black hat ARSENAL 2022

cwe_checker

Architecture-Independent Binary Vulnerability Analysis black hat ARSENAL 2022

#Who Am I
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cwe_checker

Architecture-Independent Binary Vulnerability Analysis

Security analysis of programs running on embedded devices is difficult

No access to source code

Emulation is difficult

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Reversing binary code is too time-consuming

Cannot perform dynamic analyses directly on the device

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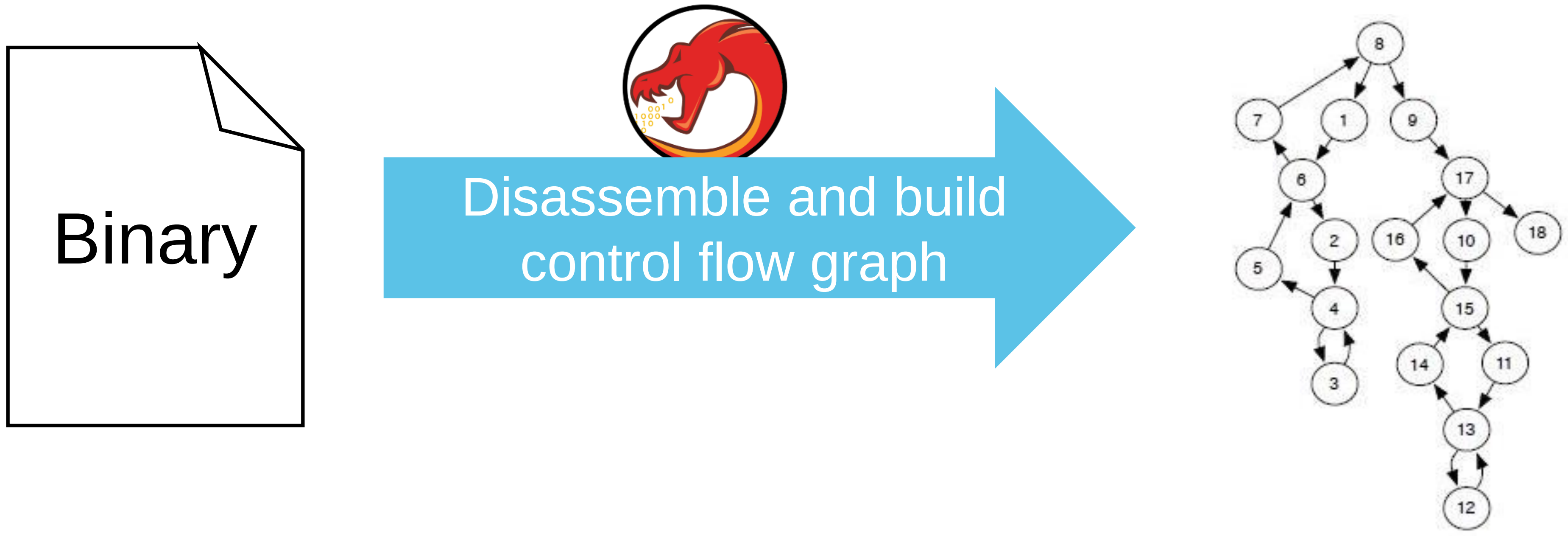
Security analysis of programs running on embedded devices is difficult

Reversing binary code is too time-consuming

Cannot perform dynamic analyses directly on the device cwe checker

- The cwe_checker detects potential bugs and vulnerabilities in binaries
- Helps you focus the manual analysis on important parts

