

Performance and Code Tuning Overview

CPSC 315 – Programming Studio

adapted from John Keyser's 315 slides

Is Performance Important?

- Performance tends to improve with time
 - Hardware Improves (SW tweak might not last?)
- Other things can be more important
 - Accuracy
 - Robustness
 - Code Readability
- Worrying about it can cause problems
 - “More computing sins are committed in the name of efficiency (without necessarily achieving it) than for any other single reason – including blind stupidity.” – *William A. Wulf*

Performance Increases without Code Tuning

- Lower your Standards/Requirements
 - Asking for more than is needed leads to trouble
 - Example: Return in 1 second
 - Always?
 - On Average?
 - 99% of the time?

Performance Increases without Code Tuning

- Lower your Standards/Requirements
- High Level Design
 - The overall program structure can play a huge role

Performance Increases without Code Tuning

- Lower your Standards/Requirements
- High Level Design
- Class/Routine Design
 - Algorithms used can have real differences
 - Can have largest effect, especially asymptotically

Performance Increases without Code Tuning

- Lower your Standards/Requirements
- High Level Design
- Class/Routine Design
- Interactions with Operating System
 - Hidden OS calls within libraries – their performance affects overall code

Performance Increases without Code Tuning

- Lower your Standards/Requirements
- High Level Design
- Class/Routine Design
- Interactions with Operating System
- Upgrade Hardware
 - Straightforward, if possible...

Performance Increases without Code Tuning

- Lower your Standards/Requirements
- High Level Design
- Class/Routine Design
- Interactions with Operating System
- Upgrade Hardware
- Compiler Optimizations
 - “Automatic” optimization,
 - Getting better and better, though not perfect
 - Different compilers work better/worse

Code Profiling

- Determine where code is spending time
 - No sense in optimizing where no time is spent
- Provide basis for measurement
 - Determine whether “improvement” really improved anything
- Need to take precise measurements

Profiling Techniques

- Profiler – compile with profiling options, and run through profiler
 - Gets list of functions/routines, and amount of time spent in each
- Use system timer
 - Less ideal
 - Might need test harness for functions
- Use system-supported real time
 - Only slightly better than wristwatch...
- Graph results for understanding
 - Multiple profile results: see how profile changes for different input types

What Is Tuning?

- Making small-scale adjustments to correct code in order to improve performance
 - After code is written and working
- Affects only small-scale: a few lines, or at most one routine
 - Examples: adjusting details of loops, expressions
- Code tuning can *sometimes* improve code efficiency *tremendously*

What Tuning is Not

- Reducing lines of code
 - Not an indicator of efficient code
- A guess at what might improve things
 - Know what you’re trying, and *measure* results
- Optimizing as you go
 - Wait until finished, then go back to improve,
 - as optimizing while programming is often a waste
- A “first choice” for improvement
 - Worry about other details/design first

Common Inefficiencies

- Unnecessary I/O operations
 - File access especially slow
- Paging/Memory issues
 - Can vary by system
- System Calls
- Interpreted Languages
 - C/C++/VB tend to be “best”
 - Java about 1.5 times slower
 - PHP/Python about 100 times slower

Operation Costs

- Different operations take different times
 - Integer division longer than other ops
 - Transcendental functions (sin, sqrt, etc.) even longer
 - Knowing this can help when tuning
- Vary by language
 - In C++, private routine calls take about twice the time of an integer op, and in Java about half the time.

Remember

- Code readability/maintainability/etc. is usually more important than efficiency
- Always start with well-written code, and only tune at the end
- Measure!