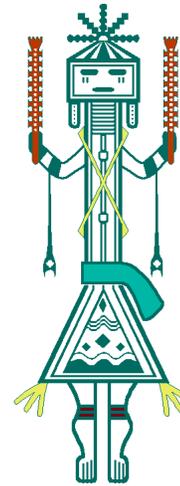


Software Performance Engineering: What Can It Do For You?



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Objectives



- ♦ A new paradigm?
 - ♦ What?
 - ♦ Why?
- ♦ SPE overview
- ♦ What can it do for you?
- ♦ Conclusions

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The Dominant Paradigm

- ♦ Build and Test (Fix-It-Later)
 - ♦ Wishful thinking - won't have performance problems
 - ♦ Pad budgets and schedules to fix problems found by tests
 - ♦ "You can't do anything about performance until you have something to measure."
- ♦ Improving the dominant paradigm
 - ♦ TQM or Six Sigma for testing
 - ♦ Do it faster
 - ♦ Strategic feasibility studies—"Best in class for testing/tuning."
 - ♦ "Retreats" for testing team



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What's Wrong?

- ♦ The dominant paradigm is reactive
 - ♦ Finds problems, doesn't prevent them
 - ♦ Doesn't provide guidance for solving problems
 - ♦ Often finds problems when it is too late
 - ♦ Each problem is seen as unique



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A "New" Paradigm

- ♦ A proactive approach to performance
- ♦ Early performance assessment and prediction
- ♦ Decision support for architects and designers
- ♦ Early identification and elimination of problems
- ♦ Guidelines and principles for
 - ♦ Preventing problems
 - ♦ Building-in performance



A Paradigm Shift



"The significant problems we face cannot be solved at the same level of thinking we were at when we created them."

- Albert Einstein

Why Worry About Performance?

- ♦ Many systems cannot be used as initially implemented due to performance problems
- ♦ Problems are often due to fundamental architecture or design factors rather than inefficient coding
 - ♦ introduced early in development
 - ♦ not discovered until late, or worse after they fail in the market

What Does Poor Performance Cost?

- ♦ Forrester Research Downtime cost survey - 430 Global 2000 IT executives
 - ♦ 43% - \$10,000 to \$100,000 per hour
 - ♦ 7% - up to \$1 million per hour
- ♦ Anecdotal evidence that project managers pad budgets and timelines
 - ♦ Expect 3x to 8x factor for re-work
 - ♦ Back off 30-50% to get initial project funding

What's the problem, just fix it?

- ✦ Re-work impacts schedules & budgets
- ✦ Slow systems affect productivity
- ✦ Severe performance problems can cause irreparable damage to competitiveness and brand
- ✦ May not be possible to achieve performance requirements with tuning
- ✦ Tuning results in poorer overall performance (than building performance into architecture)
- ✦ Infrastructure costs usually higher



Performance Management—When?

“Whether or not a system will be able to exhibit its desired (or required) quality attributes is largely determined by the time the architecture is chosen”

- Clements and Northrop

Software Engineering Institute

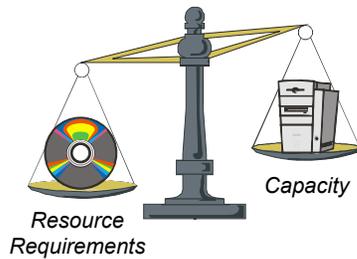
Goal

- ✦ Adopt proactive approach to performance management
- ✦ Early assessment of software and system decisions to determine their impact on performance
- ✦ Early assessment of the architecture is important because
 - ✦ architecture has the most significant influence on performance
 - ✦ architectural decisions are the most difficult to change

Overview of SPE



Performance Balance



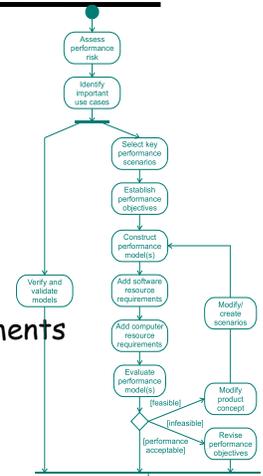
- ✦ Quantitative Assessment (performance models)
- ✦ Begins early, frequency matches system criticality
- ✦ Often find architecture & design alternatives with lower resource requirements
- ✦ Select cost-effective performance solutions early

