
CONSERVATIVE GC
THE FINAL SEGFAULT

GC: what is needed?

- Allocator
- Mark
- Sweep

Allocator

The whole API:

```
std::map<void*, size_t> allocated;
void* heap;
static constexpr size_t MIN_SIZE =
  sizeof(void*) * 2;

[[nodiscard]] void* allocate(size_t size);
void deallocate(void* p);
```

Mark

Find all reachable objects.
Search begins with GC roots, i.e.

- Globals
- Registers
- Stack

GC roots

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GC roots

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LOGIC [Challenging: Failure] — You didn't think that scanning the globals and the stack would be so easy, right?

Globals and stack

Turns out, finding the location of static memory is quite hard. There's no easy way to do it, only parsing the current ELF file and asking all of the loaded dynamic libraries.

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AUTHORITY [Trivial: Success] — Who cares about globals after all? Check only the registers and the stack.
LOGIC [Easy: Success] — In GC constructor save the current rsp value as the stack base and then iterate over the whole stack, finding the roots.

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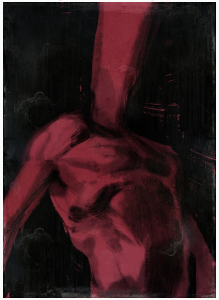

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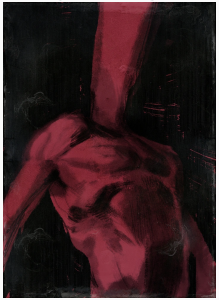

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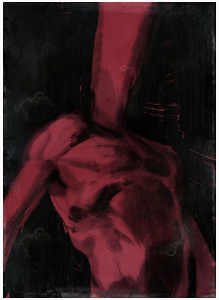

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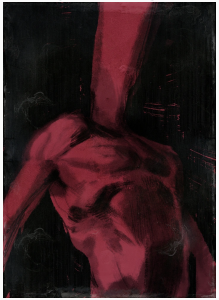

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— Sure thing. But how do we mark the objects that are reachable?
PHYSICAL INSTRUMENT [Heroic: Success] — I'll say it again. The %!@& do you need memory for? Write a bitset for the whole heap.

Sweep phase

Three lines:

```
for (auto&& [ptr, _] : allocator.allocated) {
  if (!reachable[...]) {
    allocator.deallocate(ptr);
  }
}
```

Just find all unreachable blocks and free them.

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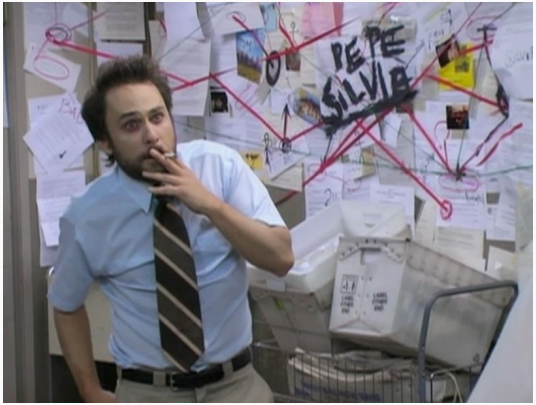

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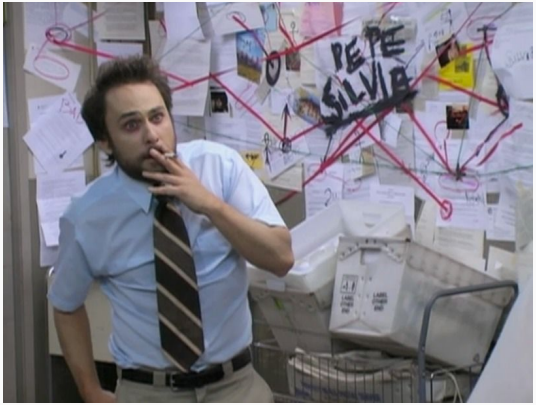
That led to some funny cosequences while testing: ‘std::println‘ uses ‘std::format‘, which, in turn, allocates a string, and its constructor is using ‘new‘.
But we used ‘println‘ for logging in our allocator. We got to the point where doing literally anything with dynamic memory will cause a stack overflow.



IT WORKS (kinda)

Harsh reality

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We plugged in an AVL tree for testing and got all sorts of undefined behaivour. We fixed some UB. We saw some strange register shuffling. We saw the explosion of GoogleTest.

Not so grand finale

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We messed something up with scanning. Probably registers. Now we get a deterministic invalid behaivour.