

How Slow is 20 Seconds?

`fib(fib)(30)` makes **2,692,537** recursive function calls

So 20 seconds means about **7ms** per call

Latency Numbers Every Programmer Should Know (Dean 2009)

L1 cache reference	1/2 ns		
Branch mispredict	5 ns		
L2 cache reference	7 ns		
Mutex lock/unlock	25 ns		
Main memory reference	100 ns		
Compress 1 K bytes with Zip	3,000 ns	3 µs	
Send 1 K bytes over 1 Gbps network	10,000 ns	10 µs	
Read 4 K randomly from SSD	150,000 ns	150 µs	
Read 1 MB sequentially from memory	250,000 ns	250 µs	
Round trip within same datacenter	500,000 ns	500 µs	
Read 1 MB sequentially from SSD	1,000,000 ns	1,000 µs	1 ms
Disk seek	10,000,000 ns	10,000 µs	10 ms
Read 1 MB sequentially from disk	20,000,000 ns	20,000 µs	20 ms
Send packet CA→Netherlands→CA	150,000,000 ns	150,000 µs	150 ms

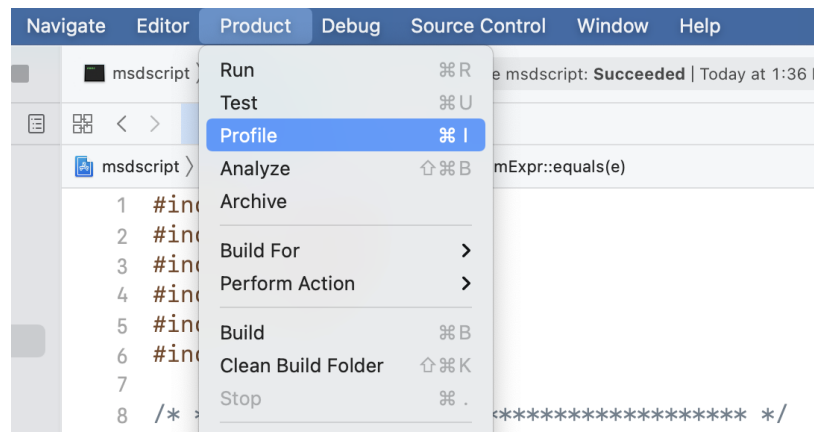
Using a Profiler

Xcode and CLion can both run profilers, but you don't get to type expressions into the profiled program

