

Profiling



April 4, 2011

Optimization Quotes

More computing sins are committed in the name of efficiency (without necessarily achieving it) than for any other single reason -

William A. Wulf

Optimization Quotes

We should forget about small efficiencies, say about 97% of the time: premature optimization is the root of all evil.

Donald E. Knuth (quoting Tony Hoare)

Optimization Quotes

Rules of Optimization:

Rule 1: Don't do it.

Rule 2 (for experts only): Don't do it yet.

M.A. Jackson



Levels of Optimization

- High-level Program Structure
- Data Structures / Algorithms
- Efficient Program Code
- Assembly
- Hardware

80/20 Rule

"80% of the time is spent in 20% of the code"

So?

How?



Measuring Code

`time command`

Manual Instrumentation

```
int calls_to_foo = 0;

void foo(string arg)
{
    ++calls_to_foo;
    // ...do the actual work...
}
```

Manual Instrumentation

```
#include <sys/time.h>
struct timeval start, end;

gettimeofday(&start, NULL);
// do the work.
gettimeofday (&end, NULL);

fprintf(stderr, "%f ms\n",
        (end.tv_sec - start.tv_sec) * 1000.0 +
        (end.tv_usec - start.tv_usec) / 1000.0 );
```

Pitfalls

```
bool iszero(int n) {  
    return n == 0;  
}
```

```
double total_us = 0.0;  
  
bool iszero(int n) {  
    struct timeval start, end;  
    gettimeofday(&start, NULL);  
  
    bool answer = (n == 0);  
  
    gettimeofday(&end, NULL);  
    total_us +=  
        (end.tv_sec - start.tv_sec) * 1.0e6  
        + (end.tv_usec - start.tv_usec);  
  
    return answer;  
}
```

Profilers

Tools exist to instrument the code for you.

Counting calls (possibly in a smart fashion)

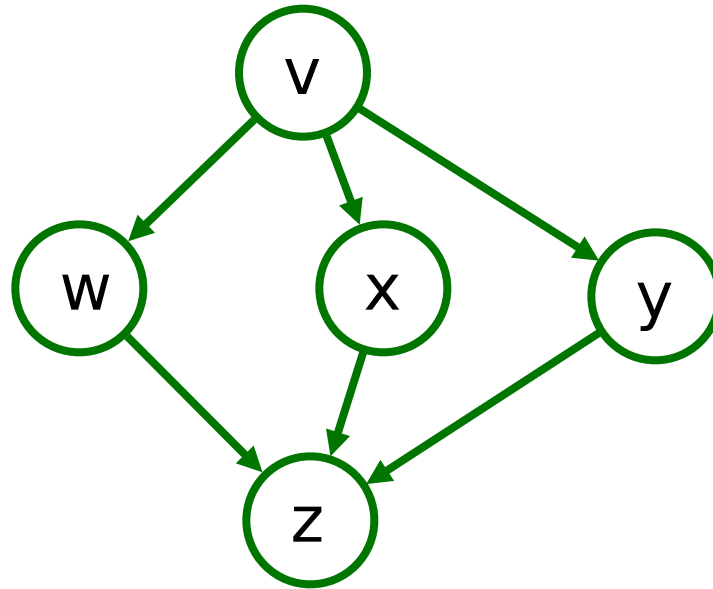
PC sampling

Flat profile

Hierarchical profile

One widely-available tool is `gprof`

Assigning Time?



Using gprof

Compile with the `-gp` flag.

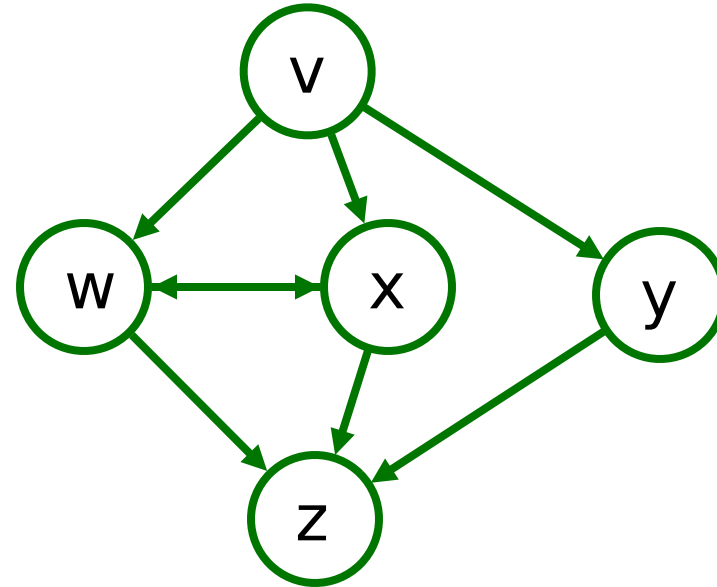
Run the program (which will generate `gmon.out`)

Get "readable" though verbose output via

```
gprof <executable-name> gmon.out
```

Other issues

What to do about cycles?



Input dependence

Profile

Call graph