

Take-home code sample specification for embedded firmware roles

Task

Your goal is to create a glibc-based shared library object (.so) that wraps libc's malloc(), realloc(), calloc(), and free() (see: man 3 malloc) and instruments them to provide statistics every 5 seconds. The wrapping must be activated by utilizing the LD_PRELOAD environment variable technique so that it can be applied to any arbitrary dynamic binary. Initialization could be performed on the first call to any of the wrapped functions. Every 5 seconds or so print out the statistics summary to stderr followed by two newlines. You don't have to use another thread; it is acceptable to just check the time since the last print on an invocation to malloc/realloc/calloc/free.

Requirements

- Should track allocations by age
- Should track allocations by size
- Library should not count anything it does internally as part of the tracking (it should only track the user application)
- Library should be threadsafe

Deliverable

tar file with:

- .c / .cpp files (C/C++)
- Makefile (GNU make, utilizing only GNU compiler tools)
- Any tests you wrote
- Readme on how to build and run, info on your GNU/Linux distribution, plus anything else you want to tell us :)

Notes

- Performance note: You are not expected to make this particularly fast, but asymptotically optimal solutions may be graded higher. It's geared toward more of a memory profiling/debugging tool. You should track both the overall allocations and current allocations, where current allocations is restricted to pointers not yet freed or realloc'd and overall allocations includes every pointer returned since execution started.
- You can use any information from the web as reference. However, please do not wholesale cut and paste anything. If you get stuck, feel free to reach out for assistance. You may also submit an incomplete solution if you have made partial progress. Please include any references you have used in your Readme.

Example

Here is an example printout:

```
>>>>>>>>>>> Sat Jan 6 00:36:26 UTC 2018 <<<<<<<<<<<
```

Overall stats:

209,859 Current allocations

6,123,231 Overall allocations since start

84.3MiB Current total allocated size

Current allocations by size: (# = 8,123 current allocations)

0 - 4 bytes: #####

4 - 8 bytes:

8 - 16 bytes: ####

16 - 32 bytes:

32 - 64 bytes:

64 - 128 bytes:

128 - 256 bytes:

256 - 512 bytes: ##

512 - 1024 bytes: #

1024 - 2048 bytes: #

2048 - 4096 bytes: #

4096 + bytes: #####

Current allocations by age: (# = 8,123 current allocations)

< 1 sec: ###

< 10 sec: ##

< 100 sec: ##

< 1000 sec: #####

> 1000 sec:

Testing

In addition to your own tests, we have found the existing commands to be helpful in finding bugs:

- find /
- google-chrome
- python