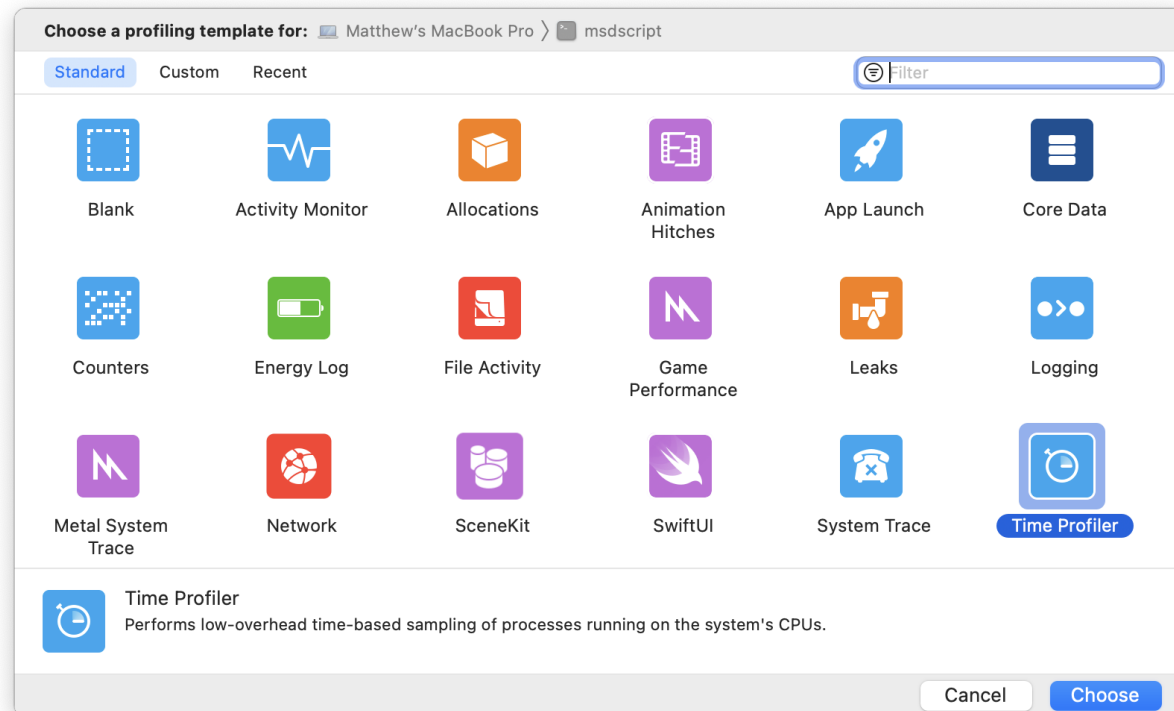
Change `msdscript` to accept a file name as a command-line argument:

```
int main(int argc, char **argv) {
    char *filename = NULL;
    .... // parse arguments from argv,
    .... // maybe setting `filename`
    PTR(Expr) e;
    if (filename != NULL) {
        std::ifstream f_in(filename);
        e = parse(f_in);
    } else
        e = parse(std::cin);
    ....
}
```

