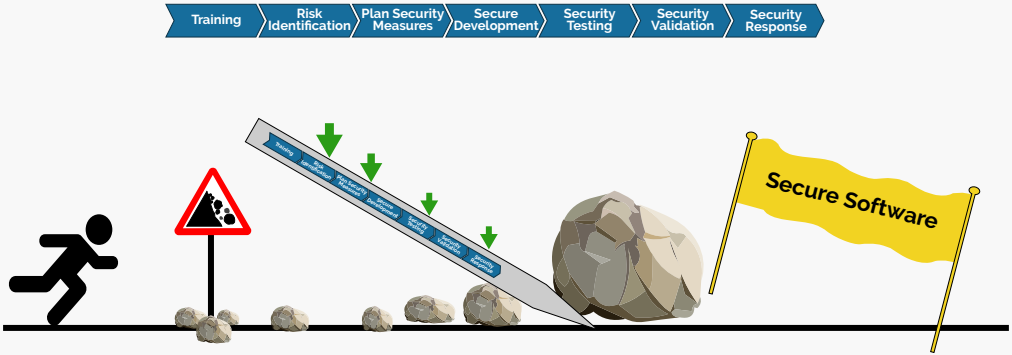
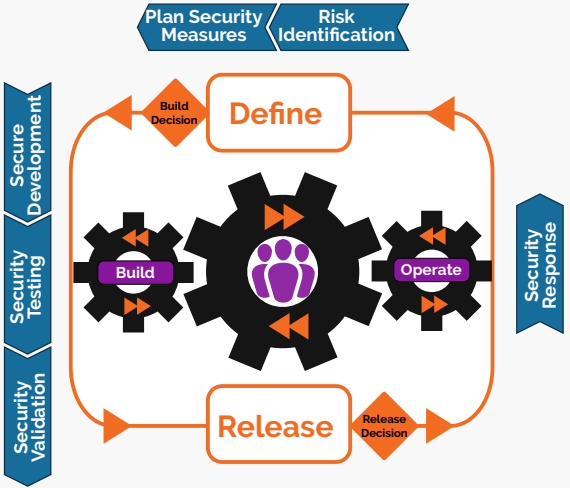


Secure Software Development Lifecycle for Cloud/Agile



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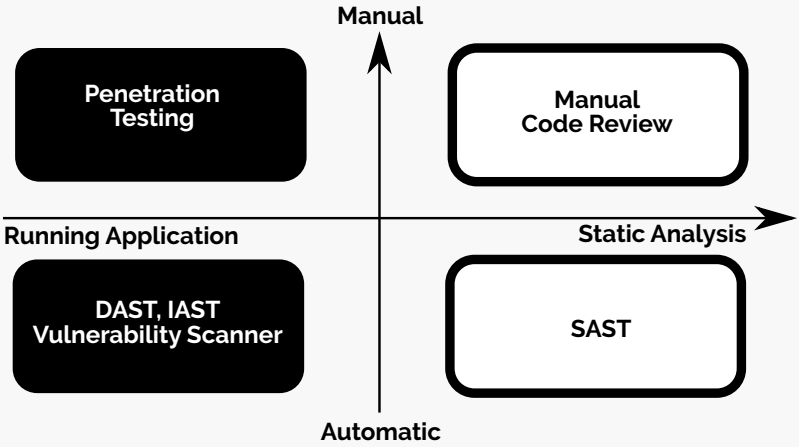

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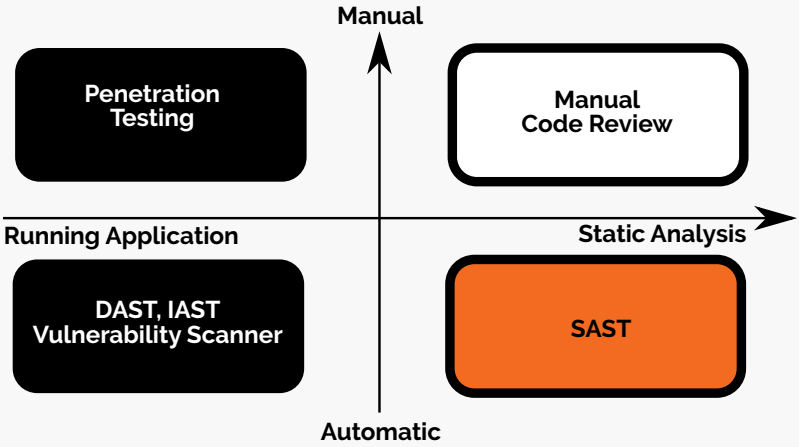
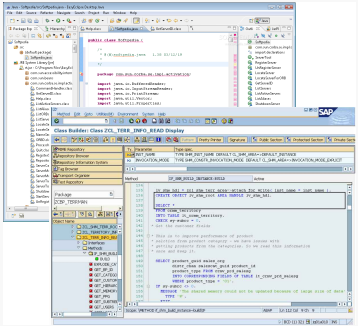


In 2010: Static Analysis Becomes Mandatory



SAST tools used at SAP:

Language	Tool	Vendor
ABAP	CodeProfiler	Virtual Forge
Others	Fortify	HP

- Since 2010: SAST mandatory for all SAP products
- Within two years, multiple billions lines analysed
- Constant improvement of tool configuration
- Further details:
  Deploying Static Application Security Testing on a Large Scale. In GI Sicherheit 2014. Lecture Notes in Informatics, 228, pages 91-101, GI, 2014.

