Teste e Verificação de Software

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Static Analysis

Analysis of software development artifacts, e.g., requirements or code, carried out without execution of these software development artifacts. Static analysis is usually carried out by means of a supporting tool. [ISTQB]

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Static Testing

- Testing done in a non-runtime environment
- **Review**
  - Errors in user requirements, architecture, design or use cases
- **Static Analysis**
  - The code is structurally tested without being run
  - Generally done with a support tool

Why is Static Analysis important?

- According to ESI International, approximately 50% of project failures result from poor definition of the user requirements
- Goes hand in hand with proper agile methodology implementation
- Helps setting the project for success from the very first stages
- Documentation analysis, otherwise neglected

Why is Static Analysis important?

- Whitebox visibility
- Cost-efficient
- Structural analysis
- Generate internal tests
- Early error detection
- Automated scan on all code
- Exact location error detection

Goals of Static Analysis

- Detect errors that go silent through dynamic analysis
- Code refactoring suggestions
- Enforce attention to artifacts often neglected by developers

Dynamic vs Static Analysis

- Designed to test the code during runtime
- Only verifies the part that is executed
- Misleading security sense
- Exact error locations are hard to find
- Time consuming in certain situations

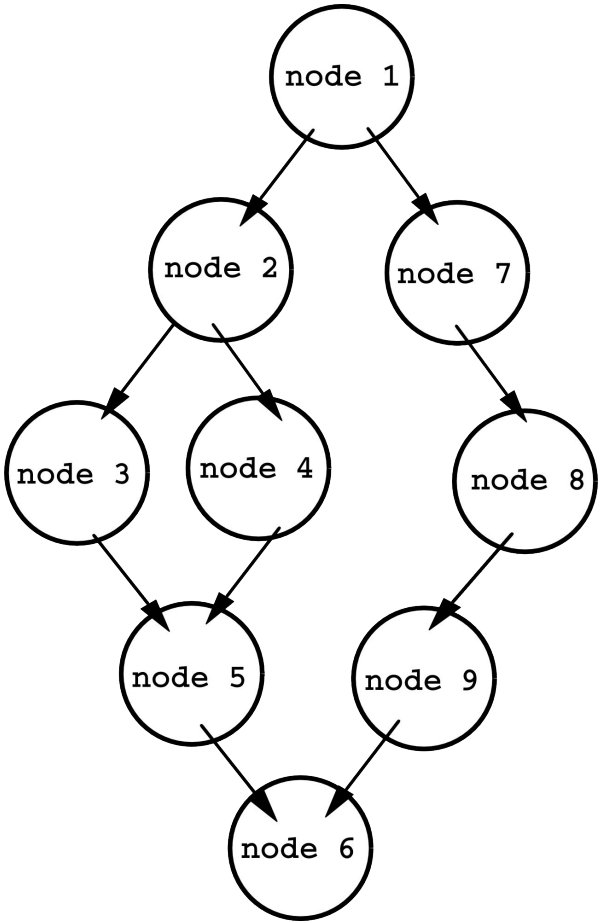
Techniques to analyze static source code

Data Flow Analysis

- Collects runtime information about the data in a program while in its static state
- Code divided into blocks
- Determine input and output for the blocks in order to retrieve data flow

Control Flow Graph

- Used in data flow analysis.
- Representation of the blocks (nodes representing instructions) and data flow (edges representing transitions/paths) in a computer program.



Taint Analysis/Checking

- Checks variables potentially influenced by outside input.
- Creates variable list
- Determines if there's a risk in using those variables (e.g. SQL Injection)
- Feature in some languages

Lexical Analysis

- Transforms code syntax into tokens of information.
- Abstract source code to make it easier to manipulate.

```
<?php $name = "Ryan"; ?>
```

```
T_OPEN_TAG
T_VARIABLE
=
T_CONSTANT_ENCAPSED_STRING
;
T_CLOSE_TAG
```

Strengths

- Early error detection
- Faster non-runtime error detection
- Handles time consuming tasks for developers
- Pinpoints errors against the entire codebase
  - Does not depend on the ran parts of the code

Strengths

- Scales well
- For things that such tools can automatically find with high confidence, such as buffer overflows or SQL Injection Flaws they are great.