Demo


Binary
Disassemble and build control flow graph
8
7
1
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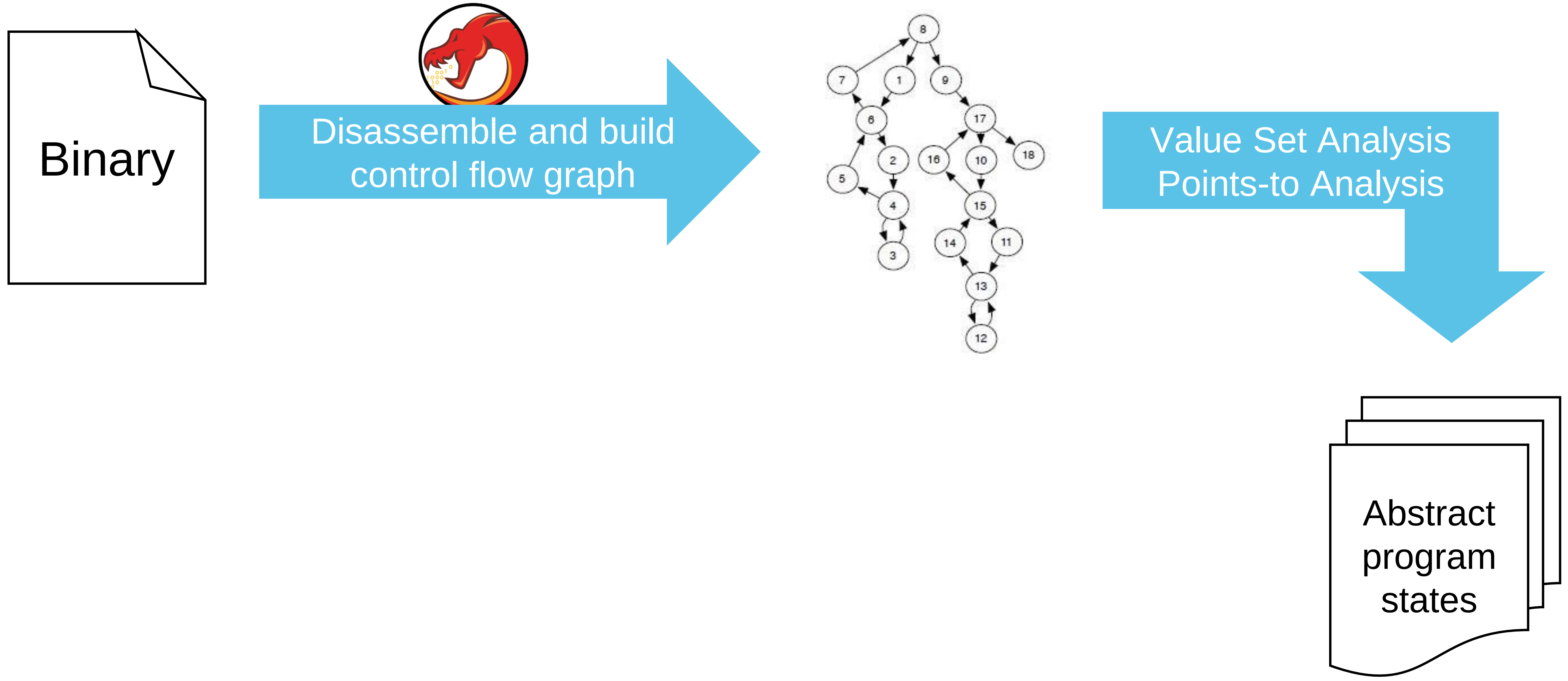
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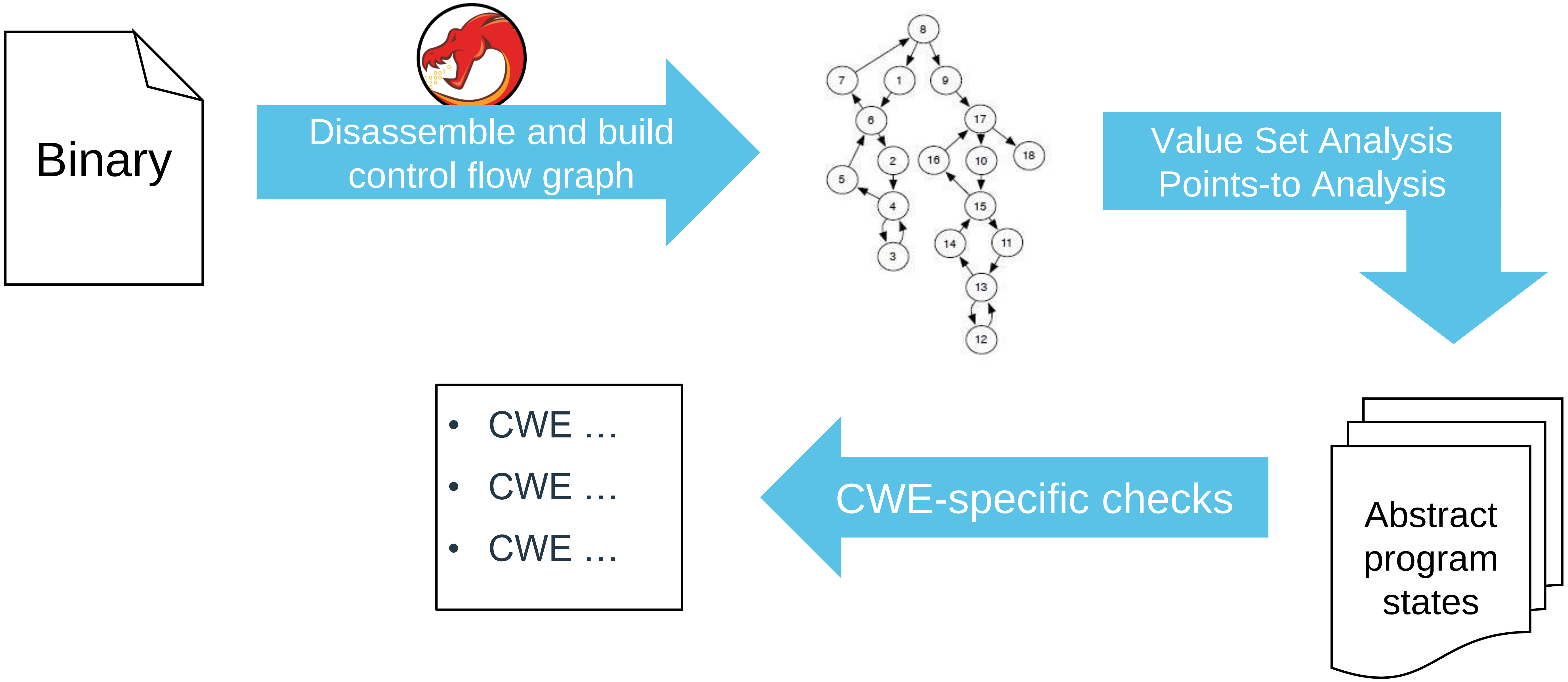