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The SPE Process

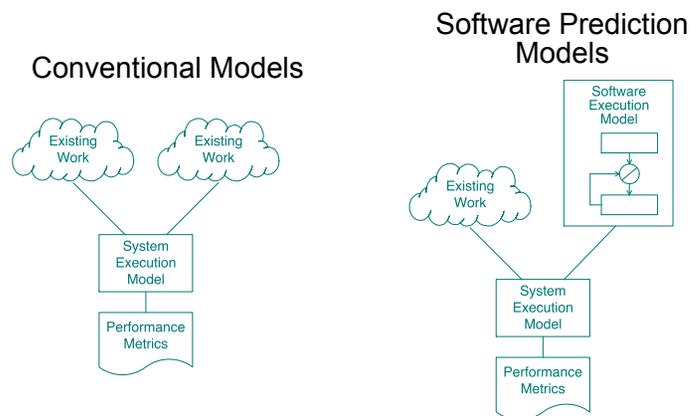
1. Assess performance risk
2. Identify critical use cases
3. Select key performance scenarios
4. Establish performance requirements
5. Construct performance models
6. Determine software resource requirements
7. Add computer resource requirements
8. Evaluate the models
9. Verify and validate models and software performance.



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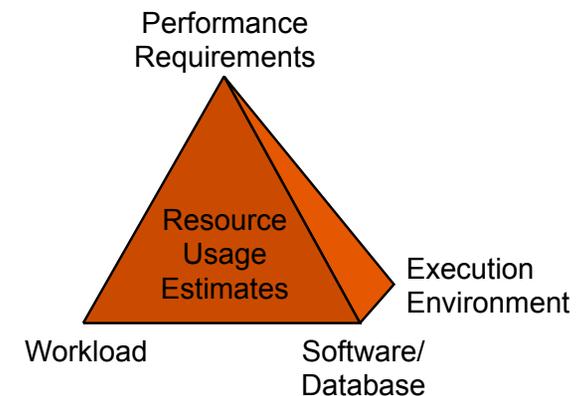
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SPE Model-based Approach



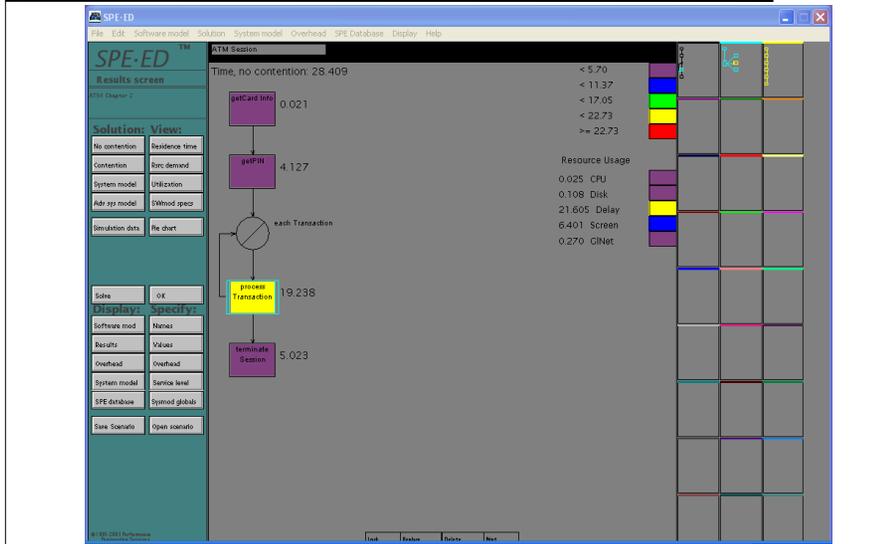
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What You Need to Know



