Bringing Security Testing to Development

How to Enable Developers to Act as Security Experts

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Background: SAP SE

- SAP SE
  - Business Software Vendor
  - Over 68000 employees
  - Worldwide development
- Myself
  - Security Testing Strategist
  - Researcher
  - Working in the central Software Security Team

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De-centralized Secure Development Model

Central Security Expert Team

- S2DL 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 dev. teams
- Organize local security activities
- Support developers and architects
- Support product owners/responsibles

Development Teams

- Select technologies
- Select development model
- …

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MOTIVATION

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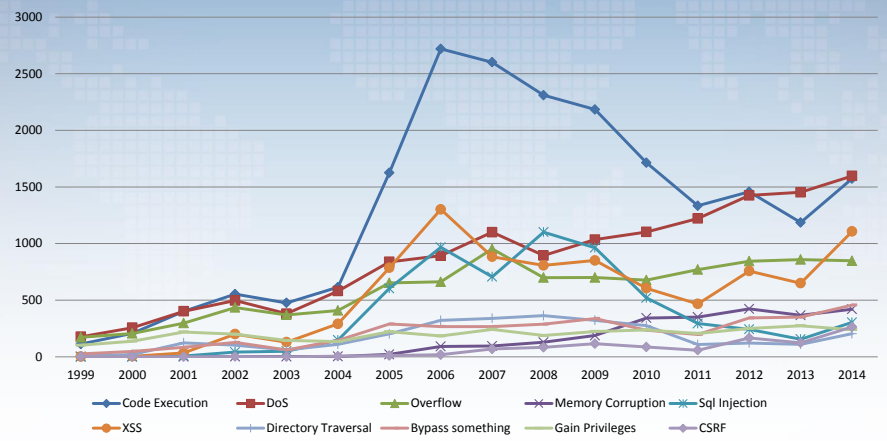
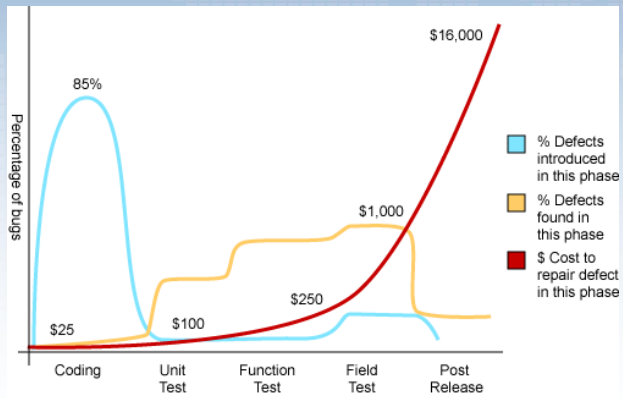
Vulnerability Distribution



Source: www.cvedetails.com

When Do We Fix Bugs?



Source: Applied Software Measurement, Capers Jones, 1996

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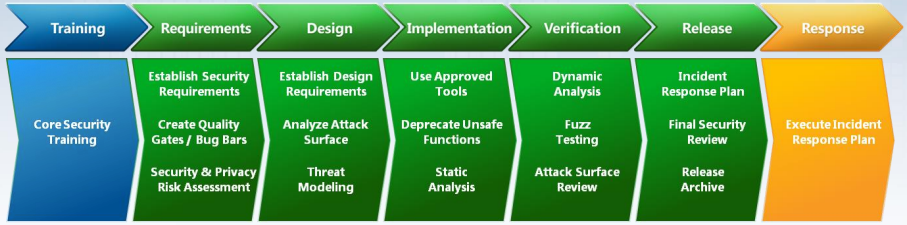
Microsoft's SDL



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RISK BASED SECURITY TESTING AS PART OF SAP'S S²DL

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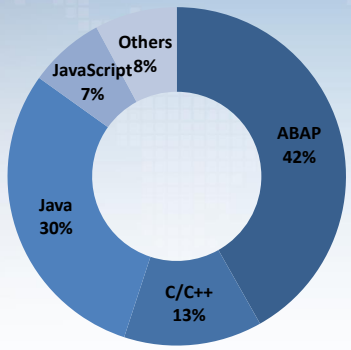
Our Start: SAST as Baseline