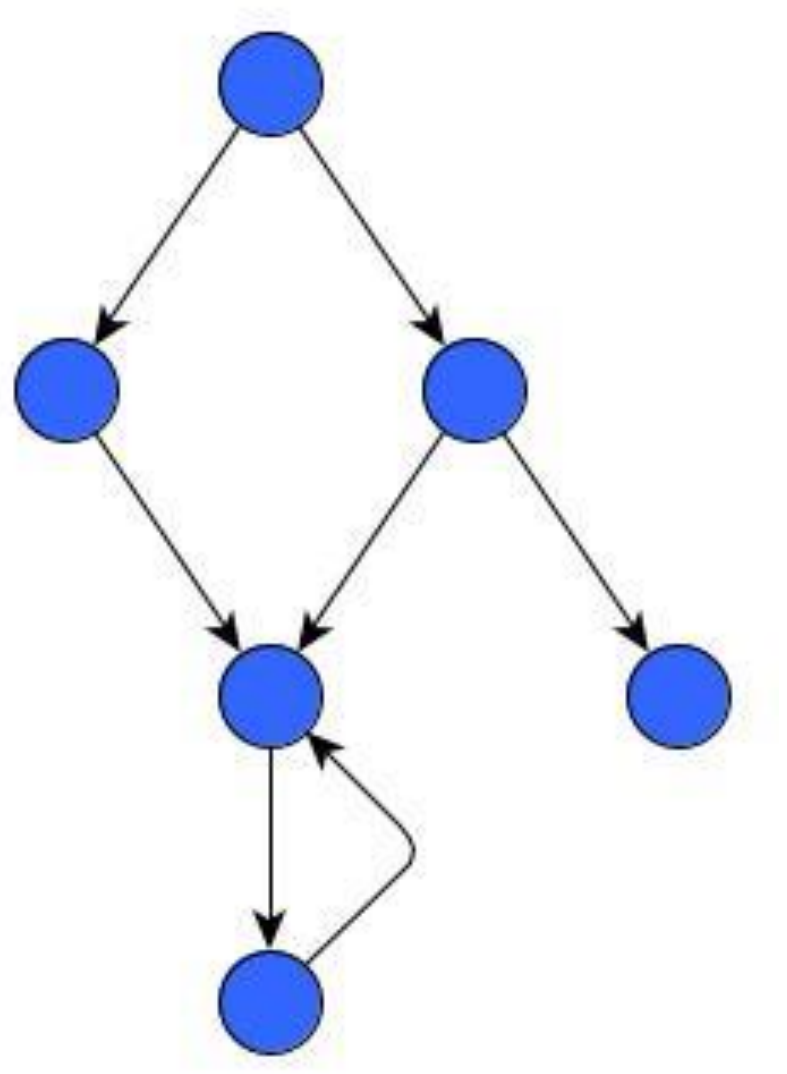
Value Set Analysis
Points-to Analysis
Abstract program states


