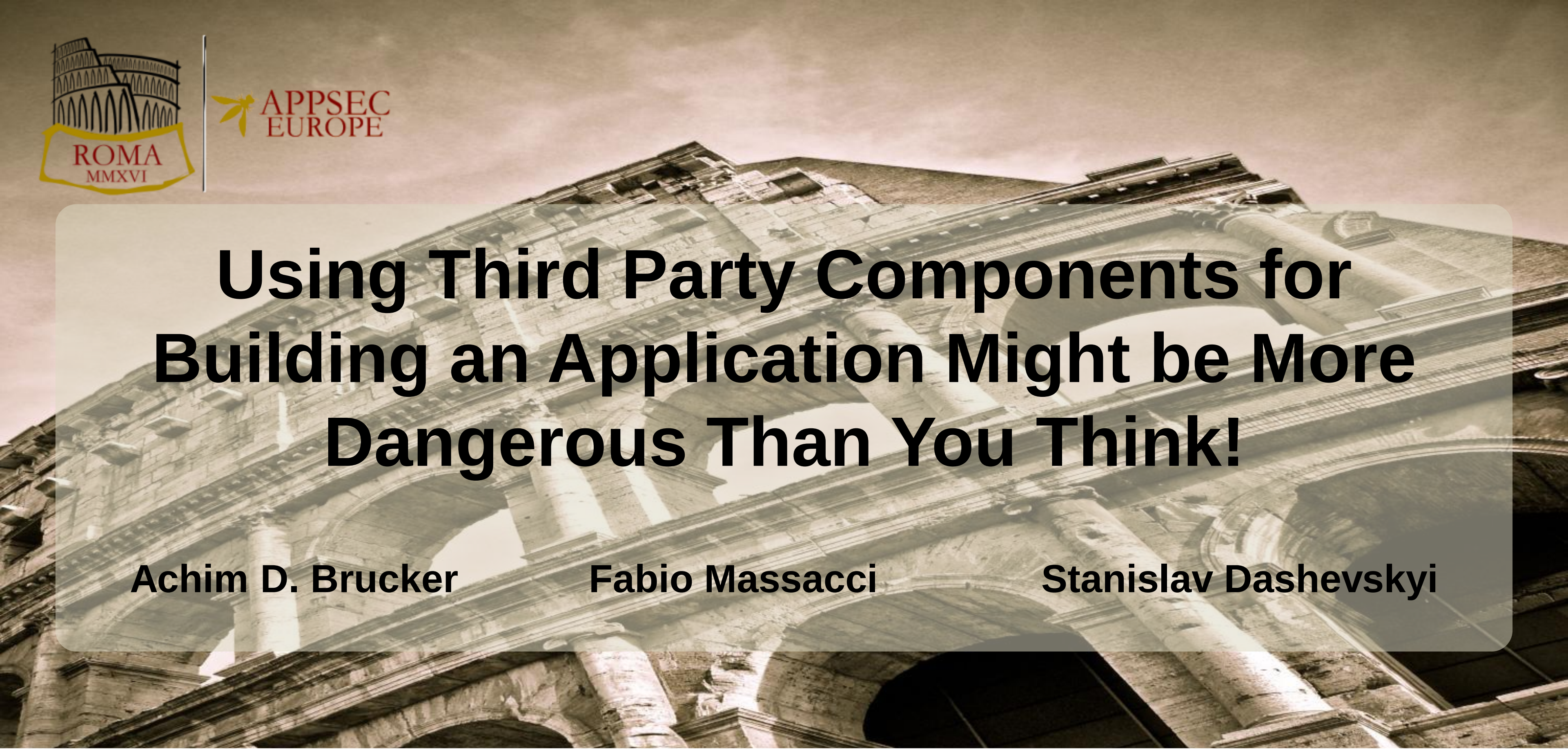

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APPSEC EUROPE

Using Third Party Components for Building an Application Might be More Dangerous Than You Think!

Achim D. Brucker Fabio Massacci Stanislav Dashevskyi

The University Of Sheffield.

SAP

FONDAZIONE BRUNO KESSLER

UNIVERSITY OF TRENTO - Italy

Abstract

Today, nearly all developers rely on third party components for building an application. Thus, for most software vendors, third party components in general and Free/Libre and Open Source Software (FLOSS) in particular, are an integral part of their software supply chain.

As the security of a software offering, independently of the delivery model, depends on all components, a secure software supply chain is of utmost importance. While this is true for both proprietary and as well as FLOSS components that are consumed, FLOSS components impose particular challenges as well as provide unique opportunities. For example, on the one hand, FLOSS licenses contain usually a very strong “no warranty” clause and no service-level agreement. On the other hand, FLOSS licenses allow to modify the source code and, thus, to fix issues without depending on an (external) software vendor.