A De-Centralised Application Security Approach

How SAP's Application Development Approach Developed Over Time

- Governance & approvals
- De-centralized approach

- ~~One~~ Two SAST tools fit all
  - VF CodeProfiler
  - Fortify

- Blending of Security Testing Tools
  - SAST:
    SAP Netweaver CVA Add-on, Fortify, Synopsis Coverity, Checkmarx, Breakman
  - DAST:
    HP WebInspect, Quotium Seeker
  - Others:
    Burp Suite, OWASP ZAP, Codinomicon Fuzzer, BDD

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Development Teams
- feel pushed

Central Security Team
- Controls development teams
- Spends a lot time with granting exemptions

Danger
- Only ticking boxes

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Danger
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Development Teams
- are empowered
- are responsible

Central Security Team
- Supports development teams
- Can focuses on improvements
  - filling white spots
  - tooling
  - processes

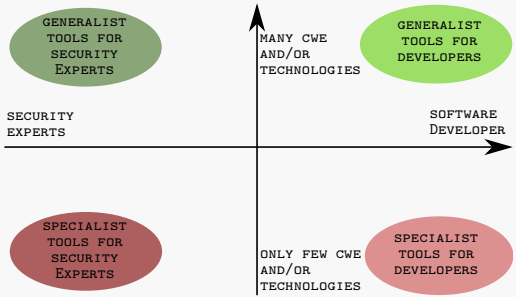
De-Centralised Approach: Organisational Setup

- Central security expert team (S^2DL owner)
  - Organizes security trainings
  - Defines product standard “Security”
  - Defines risk and threat assessment methods
  - Defines security testing strategy
  - Selects and provides security testing tools
  - Validates products
  - Defines and executes response process
- Local security experts
  - Embedded into development teams
  - Organize local security activities
  - Support developers and architects
  - Support product owners (responsibles)
- Development teams
  - Select technologies
  - Select development model
  - Design and execute security testing plan
  - …

Security Team Focus: Security Testing for Developers

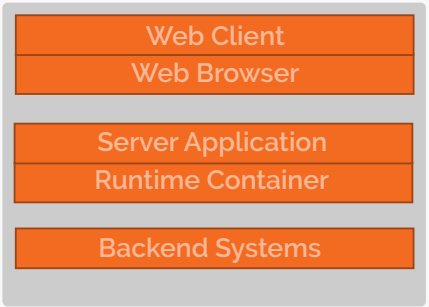
Security testing tools for developers, need to

- Be applicable from the start of development
- Automate the security knowledge
- Be integrated into dev world, e.g.,
  - IDE (instant feedback)
  - Continuous integration
- Provide easy to understand fix recommendations
- Declare their “sweet spots”



https://logicalhacking.com/blog/2016/10/25/classifying-security-testing-tools/

Combining Multiple Security Testing Methods and Tools



- Risks of only using only SAST
  - Wasting effort that could be used more wisely elsewhere
  - Shipping insecure software
- Examples of SAST limitations
  - Not all programming languages supported
  - Covers not all layers of the software stack

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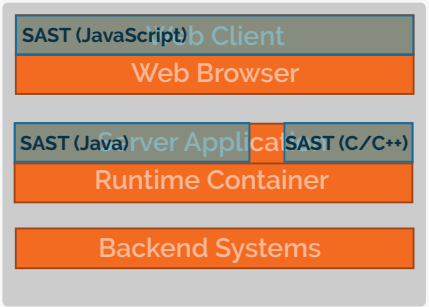

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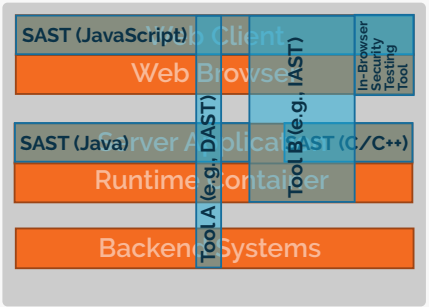

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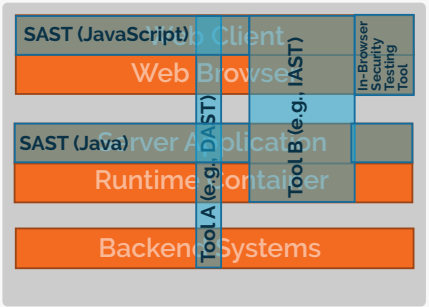