Binary
Disassemble and build control flow graph
Value Set Analysis
Points-to Analysis
Abstract program states
CWE-specific checks
CWE …
CWE …
CWE …

Example: CWE-476 Null Pointer Dereference

- Via taint analysis



Example: CWE-476 Null Pointer Dereference

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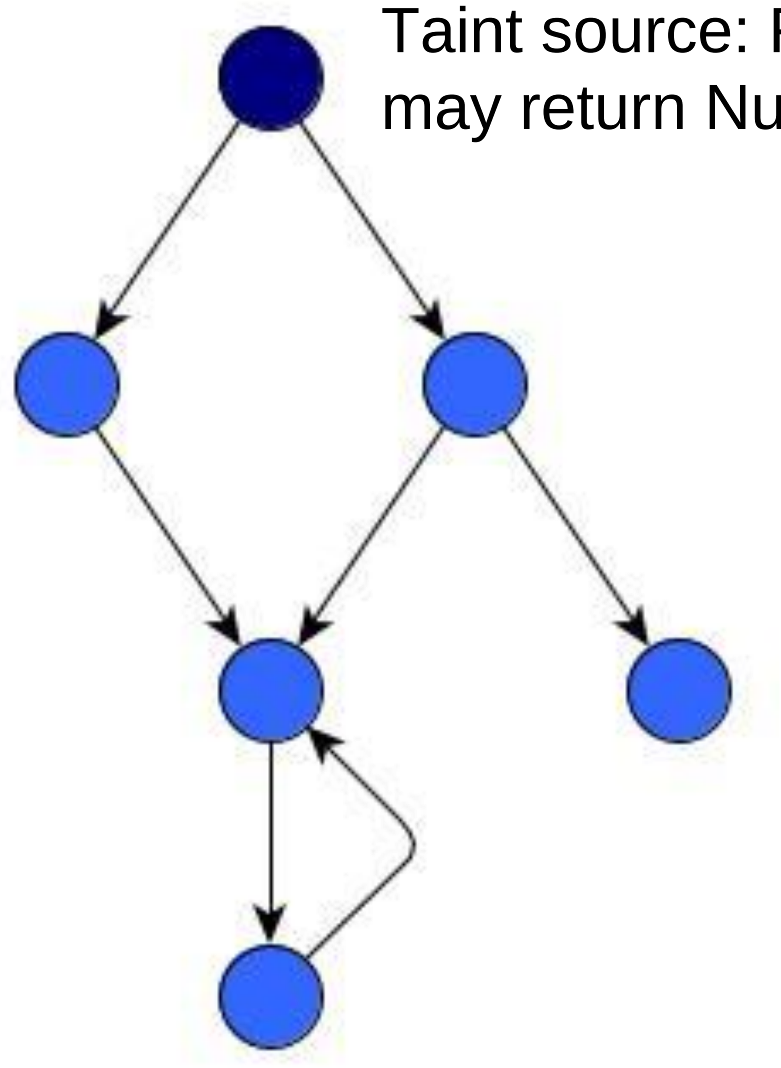
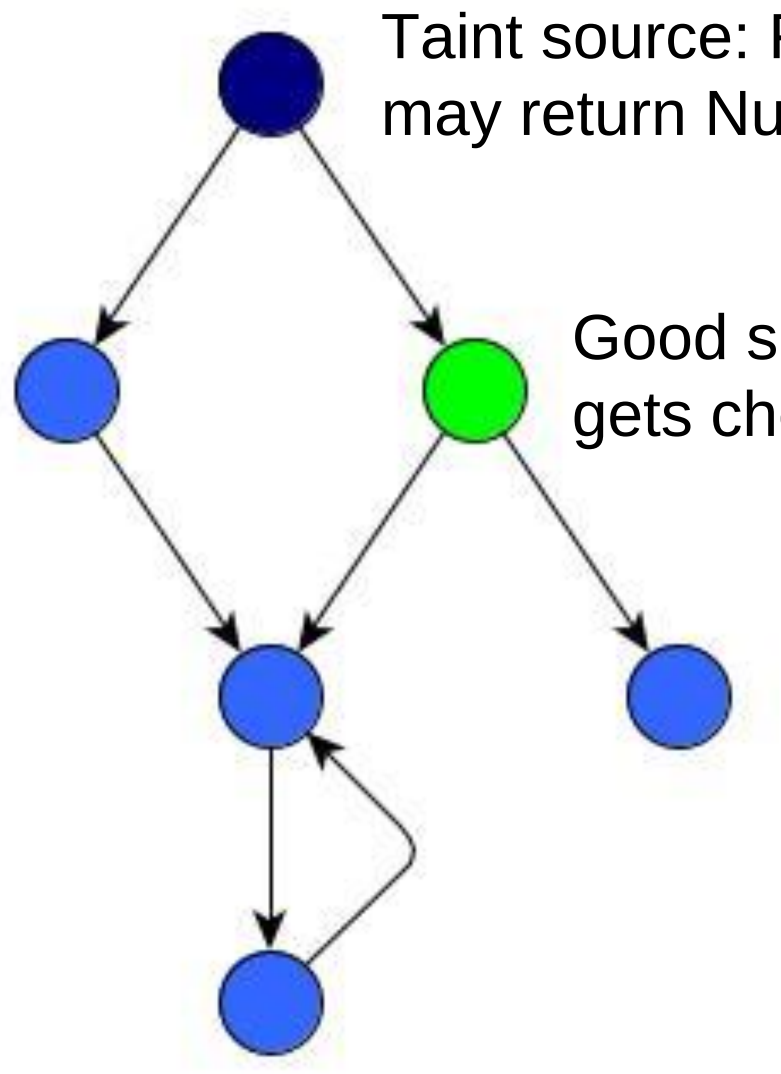