This talk is based on working on integrating securely third-party components in general, and FLOSS components in particular, into the SAP's Security Development Lifecycle (SSDL). Thus, our experience covers a wide range of products (e.g., from small mobile applications of a few thousands lines of code to large scale enterprise applications with more than a billion lines of code), a wide range of software development models (ranging from traditional waterfall to agile software engineering to DevOps), as well as a multiple deployment models (e.g., on premise products, custom hosting, or software-as-a-service).

About Us

Achim D. Brucker

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- Software Security Consultant
- Until 12/2015: Security Testing Strategist at SAP SE, Germany

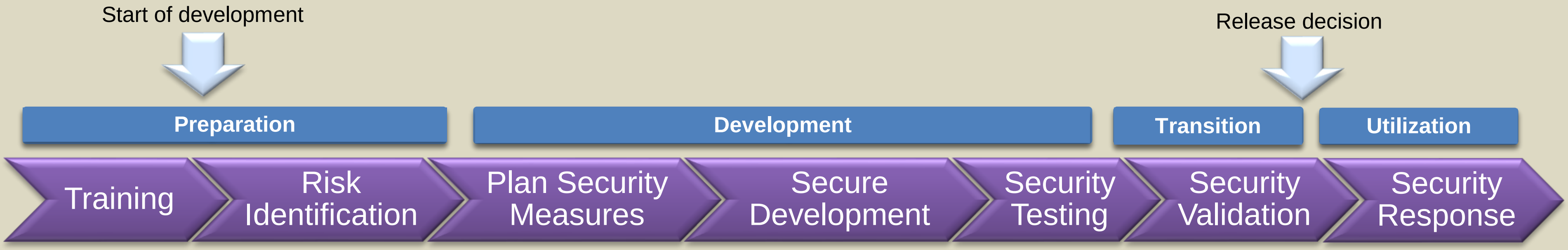
Stanislav Dashevskyi

- PhD Student at the University of Trento and SAP SE, France

Part I:

Securing The Software Supply Chain
or
The Security Risk of Third Party Components

Secure Software Development



Start of development

Release decision

Preparation | Development | Transition | Utilization

Training

- Security awareness
- Secure programming
- Threat modeling
- Security static analysis
- Data protection and privacy
- Security expert curriculum

Risk Identification

- Security Risk Identification and Management (SECURIM)
- Data Privacy Impact Assessment
- Threat Modeling

Plan Security Measures

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

Secure Development

- Secure programming
- Static code scan
- Code review

Security Testing

- Dynamic testing
- Manual testing
- External security assessment

Security Validation

- Independent security assessment

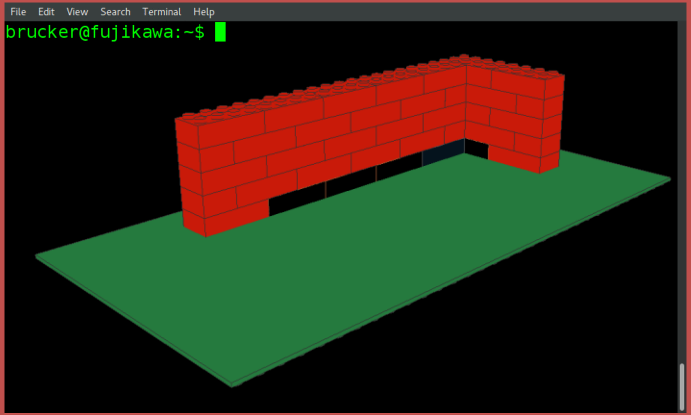
Security Response

- Execute the security response plan

Source: SAP’s Security Development Lifecycle (S^2DL)

Secure Software Development

How We Used To Develop Software



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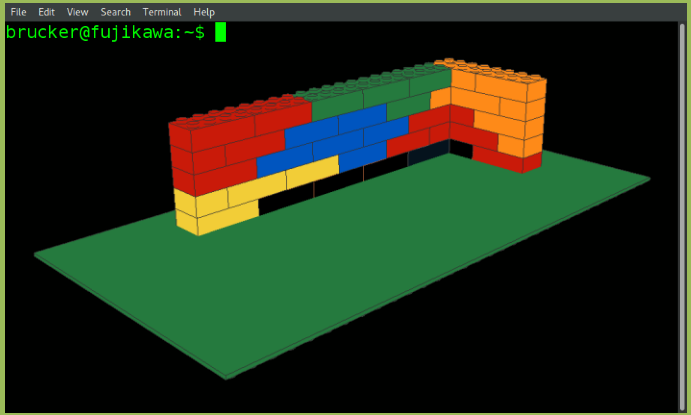
- Very few external dependencies
- Full control over source code

