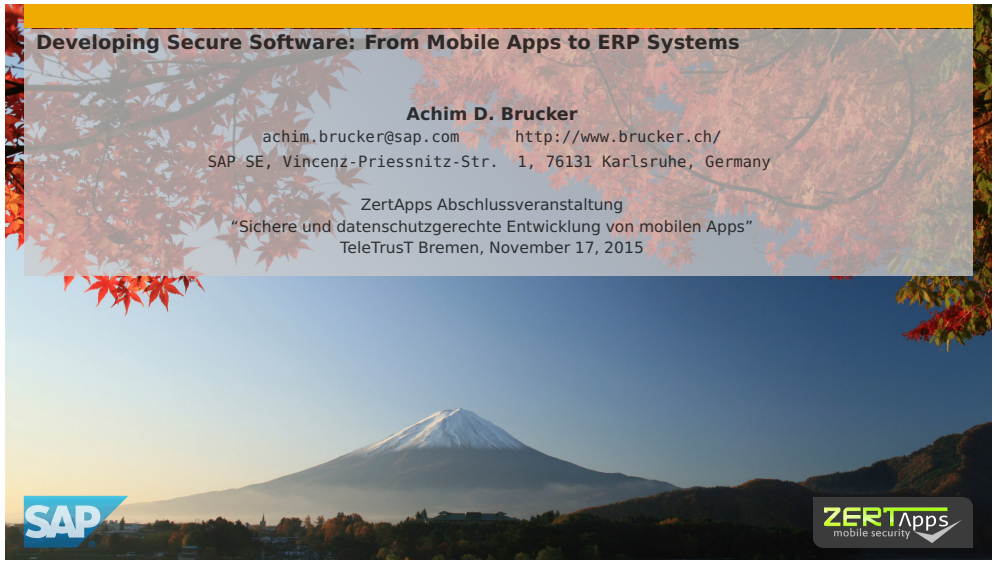

Developing Secure Software: From Mobile Apps to ERP Systems

Abstract

Developing secure software is, in general, challenging and requires and end-to-end secure software development lifecycle. It is particular challenging if the secure software development lifecycle needs to fit the whole range of software products from small mobile apps to large scale enterprise system and needs to be applicable to a wide range of software development methodologies.
In this presentation, we will present SAP’s approach to developing secure software in general and, in particular, highlight the challenges of developing mobile applications securely.

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Agenda

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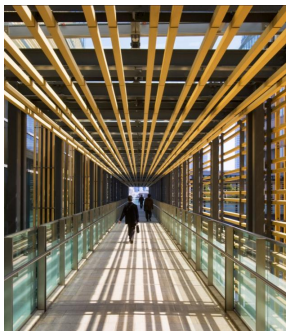
SAP SE

- 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, Germany (close to Heidelberg)



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Personal Background

- I wear two hats:
  - **(Global) Security Testing Strategist**
  - Research Expert/Architect

  Working for the central software security team
- Background:
  Security, Formal Methods, Software Engineering
- Current work areas:
  - Static code analysis
  - (Dynamic) Security Testing
  - Mobile Security
  - Security Development Lifecycle
  - Secure Software Development Lifecycle

http://www.brucker.ch/

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SAP Uses a De-centralised Secure Development Approach

- **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
  - . . .

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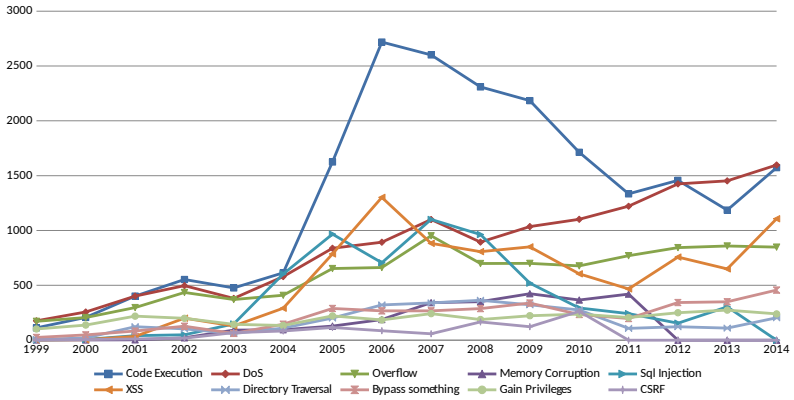
Vulnerability Distribution