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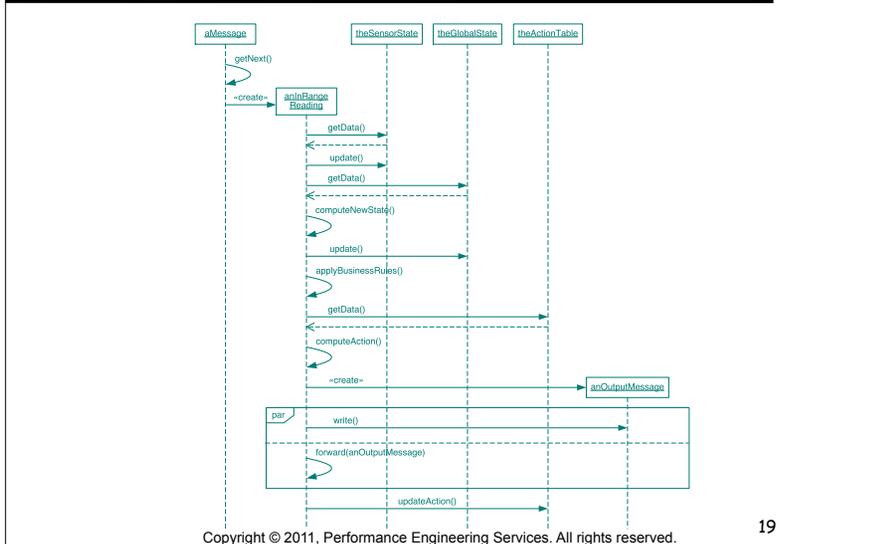
Software Model Results



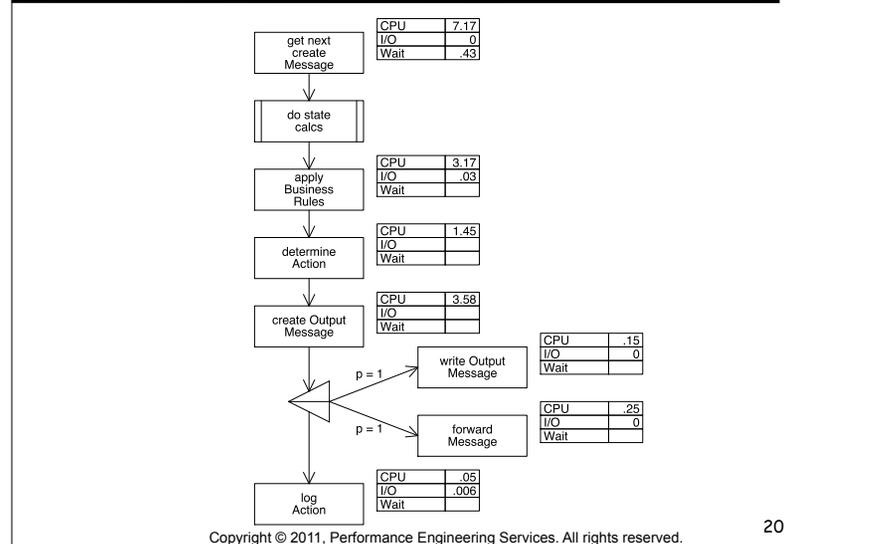
Example: The Problem

- ◆ System upgrade
 - ◆ new requirements
 - ◆ higher volumes
 - ◆ "hot" standby for failover
- ◆ Current capacity 2,000 messages per second
 - ◆ 20 concurrent streams
 - ◆ 100 messages per second each
- ◆ Needed capacity 20,000 msg/sec
- ◆ Ten-fold increase in hardware unacceptable (machines >\$1.25 m each)