How We Develop Software Today



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- Many external dependencies
- Only control over a small part of the source code

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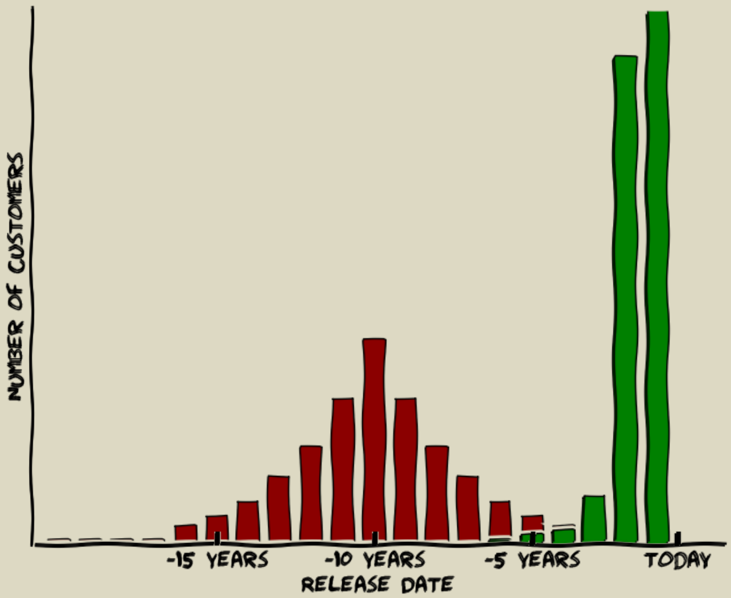
The Maintenance Challenge