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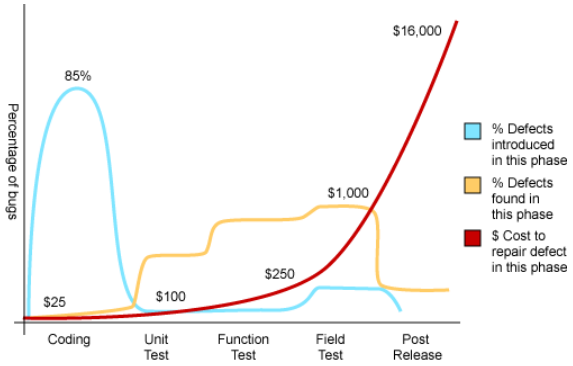
When Do We Fix Bugs



Source: Applied Software Measurement, Capers Jones, 1996

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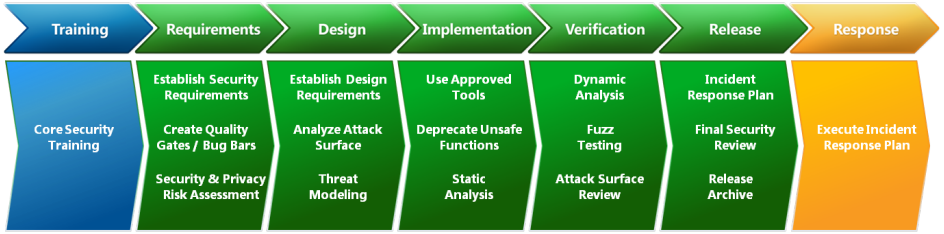
Microsoft's SDL



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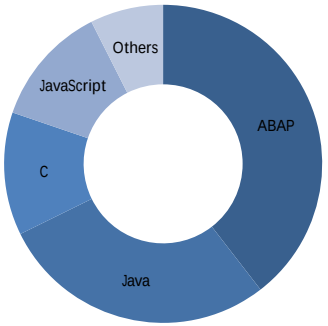
Our Start: SAST as a Baseline



SAST tools used at SAP:

Language	Tool	Vendor
ABAP	CVA (SLIN_SEC)	SAP
JavaScript	Checkmarx CxSAST	Checkmarx
C/C++	Coverity	Coverity
Others	Fortify	HP

- Since 2010, mandatory for all SAP products
- Multiple billions lines analyzed
- 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.

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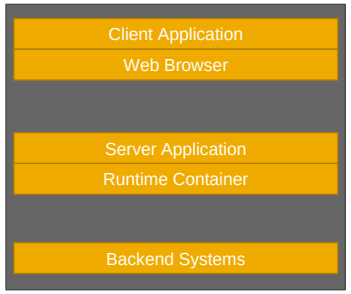
Combining Multiple Security Testing Methods and Tools



- 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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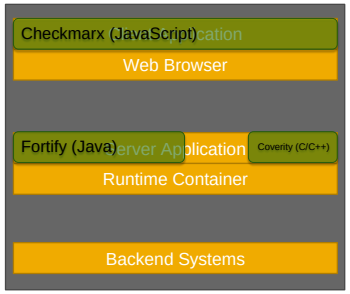
Combining Multiple Security Testing Methods and Tools



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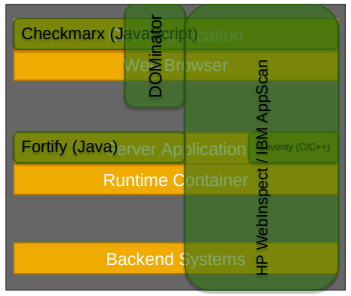
Combining Multiple Security Testing Methods and Tools



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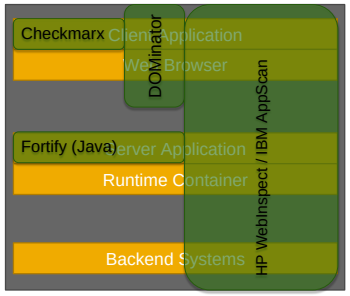

