Secure Software Development – SSD

Assignment Defensive Programming

06.12.2023

Winter 2023/24, www.iaik.tugraz.at/ssd

Defensive Programming

Since you’re now an expert in fixing and exploiting bugs,
it is important to know how to avoid them.

Mistakes can happen everywhere

- Mistakes happen everywhere
- Especially in low-level C code
  - Look at the defenselets
- It is up to you to write better, safer code

Write Readable Code

- What does the following code do?
  `!ErrorHasOccured() ??!??! HandleError();`
- Error handling, but what is the `??!??!` operator?

```
#define MAGIC(e) (sizeof(struct { int:-!!(e); }))
```

- It is magic of course! What is `:-!!` though?
- Such code is unreadable and easily causes bugs

https://stackoverflow.com/questions/7825055/what-does-the-operator-do-in-c

https://stackoverflow.com/questions/9229601/what-is-in-c-code

https://stackoverflow.com/questions/652788/what-is-the-worst-real-world-macros

Goal

- Implement software in a secure manner
  - Use good coding style
  - Use defensive programming principles
  - Do proper error handling
  - Write your own tests
- Become a better software-engineer

Task: Defensive Programming

Defensive-Programming Part 1:

Deadline: 14th of January 23:59 (14.01.2024)

Tag: `defensive`

Next KU dates (possible to ask assignment questions):

13.12.2023 / 20.12.2023 / 10.01.2024

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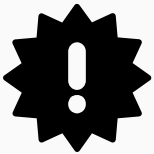
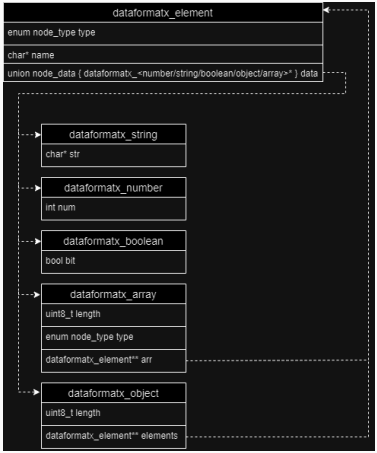


- Upstream: `https://extgit.iaik.tugraz.at/sase/practicals/2023/exercise2023-upstream.git`
  - `defensive/docker.sh`



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  - Load/Write to/from files (already implemented)
  - Working with structure (add, remove, create, free nodes)
  - Handle values of nodes (set, get, merge, split, replace)
- Assignment: Implement remaining functionality

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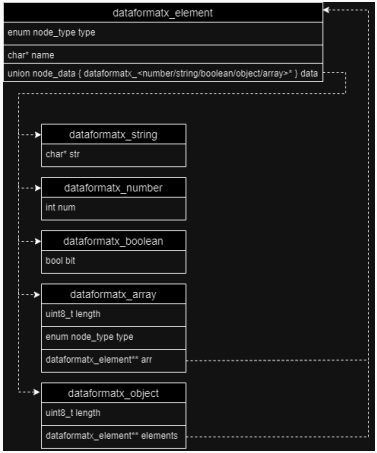

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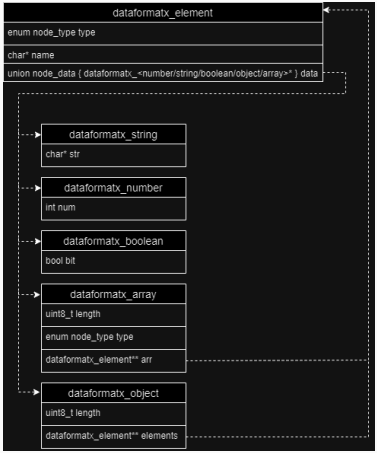

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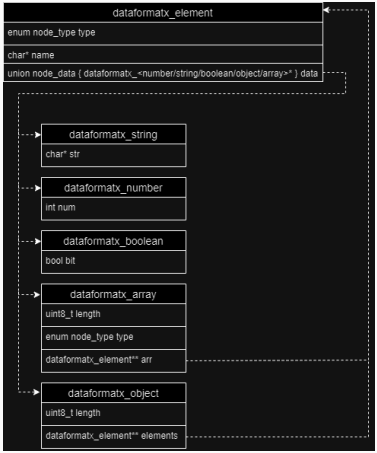

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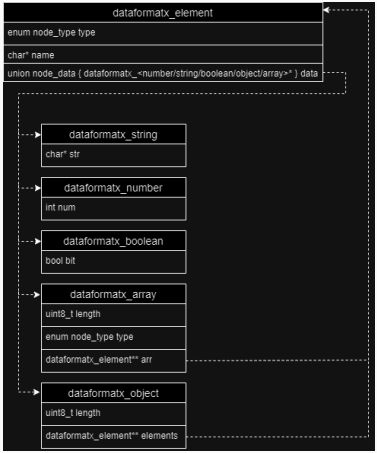

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  - Static code analysis (`cppcheck`/`scan-build`)
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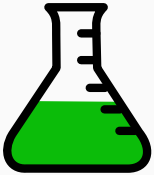

- We provide some basic test cases
- They are correct but do not cover all edge cases!
- Implement your own exhaustive test cases
- Think of corner cases
  - NULL pointers, integer overflows, out of mem, ...
- Good coverage yields bonus points (if above 50%)

Overall branch coverage	Bonus points
65% <= *cov* < 70%	1
70% <= *cov* < 80%	2
80% <= *cov* < 90%	3
90% <= *cov* < 95%	4
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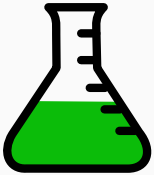

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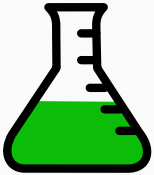

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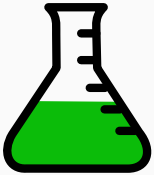

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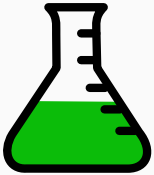

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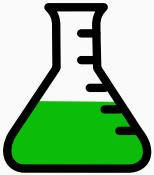

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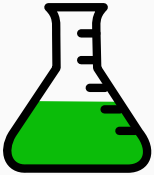

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We test your submission against our own test suite.

Implementation flaws or issues will (in addition to failed testcases) globally reduce points, regardless of whether exploitable or not!

- -5 points per issue
  - Hard program crash, segfault and similar
  - Memory corruptions/leaks, use after free, use of uninitialized memory
  - other stuff reported by valgrind, address sanitizer & co
  - Format string vulnerability, integer overflow, ...
  - Undefined behavior, e.g. `(void*)x + 1`
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