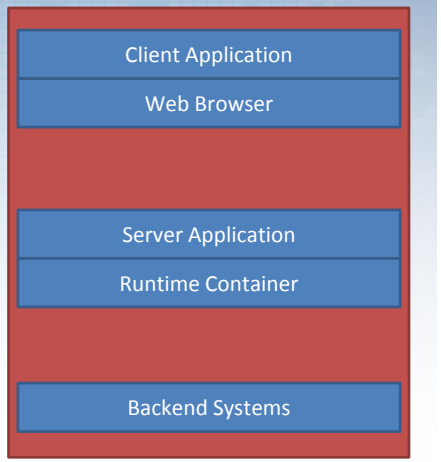


Language	Tool	Vendor
ABAP	CVA (SLIN_SEC)	SAP
C/C++	Coverity	Coverity
JavaScript, Ruby	Checkmarx	Checkmarx
Others	Fortify	HP

- Mandatory since 2010 for all products
- Multiple billons lines analyzed
- Constant improvements:
  - tool configuration (e.g., based on feedback from development, validation, response)
  - new tools and methods

Are We Done?

- SAST Advantages
  - Early in Development
  - Wide range of vuln. Types
  - Good fix instructions
- SAST Limitations
  - Quality depends on programming language used
  - Usually covers only one layer of the application stack



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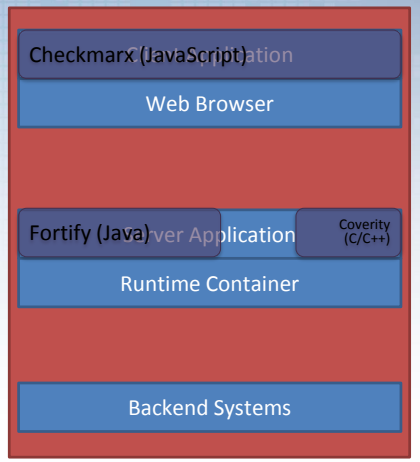

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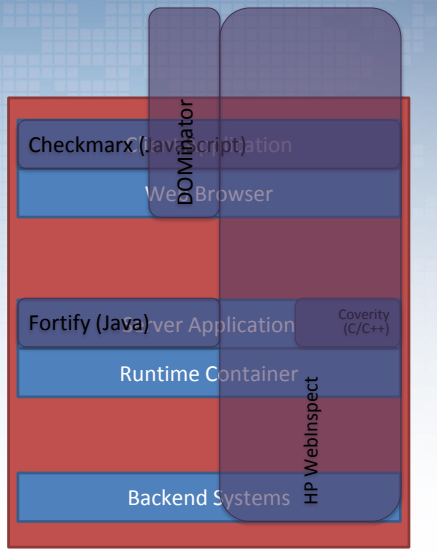

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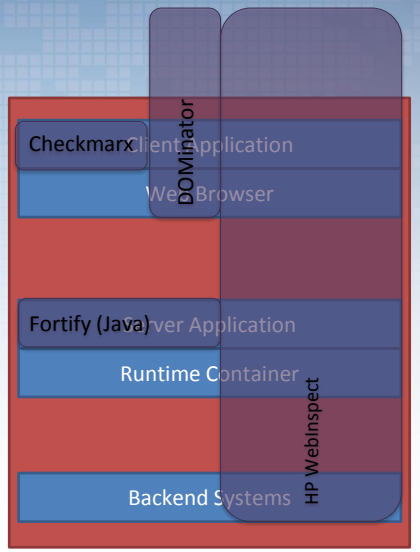
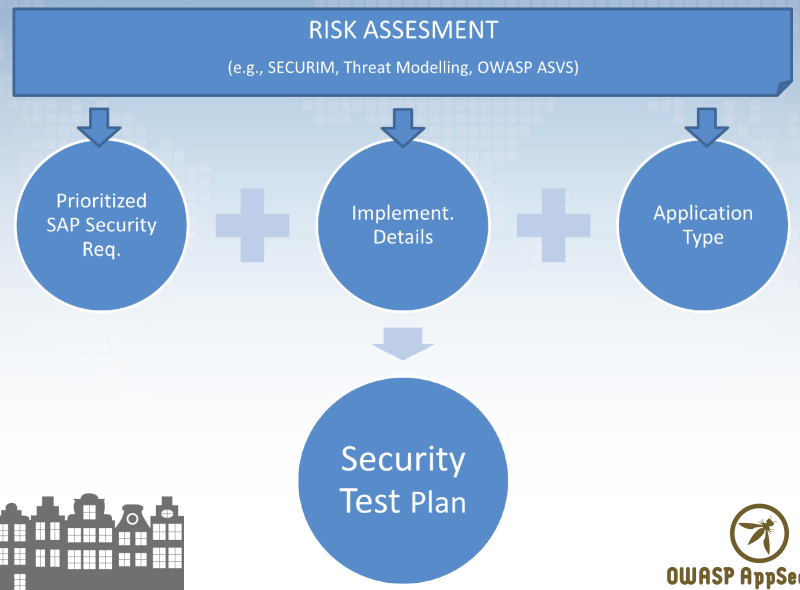
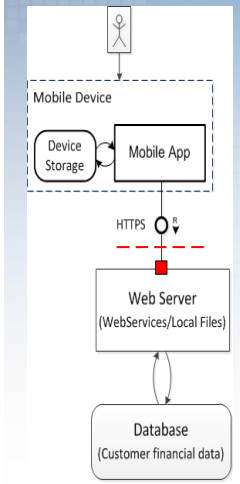