Taint source: Function that may return Null pointer

Example: CWE-476 Null Pointer Dereference

- Via taint analysis

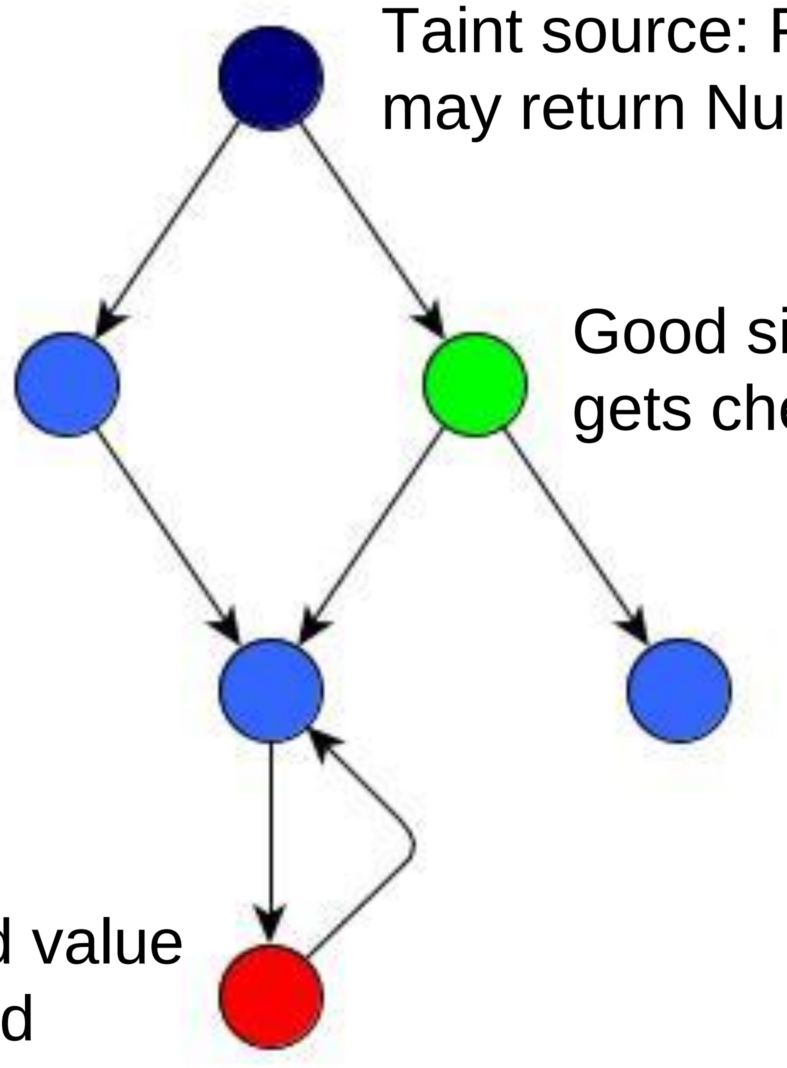


Taint source: Function that may return Null pointer

Good sink: Tainted value gets checked for being null

Example: CWE-476 Null Pointer Dereference

- Via taint analysis



Taint source: Function that may return Null pointer

Good sink: Tainted value gets checked for being null

Bad sink: Tainted value gets dereferenced

Analyze ELF binaries of many different CPU architectures

- x86, ARM, MIPS, PowerPC and more
- Experimental support for bare-metal and PE binaries exists

Contains checks for many bug types

- Currently checks for over 16 different CWE types implemented
- Behavior of checks configurable

Fast analysis

- Good for quick initial assessments
- Scan whole firmware images for certain bug types

Bugs need to be verified manually

- Path insensitivity will lead to false positives for most checks

Not suited for analysis of binaries written in other languages than C

- Control flow graph recovery not (yet) good enough for C++ and other languages

Summary

- The cwe_checker is a tool to quickly find potential bugs and vulnerabilities in firmware binaries.
- Detects 16+ different CWE types
- Based on static analysis
  → Beware of false positives/negatives!
- Easy to try out – just pull the Docker image *fkiecad/cwe_checker*
- Easy to integrate into your own toolchain thanks to JSON output

https://github.com/fkie-cad/cwe_checker
LGPL 3.0 Licence
@cwe_checker