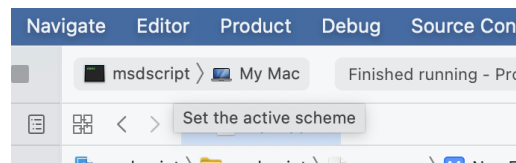
Xcode Profiling Tips



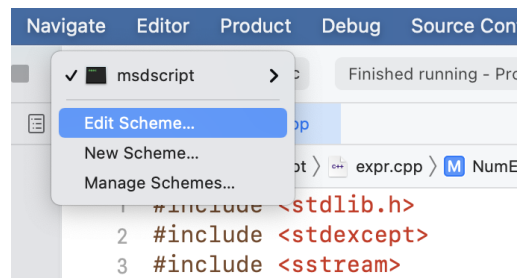
Xcode Profiling Tips



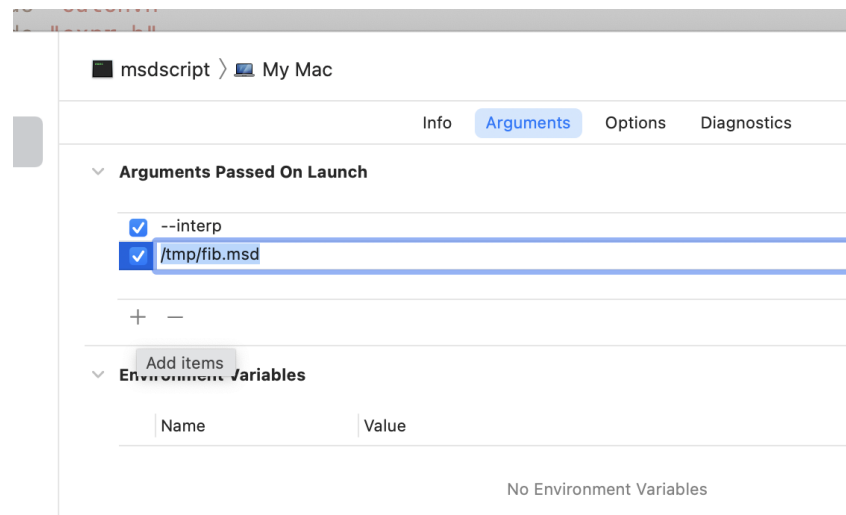
Xcode Profiling Tips



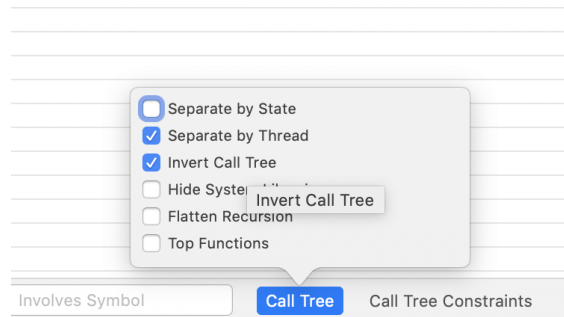
Xcode Profiling Tips



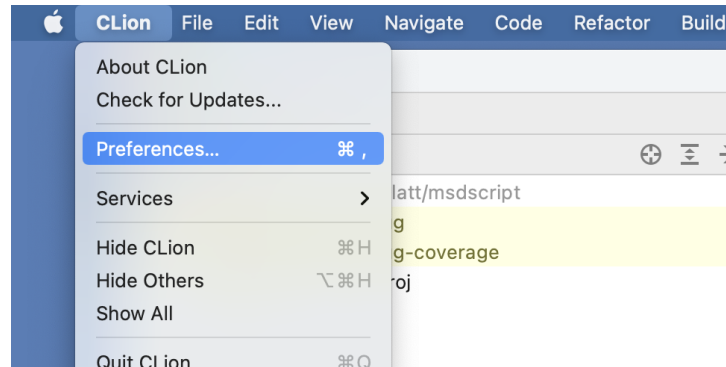
Xcode Profiling Tips