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A Risk-based Test Plan

- Combines multiple security testing methods, e.g., code scans, dynamic analysis, manual penetration testing or fuzzing
- Selects the most efficient test tools and test cases based on the risks and the technologies used in the project
- Re-adjusts priorities of test cases based on identified risks for the project
- Monitors false negative findings in the results of risk assessment

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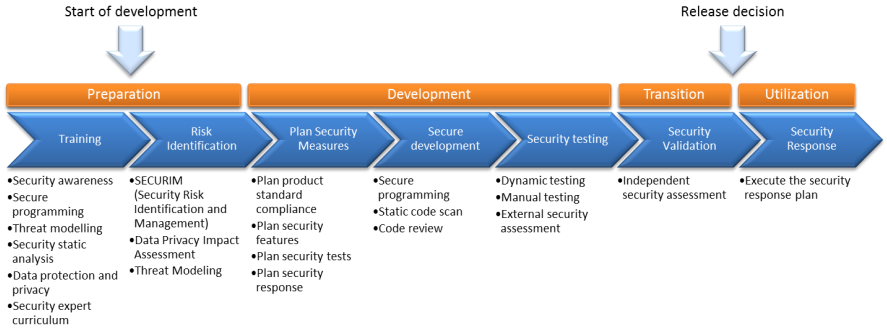
SAP' Secure Software Development Lifecycle (S^2DL)



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Security Validation

- Acts as first customer
- Is not a replacement for security testing during development
- Security Validation
  - 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)

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Penetration tests in productive environments are different:

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

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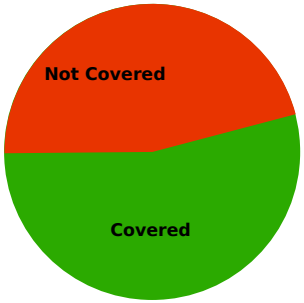
How to Measure Success

- Analyze the vulnerabilities reported by
  - Security Validation
  - External security researchers
- Vulnerability not detected by our security testing tools
  - 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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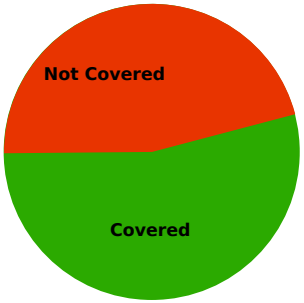

Success criteria:
Percentage of vulnerabilities not covered by our security testing tools increases

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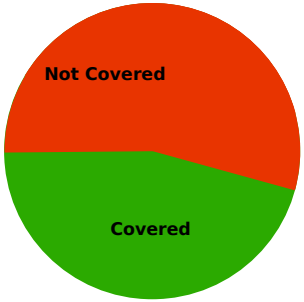

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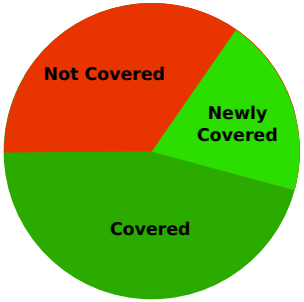

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4 Lesson's Learned

5 How Does This Apply to Mobile Development?

6 Conclusion

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Key Success Factors

- A holistic security awareness program for
  - Developers
  - Managers

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Key Success Factors

- A holistic security awareness program for
  - Developers
  - Managers
- Yes, security awareness is important

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Key Success Factors

- A holistic security awareness program for
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- Yes, security awareness is important **but**

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Key Success Factors

- A holistic security awareness program for
  - Developers
  - Managers
- Yes, security awareness is important **but**

> Developer awareness is even more important!

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Listen to Your Developers!

> 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)!

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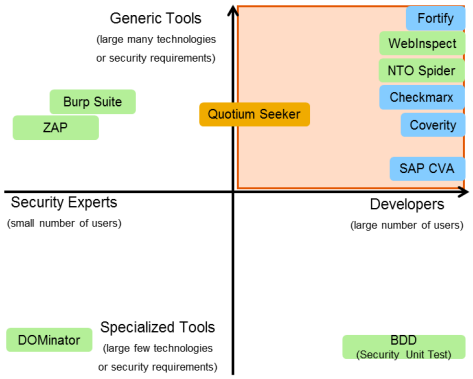
Security Testing for Developers

Security testing tools for developers, need to

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



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Collaborate!