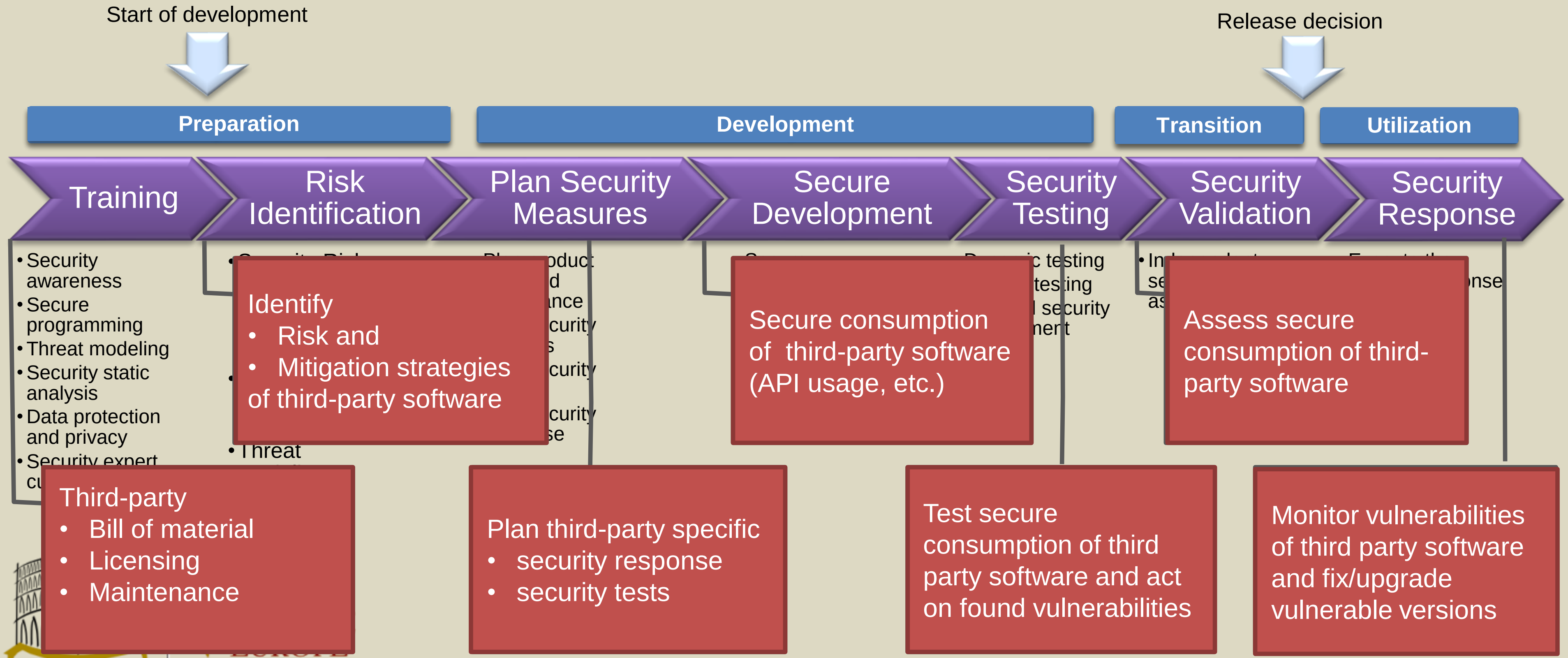


- > 90% of customers are using the latest two releases

- > 50 % of customers are using releases older 10 years

Product	Release	EoL	Ext. EoL
Windows XP	2001	2009	2014
Windows 8	2012	2018	2023
SAP SRM	2006	2013	2016
Red Hat	2012	2020	2023
Tomcat	2007	2016	n/a

Secure Software Development



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Identify
- Risk and
- Mitigation strategies

of third-party software

Secure consumption of third-party software (API usage, etc.)

Assess secure consumption of third-party software

Third-party
- Bill of material
- Licensing
- Maintenance

Plan third-party specific
- security response
- security tests

Test secure consumption of third party software and act on found vulnerabilities

Monitor vulnerabilities of third party software and fix/upgrade vulnerable versions

Source: SAP's Security Development Lifecycle (S^{2}DL)

Types of Third-Party Software

	Commercial Libraries Outsourcing Bespoke Software	Freeware	Free/Libre Open Source Software (FLOSS)
	• Outsourcing • SAP HANA	• Jabra Device Driver • NVIDIA Device Driver	• Apache Tomcat • JQuery
Upfront costs	**High**	**Low**	**Low**
Ease of access (for developers)	**Hard**	**Medium**	**Easy**
Modification of Source Code	**Depends on contract**	**Impossible**	**Possible**
Support contract	**Easy**	**Hard**	**Medium**

Types of Third-Party Software

	Commercial Libraries Outsourcing Bespoke Software	Freeware	Free/Libre Open Source Software (FLOSS)
	[illegible]	Device Driver [illegible]iver	• Apache Tomcat • JQuery
Upfront costs	[illegible]	[illegible]	Low
Ease of access (for developers)	[illegible]	[illegible]	Easy
Modification of Source Code	Depends on contract	[illegible]	Possible
Support contract	Easy	Hard	Medium

FLOSS is

- Widely used in industry
- Offers possibility for self-maintenance
- Vulnerability data is available

