

CSE 410 - Computer Systems November 5, 2001

Readings and References



 Chapter 2, Computer Organization & Design, Patterson and Hennessy

• Other References

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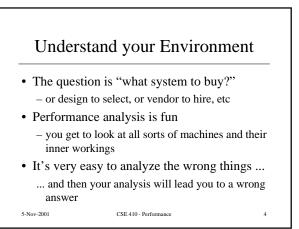
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Performance Analysis - When?

- Evaluation prior to system purchase
 - deciding which system is right for the need
 - very speculative and uncertain
 - unknown future workload, future capability
- Tuning prior to product release
 - product must meet expectations or it won't sell
 - very speculative and uncertain
 - sensitive to configuration, workload

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Time to complete task

- The best metric is time to complete the task, as perceived by the user
- Total performance is the sum of many individual factors and perceptions
- Understand the task and the expectations

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- write down the tasks to be accomplished
- write down the user expectations for

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Evaluation tools Simulation – necessary if there is no system in place yet – accuracy of the simulation is critical

- how is accuracy defined?
- Prototypes
 - accuracy is critical it looks real, but you don't have the real product in hand yet
 - where are the simplifications, are they important?

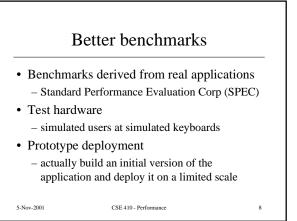
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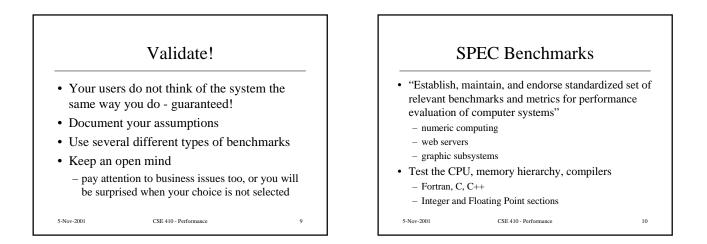
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Benchmarks

- · High potential for misleading results
- · May not reflect actual operation at all - reading from disk controller cache, not disk - product vendor tweaked system for benchmark
- · Simplified representation of the workload may completely miss critical factors
 - eg, operating system performance under heavy user load CSE 410 - Performance

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CPU 2000	
Compression	Quantum physics
FPGA circuit placement	Shallow water model
C compiler	Multi-grid field
Combinatorial Optimizer	Partial Dif. Equations
Chess	3D Graphics
Word Processing	Fluid Dynamics
Visualization	Image recognition
Perl	Seismic wave simulatio
Group Theory	Image processing
OO Database	Chemistry, Meteorology
Place and route simulator	Number theory

More SPEC Benchmarks

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- Java Virtual Machines
- · server-side Java
- · shared-memory parallel programming
- SMTP and POP3 mail servers
- NFS (network file server) computers
- · World Wide Web Servers
- System MultiTasking performance
- · high-end industrial-style applications
- · graphics performance

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Tuning - Design for speed

- Think about performance early and often
- Good algorithms first
 - throw faster hardware at it only when you can't think of anything else
- Product is almost ready, but ...
 - particular data models cause problems
 - many concurrent users cause problems

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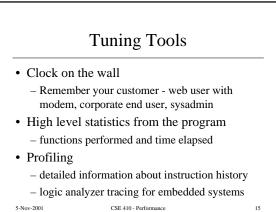
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- etc

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Tuning - The product is slow · Let the numbers tell you what to work on • Don't assume anything! - I/O bottlenecks, memory thrashing, unusual data sets, unexpected usage patterns, ...

- the problems can be anywhere
- the solutions can be anywhere
- Make sure you are solving real performance issues as perceived by the real users 5-Nov-2001 CSE 410 - Performance 14



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Profiling • Continuously sample CPU state - built-in performance counters (eg I-cache miss) - sample program counter and context • Procedure level - Where are we spending the most time? · Instruction level - What are we doing there? - Why is it taking so long? 5-Nov-2001 CSE 410 - Performance 16