Weaknesses

- Static testing done without support tools is very time consuming
- Does not detect runtime errors
- Not enough tools for the variety of programming languages used

Weaknesses

- Limited range in security vulnerabilities
- High number of false positives
- Configuration issues dismissed
- Hard to prove that issues represent vulnerabilities
- Difficulty analysis of uncompilable code

Features of Static Analysis Tools

Coding Standards

- Set of programming rules, naming conventions and layout specifications

Why?

Code Metrics

- Measurement of depth of nesting, cyclomatic number and number of lines of code

Why?

Code Structure

- **Control flow structure** - sequence in which the instructions are executed
- **Data flow structure** - follows the track of the data item as it is accessed and modified by the code
- **Data structure** - refers to the organization of the data itself, independent of the program

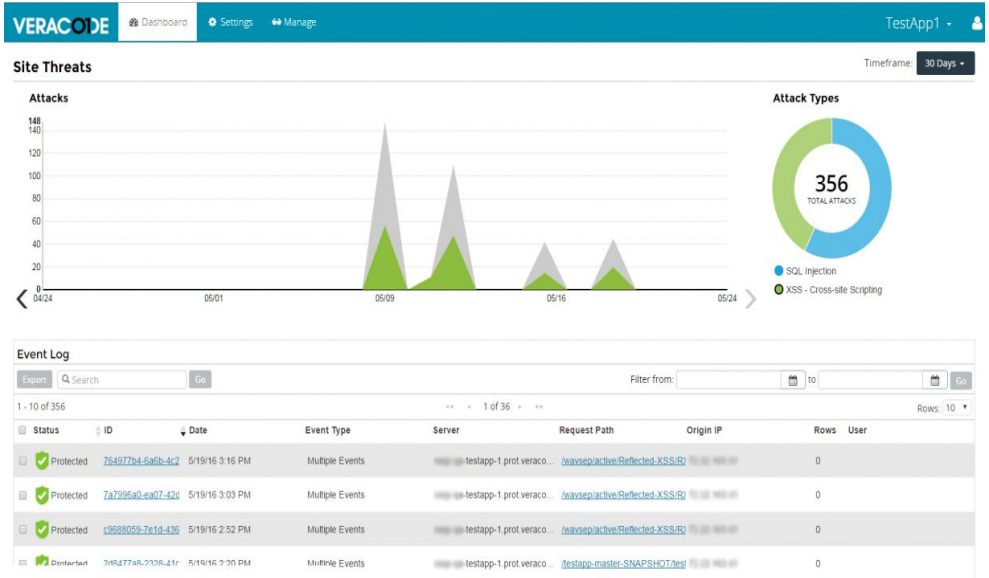
Tools

Criteria when choosing a static analysis tool

- Coverage
- Completeness
- Accuracy of results
- Customizability
- Sustainability / repeatability
- Deployment model
- Usability
- Reporting
- Security
- Cost
- Integration
- Scan performance