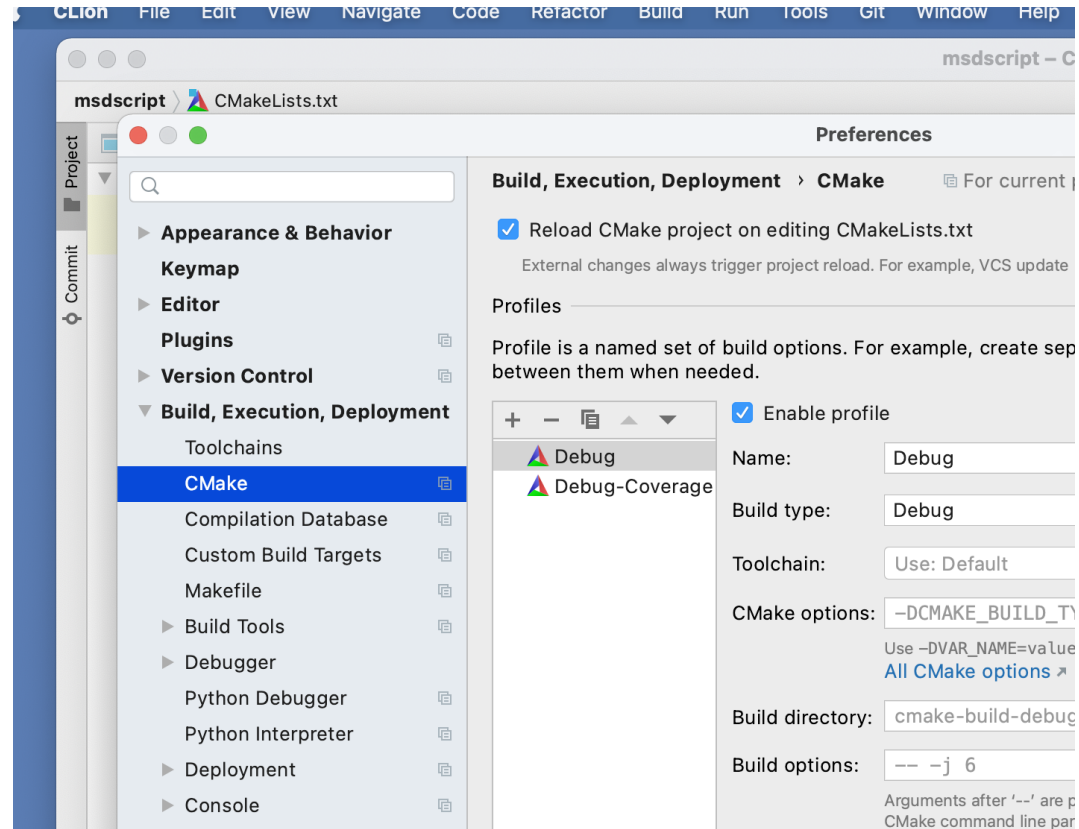
Xcode Profiling Tips



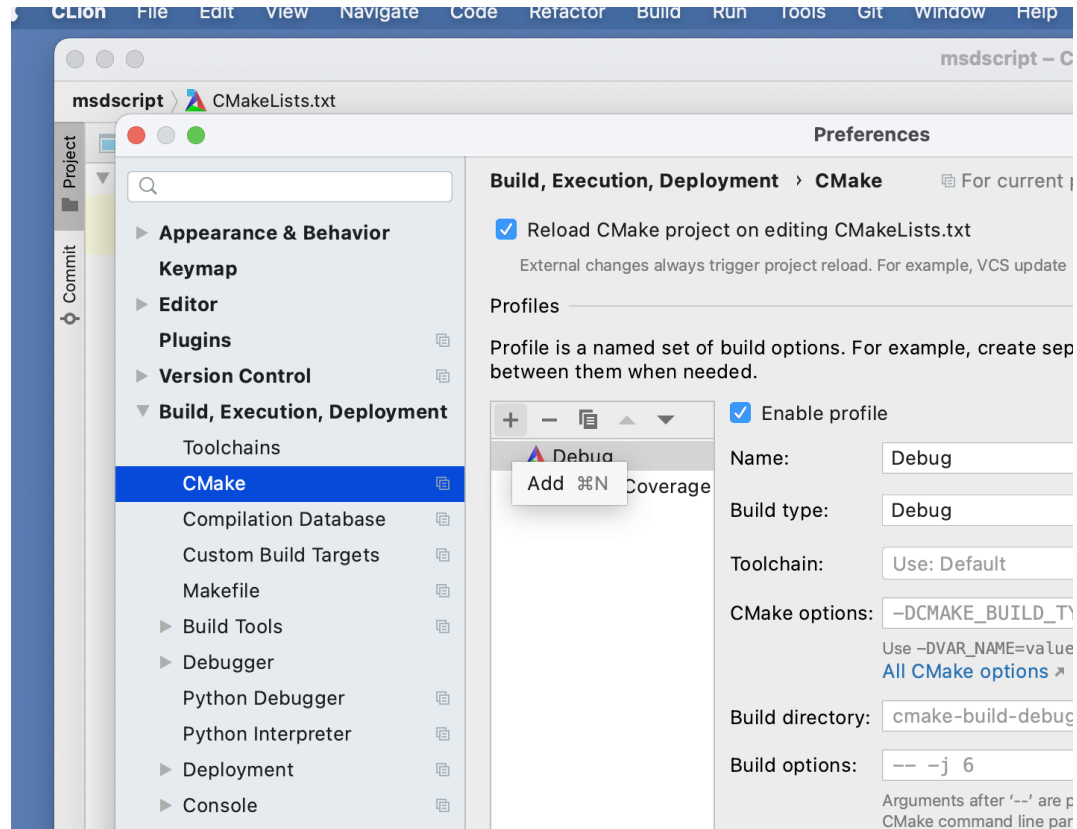
CLion Profiling Tips



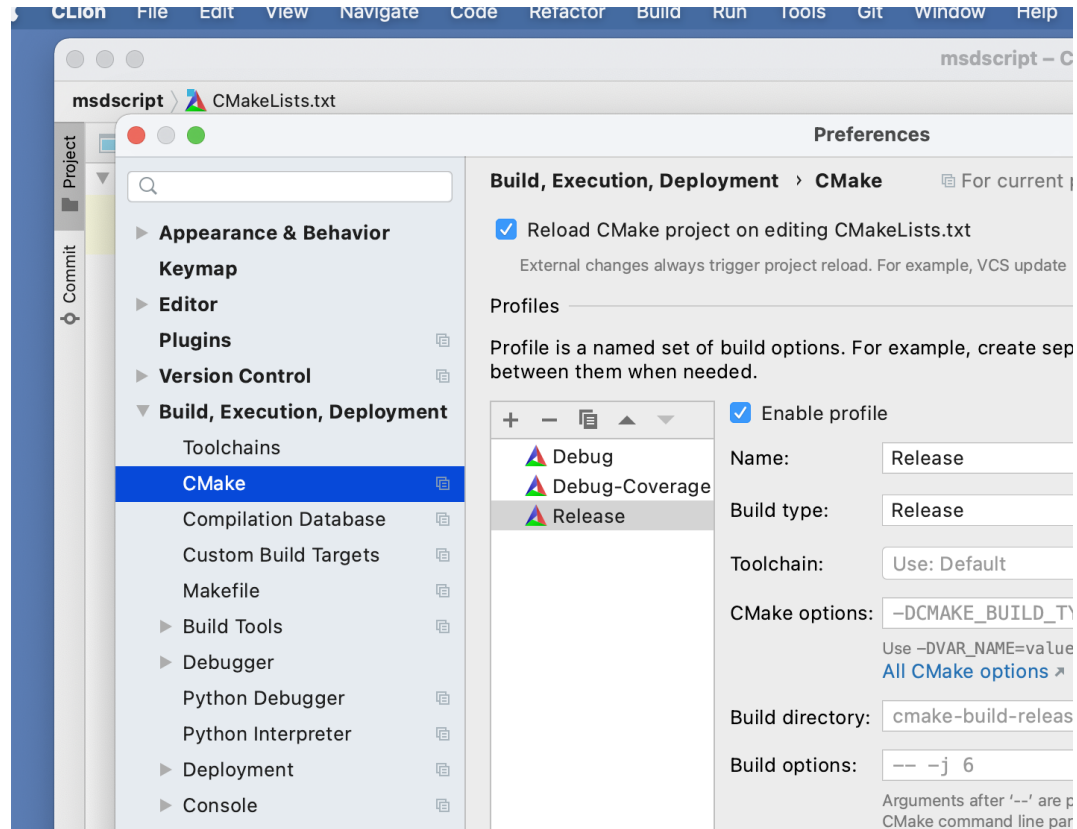
CLion Profiling Tips



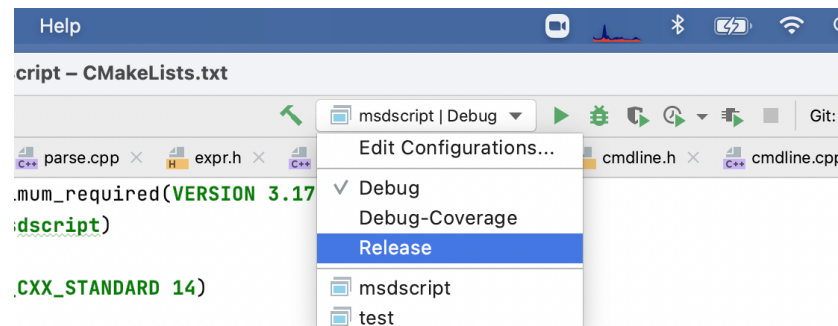
CLion Profiling Tips



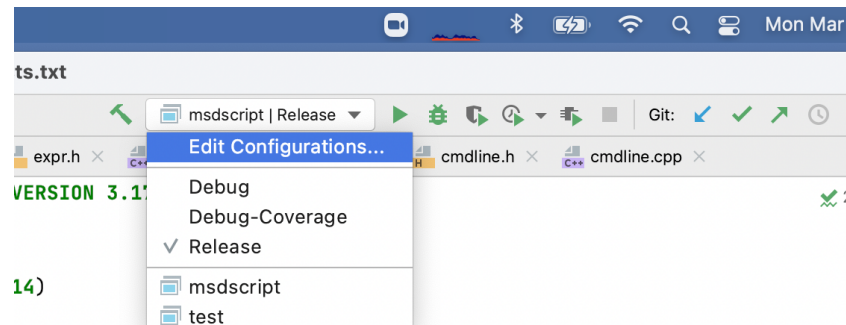
CLion Profiling Tips