Data Sources

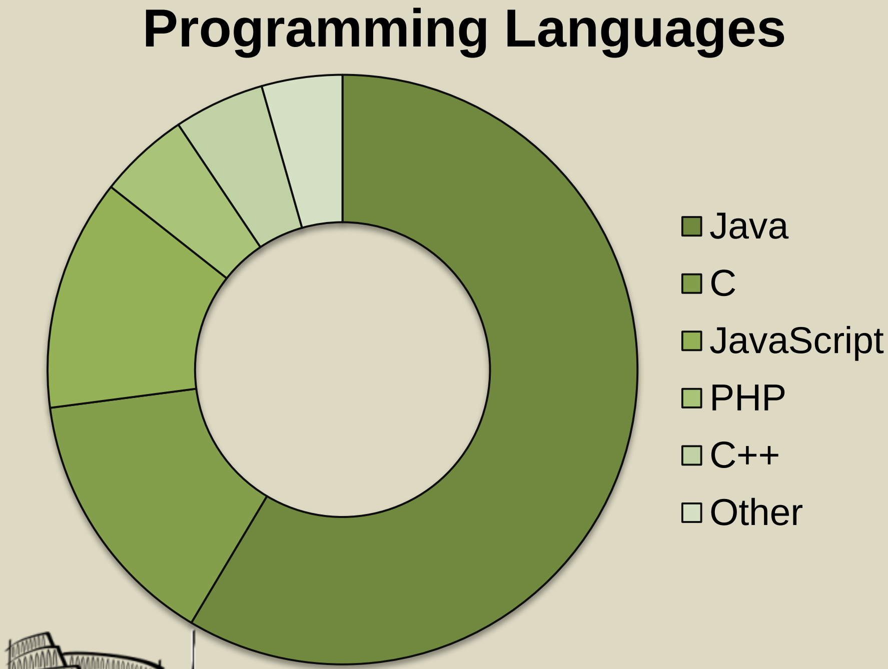
Public

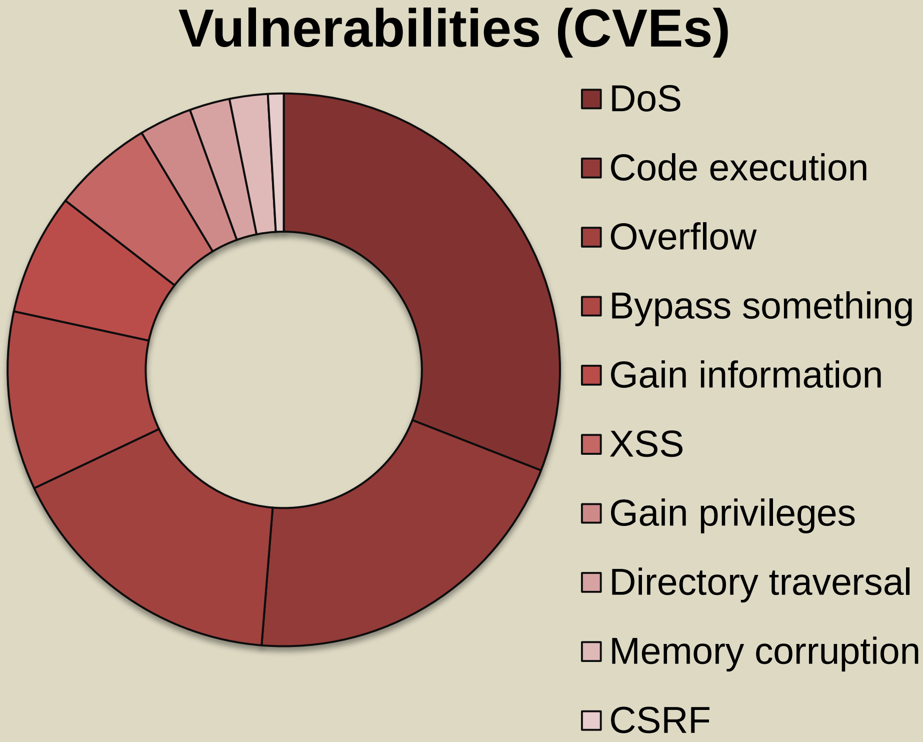
- **FOSS information repositories**
  - Open Hub (formerly Ohloh)
  - Core Infrastructure Initiative (CII) Census project
- **Public databases of vulnerabilities**
  - National Vulnerability Database (NVD)
  - Exploit Database website (ExploitDB)
  - Open Sourced Vulnerability Database (OSVDB)
- **Project data**
  - Coverity FOSS scan service
  - Source code repositories

Internal

- Software inventory (e.g., Black Duck Code Center as used by SAP)

FLOSS Usage At SAP





Based on the 166 most used FOSS components (as of autumn 2015)

Part II:

Security of Open Source Enterprise Frameworks
or
Assessing Risks and Planning Efforts of the Secure Consumption of FLOSS