How To Select The Best Tools



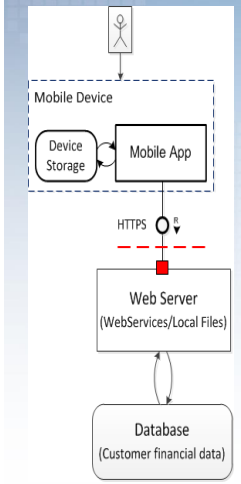
Example: Security Test Plan



Illustrative Example

- **Mobile Device**
- Risk: Attacker might inject JavaScript (XSS)
- Security Control 1: Use only UI5 controls
- Assumption: SAP Kapsel with SMP and Afaria
  - Test: Static Code Analysis using Checkmarx
    - » Justification: recommended tool
    - » Expected Coverage: all client-side JavaScript code
    - » Expected Effort: 10min per development day (ramp-up not included)
- Security Control 2: use only SSL connections with valid certificates
  - Test 1: Static Code Analysis for finding non-https connections
    - » Justification: low effort, already included in test for Security Control 1
    - » Expected Coverage: all client-side JavaScript code
    - » Expected Effort: included in effort for scans for Security Control 1
  - Test 2: Manual test with invalid certs (e.g., self-signed, own CA)
    - » Justification: no automated tool available, self-signed certificates allowed during development
    - » Expected Coverage: all https connections used for accessing the Web Server
    - » Expected Effort: ½ day towards the end of development
- **Web Server / Web Application (…)**

Example: Security Test Report



Illustrative Example

- **Mobile Device**
- Risk: Attacker might inject JavaScript (XSS)
- Security Control 1: Use only UI5 controls
- Assumption: SAP Kapsel with SMP and Afaria
  - Test: Static Code Analysis using Checkmarx
    - » Result: no issues
    - » Actual Coverage: all client-side JavaScript code
    - » Actual Effort: total effort 2 days (15min per day, instead of expected 10)
- Security Control 2: use only SSL connections with valid certificates
  - Test 1: Static Code Analysis for finding non-https connections
    - » Result: exempted one issue
    - » Actual Coverage: all client-side JavaScript code
    - » Actual Effort: included in effort for scans for Security Control 1
  - Test 2: Manual test with invalid certs (e.g., self-signed, own CA)
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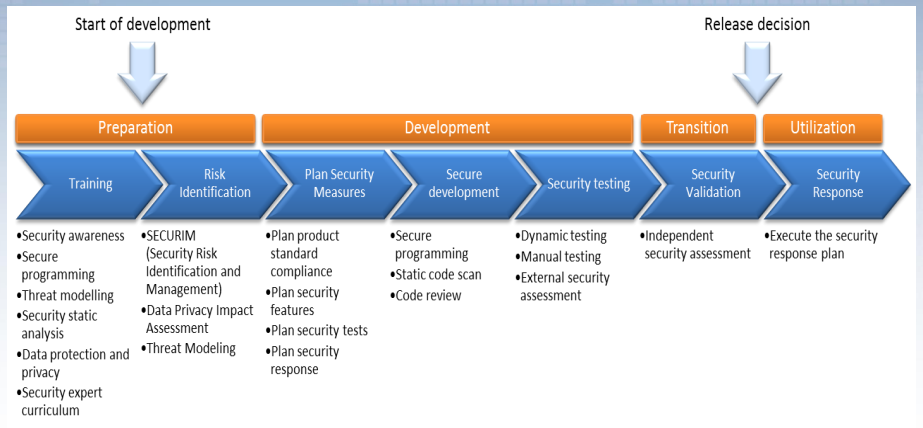
SAP's S²DL



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 S²DL
  - 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)

- Note, 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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LESSONS LEARNED

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Key Success Factor

- A holistic security awareness program for
  - Developers
  - Managers

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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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CONCLUSION

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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

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