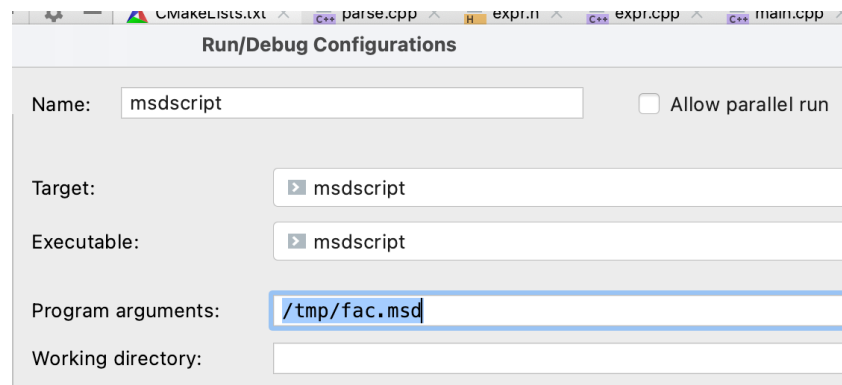
CLion Profiling Tips



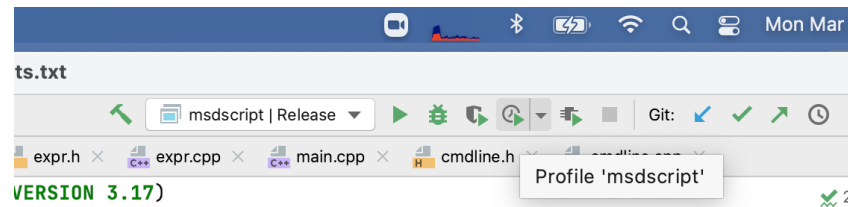
CLion Profiling Tips



CLion Profiling Tips



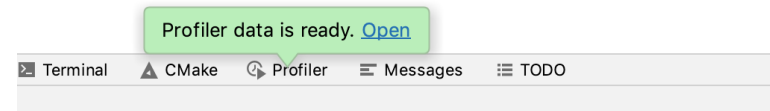
CLion Profiling Tips



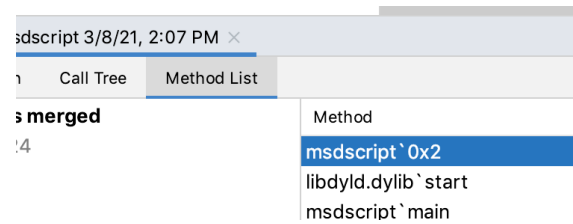
14)

CLion Profiling Tips

```
/mflatt/msdscript/cmake-build-release/msdscript ../fib.msd  
arter: waiting for profiler...  
tarting target executable itself...  
  
ith exit code 0
```



CLion Profiling Tips



CLion Profiling Tips

	Samples	Own Samples ▼
	9,674	3,682
	4,587	2,998
	3,776	1,681
	1,960	1,343
	1,027	1,027

Profile Results

Profile shows:

- lots of time allocating and deallocating
- lots of allocation in `subst`