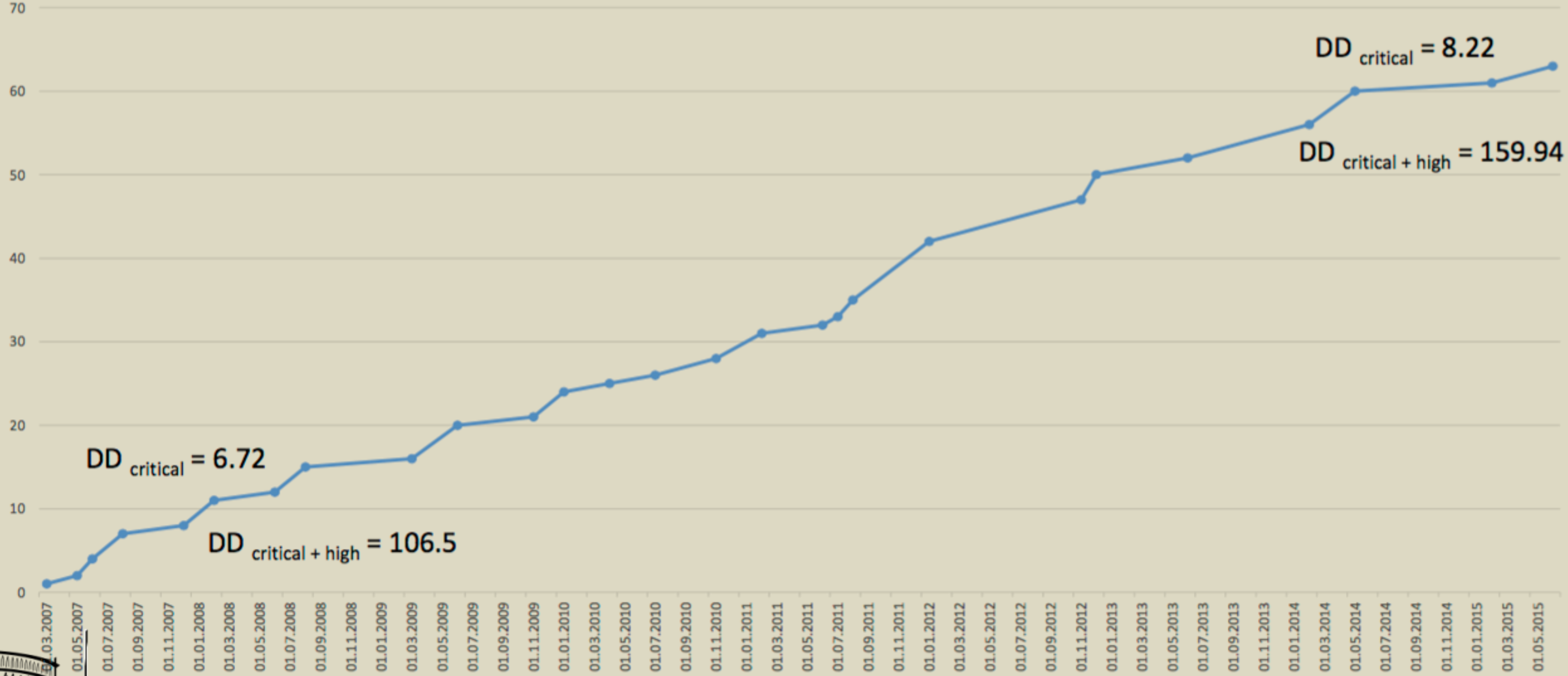
What We Want

1. How many vulnerabilities will be published next year for component X?

2. How often do I need to ship a patch to fix a vulnerability caused by component X?

https://www.flickr.com/photos/fimbrethil/4507848067/

Vulnerability Prediction?



$DD_{critical} = 6.72$

$DD_{critical + high} = 106.5$

$DD_{critical} = 8.22$

$DD_{critical + high} = 159.94$

Tomcat 6.x publicly known vulnerabilities (CVEs)

Vulnerability Prediction: Problems

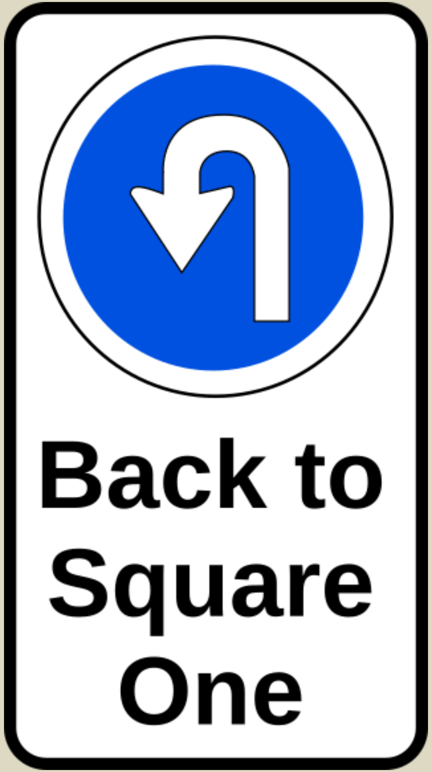
- **There is not enough data**

- **Number of vulnerabilities depends on:**

  Age of the project

  Number of users

- **Sometimes you simply have no choice…**



Understanding Factors Is More Critical Than Predictions

- **When will a vulnerability appear in a FOSS component?**
  - We do not know

- **Can we distinguish features of projects causing "problems" for consuming software?**
  - We use maintenance effort of proprietary consumers to denote “problems”
  - Does the ”security culture” of FOSS developers make a difference?
  - Does is make a difference which main language/technology is used?

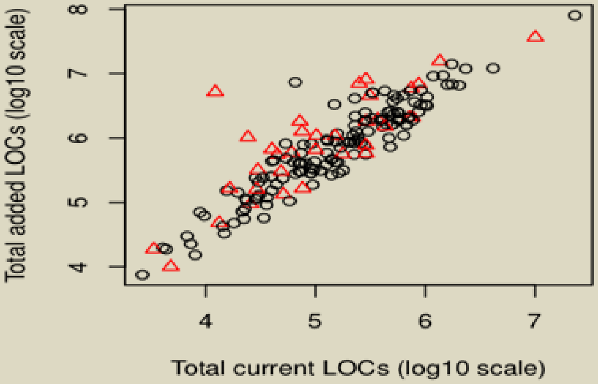
Which Factors Are Interesting?