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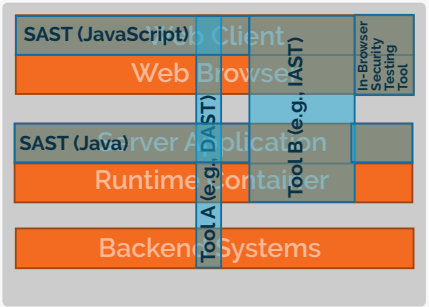

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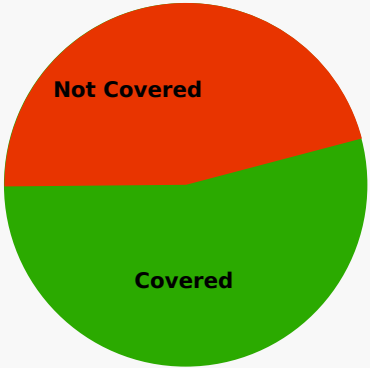
- Risks of only using only SAST
  - Wasting effort that could be used more wisely elsewhere
  - Shipping insecure software
- Examples of SAST limitations
  - Not all programming languages supported
  - Covers not all layers of the software stack
- A comprehensive approach combines
  - Static approaches (i.e., SAST)
  - Dynamic approaches (i.e., IAST or DAST)

How to Measure Success (and Identify White Spots)

- Analyze the vulnerabilities reported by
  - Security Validation
  - External security researchers
- Vulnerability not detected by currently used methods
  - Improve tool configuration
  - Introduce new tools
- Vulnerability detected by our security testing tools
  - Vulnerability in older software release
  - Analyze reason for missing vulnerability



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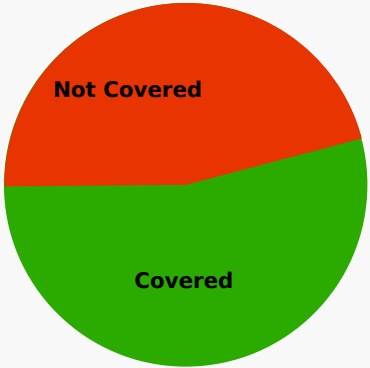

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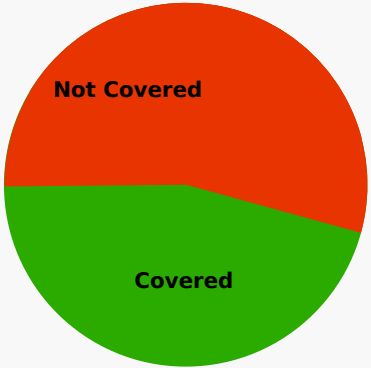

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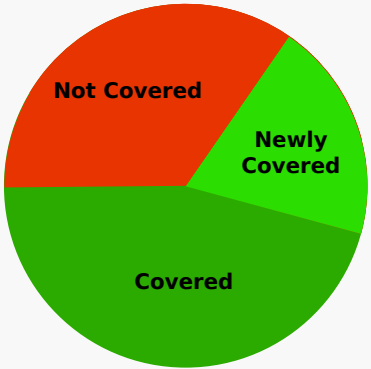

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Outline

1. Background
2. Motivation
3. Secure Software Development
4. From (Mild) Pain to Success: My Experiences at SAP
5. Lesson's Learned

Key Success Factors

- A holistic security awareness program for
  - Developers
  - Managers

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> **Developer awareness** is even more important!

Listen to Your Developers And Make Their Life Easy!

We are often talking about a lack of security awareness and, by that, forget the problem of lacking development awareness.

- Building a secure system more difficult than finding a successful attack.
- Do not expect your developers to become penetration testers (or security experts)!

Organisations can make it hard for developers to apply security testing skills!

- Don't ask developers to do security testing, if their contract doesn't allows it
- Budget application security activities centrally
- Educate your developers and make them recognised experts

Final remarks

What works well:

- Delegate power **and** accountability to development teams
- Multi-tiered model of security experts:
  - local experts for the local implementation of secure development
  - global experts that support the local security experts (champions):
    - act as consultant in difficult/non-standard situations
    - evaluate, purchase, and operate widely used security testing tools
    - can mediate between development teams and response teams
- Strict separation of
  - security testing supporting developers and
  - security validation

What does not work well:

- Forcing tools, processes, etc. on developers
- Penetration testing as “secure development” approach
  - Penetration has its value, e.g.,
    - as security integration test
    - as “meta-test” for your secure development process (validation)

Thank you for your attention!
Any questions or remarks?

Contact:

Dr. Achim D. Brucker
Department of Computer Science
University of Sheffield
Regent Court
211 Portobello St.
Sheffield S1 4DP, UK

a.brucker@sheffield.ac.uk
@adbrucker
https://de.linkedin.com/in/adbrucker/
https://www.brucker.ch/
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