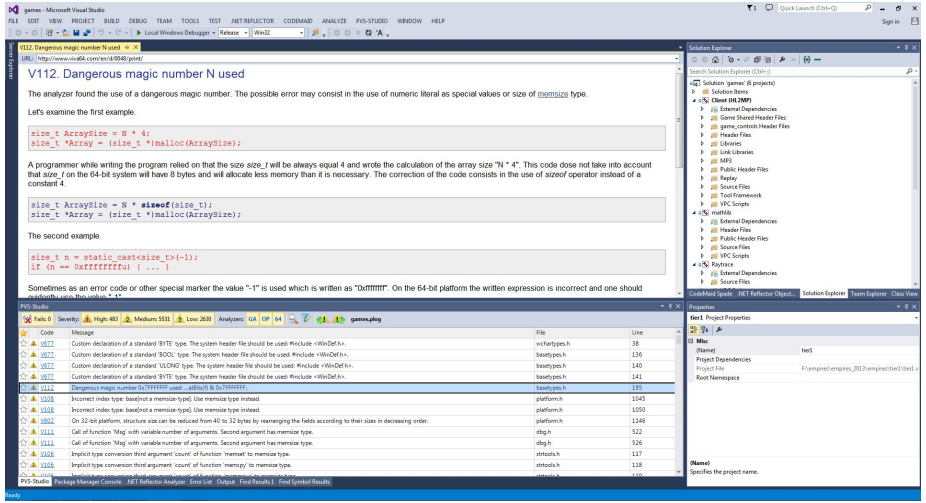
Veracode

- SaaS based
- Static security analysis
- Binary code testing



PVS-Studio

- C, C++ and C#
- Integration with Visual Studio
- Allows for automated static testing
- Windows and Linux



Parasoft

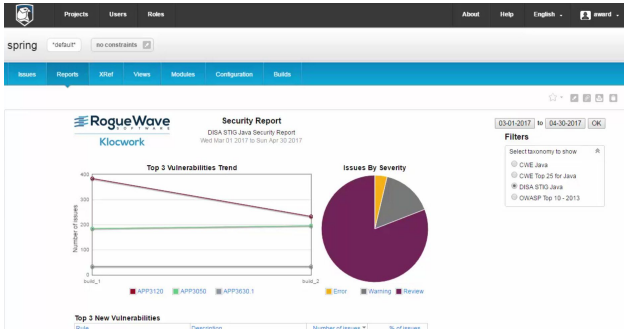
- Supports several static testing methods
- Feature to prevent future static errors

SnappyTrick

- Security oriented
- Faster code scanning
- Platform independent
  - Eliminates OS compatibility issues

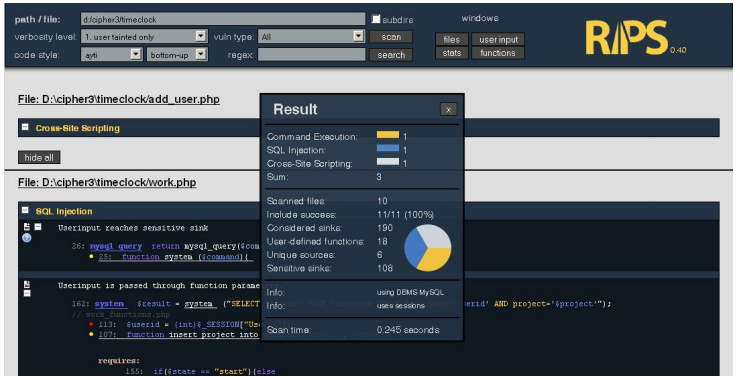
Klocwork

- Finds code vulnerabilities besides semantic related issues
- Runs along the code creation
  - Provides immediate addressing to detected errors



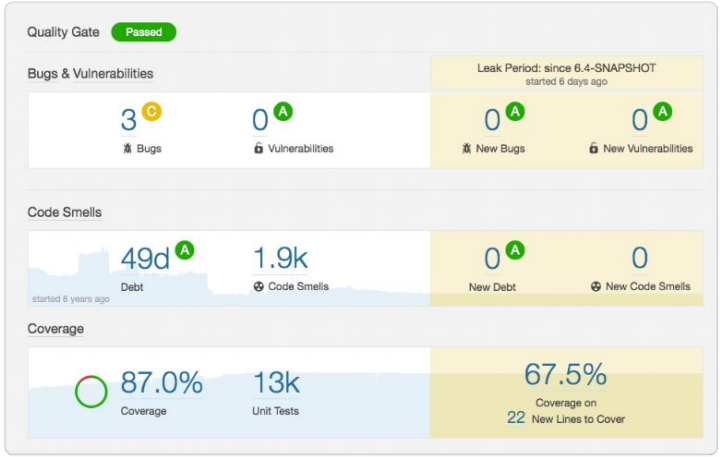
RIPS

- PHP oriented tool
- Support for the most popular PHP frameworks
- Detects complex PHP defects



SonarQube

- Web based platform
- Supports over 20 languages
- Open source
- Provides several quality reports
- Automated



Video

https://github.com/JoaoPere/TVVS-StaticAnalysis