- **Collect all possible data, build a regression model to asses the impact of each factor**

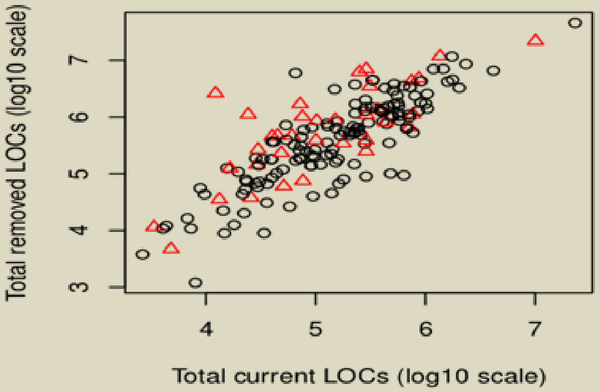
- **Can we use all data that is available?**
  - Actual Total #LoCs of a component
  - Added Total #LoCs of a component
  - Removed Total #LoCs of a component
  - Changed Total #LoCs (added, removed, etc.)...

Relationships Between Factors

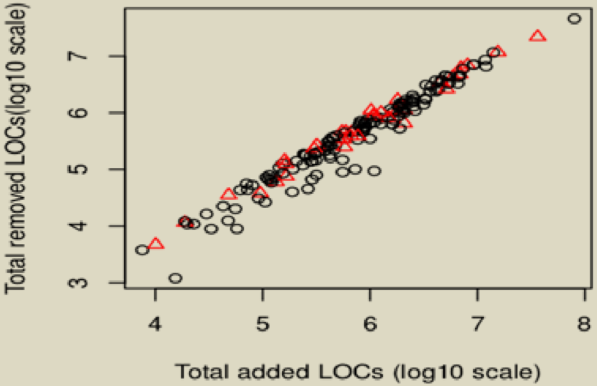
LOCS_TOTAL vs LOCS_ADDED



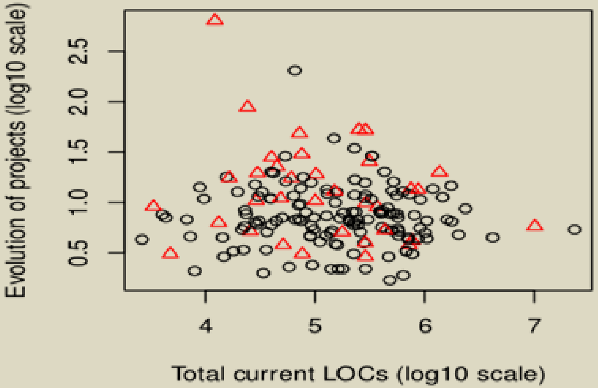
LOCS_TOTAL vs LOCS_REMOVED



LOCS_ADDED vs. LOCS_REMOVED



LOCS_TOTAL vs LOCS_EVOLUTION



Different Maintenance Models

- **60 products are using Apache Tomcat**
  - Requires a lot of expertise to resolve security issues
  - It makes more sense to have a team of Apache Tomcat experts around

- **2 products are using a small JavaScript library**
  - This does not require any major expertise
  - However, if a company ends up using large number of products for which only the “local” expertise exists, it may be problematic

Centralized Security Maintenance

- Policy: dev. teams must select only components widely used and supported within a company

- A central team resolves vulnerabilities in all FOSS components and pushes changes to all consumers

- The security maintenance effort scales logarithmically with the number of products consuming a component