Security experts need to collaborate with development experts to

- Create easy to use security APIs (ever tried to use an SSL API securely)
- Create languages and frameworks that make it hard to implement insecure systems
- Explain how to program securely

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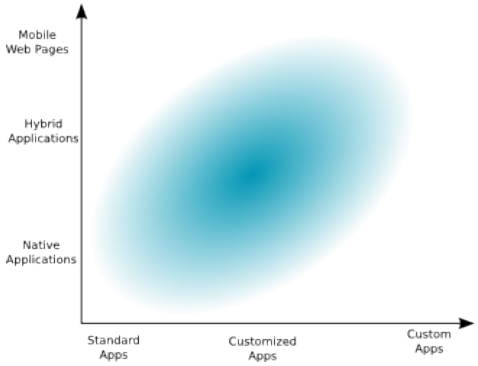
Mobile App Development at SAP



Key take aways:

- Hybrid applications are becoming the pre-dominant development model (at SAP)
- the challenges of hybrid apps are transferable to
  - web frameworks (EJB, Rails, PHP)
  - enterprise applications (XSJS, SQLScript, ABAP, JS)
  - even mobile apps contain > 500kLOC
- there are a lot of open and interesting security research questions in the area of hybrid development models

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Why Are Mobile Apps Special

Organisational Aspects

- Partly not developed by the development organisations (e.g., marketing)
- Fast update cycles (to app store, not necessarily "on device")
- Mobile apps are not patched (instead: new release)
- Processes partly defined by App Store operators (e.g., Google, Apple, . . .)

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Why Are Mobile Apps Special

Technical Aspects

- Limited/different user interface
- High volume of apps released
- Development tools are not fully under own control
- Programming languages might not be used elsewhere
- Lot of frameworks that
  - rather new
  - not as mature
  - might track users (data privacy)
- They are not independent . . .

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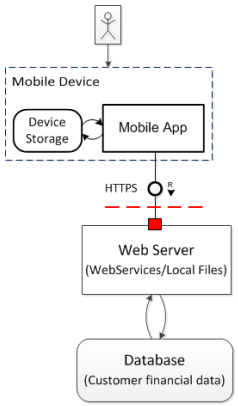
The Hidden Beast — Server

As a mobile app, you never be alone . . .

A final remark:

- usually there is at least one server “in the background”
- many security and data privacy issues are caused by
  - the communication of the app and its “own” server
  - the implementation of its “own” server
  - external servers and/or services



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Conclusion

- Secure software development is a
  - Prerequisite for the secure and compliant operation: We need SecDevOps!
  - Risk of operating and maintaining IT systems
- Security requires an end-to-end approach
  - Training of developers, architects, product owners
  - Security testing during development
  - Validation of your security testing efforts
  - Maintenance and security patch management
- Developers are your most important ally
  - Make life easy for them

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Thank you!

http://xkcd.com/327/

Dr. Achim D. Brucker
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https://www.brucker.ch/
https://logicalhacking.com/

Related Publications

Ruediger Bachmann and Achim D. Brucker.
Developing secure software: A holistic approach to security testing.
Datenschutz und Datensicherheit (DuD), 38(4):257–261, April 2014.
http://www.brucker.ch/bibliography/abstract/bachmann.ea-security-testing-2014.

Achim D. Brucker, Lukas Brügger, and Burkhart Wolff.
Formal firewall conformance testing: An application of test and proof techniques.
Software Testing, Verification & Reliability (STVR), 25(1):34–71, 2015.
http://www.brucker.ch/bibliography/abstract/brucker.ea-formal-fw-testing-2014.

Achim D. Brucker and Uwe Sodan.
Deploying static application security testing on a large scale.
In Stefan Katzenbeisser, Volkmar Lotz, and Edgar Weippl, editors, gi *Sicherheit 2014*, volume 228 of *Lecture Notes in Informatics*, pages 91–101. gi, March 2014.
ISBN 978-3-88579-622-0.
http://www.brucker.ch/bibliography/abstract/brucker.ea-sast-expierences-2014.

Achim D. Brucker and Burkhart Wolff.
On theorem prover-based testing.
Formal Aspects of Computing (FAC), 25(5):683–721, 2013.
ISSN 0934-5043.
http://www.brucker.ch/bibliography/abstract/brucker.ea-theorem-prover-2012.

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