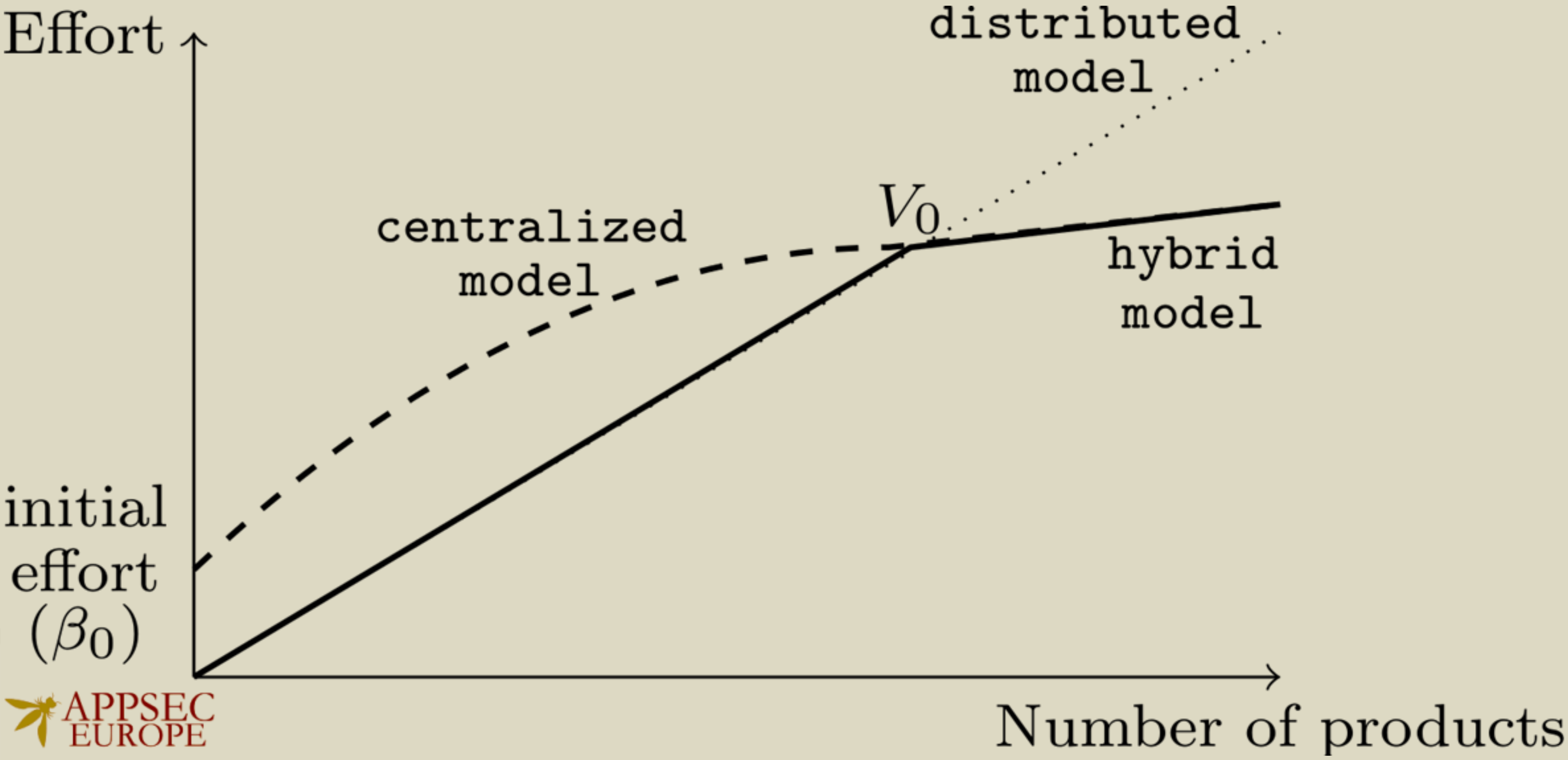
$$effort_i \propto \log\left(|vulns_i| * |products_i|\right)$$

Distributed Security Maintenance

- Policy: each dev. team is free of selecting appropriate components
- Each team has to take care of security issues individually
- While this model should decrease the effort for organizational aspects (not considered by us), it adds up for the technical part of the effort

$$effort_i \propto |vulns_i| * |products_i|$$

Hybrid Security Maintenance



Part III:

Practical Recommendations On
Controling Risk & Effort Of Using Third Party Components

Strategies For Controlling Risks (1/2)

Secure Software Development Life Cycle

- Maintain a detailed software inventory
  (Do not forget the dependencies)
- Actively monitor vulnerability databases
- Assess project specific risk of third-party components

Obtaining components (or sources)

- Download from trustworthy sources
  (https, check signatures/checksums)

Strategies For Controlling Risks (2/2)

Project Selection

- Prefer projects with private bug trackers
- Evidences of a healthy/working SDLC
  - Documented security fixes/patches (no “secret” security fixes)
  - Documented security guidelines
  - Use of security testing tools

https://www.coreinfrastructure.org/programs

Strategies For Controlling Effort

Secure Software Development Life Cycle

- Update early and often
- Avoid own forks
  (collaborate with FLOSS community)

Project selection

- Large user base
- Active development community
- Technologies **you** are familiar with
- Compatible maintenance strategy/life cycle
- Smaller (in terms of code size) and less complex might be better

Part IV:

Conclusion

Conclusion

Do not waste time with unimportant questions!

(Is FLOSS more/less secure as proprietary software)

Implement a secure consumption strategy:

- Risk assessment of third party consumption (at least security & licenses)
- Plan for the efforts of secure consumption
- Plan the efforts/costs for response and maintenance

Conclusion

Do not waste time with unimportant questions!

(Is FLOSS more/less secure as proprietary software)

Final advice:

- Accept that you can be hit by a “black swan” (e.g., heartbleed)
- If it happens:
  - Concentrate on understanding and fixing the issue
  - Understanding why you did not find the swan earlier should not be your first priority

Thank you!

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