Sequence Diagram

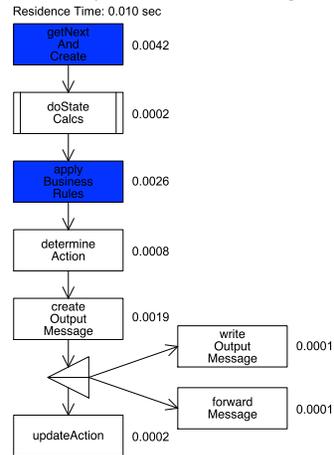


Software Model

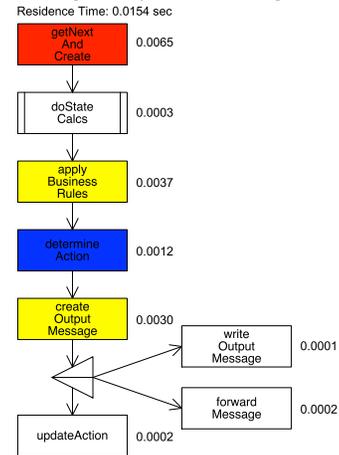


Model Results

Current System 2K messages



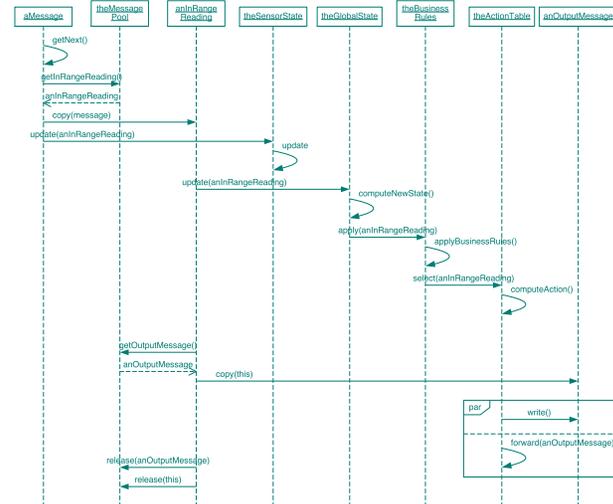
20K messages, System changes



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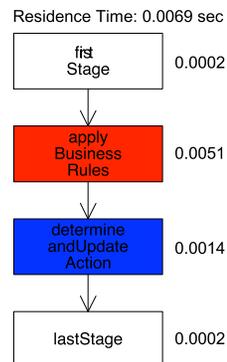
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Remove "God Class" Antipattern



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Revised Message Handler Results



Faster response, fewer processors

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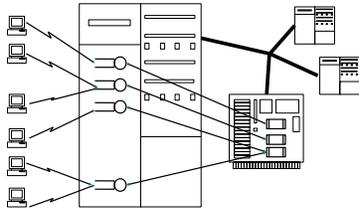
Results

- ♦ Final product
 - ♦ Could not achieve 0.004 sec/stage with the "god" class antipattern
 - ♦ Actually required 5 machines (4 additional)
- ♦ Cost/Benefit analysis
 - ♦ Cost
 - Architecture assessment/modeling studies approximately \$250,000
 - Software changes (2 months effort for 4 people)
 - ♦ Benefit
 - 10 fold increase in hardware capacity would have taken 9 more machines
 - Savings of over \$5,000,000! (+ \$5,000,000 for the redundant failover system!!)
 - Reference - CMG 2009 Tutorial paper

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Performance of Complex Systems



- ◆ Typical technical excuses:
 - ◆ "My system is more complex"
 - ◆ "I don't have the performance data"
 - ◆ "Performance depends on system usage"
- ◆ Models have been successfully used in many large, complex environments.

Other Aspects of SPE

- ◆ Extensions for modeling Web applications, concurrent, and distributed systems
- ◆ Performance walkthroughs and other data gathering techniques
- ◆ Software measurement and instrumentation
- ◆ Performance-oriented design principles
- ◆ Performance patterns and antipatterns
- ◆ Integrating SPE with software development
- ◆ Implementing an SPE initiative in your organization

Conclusions

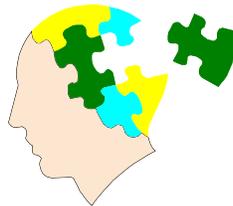
- ◆ SPE works - well-established technology
- ◆ Easily integrated into the SDLC
- ◆ SPE is cost effective
 - ◆ 1 - 10% of overall project cost
 - ◆ Savings far greater than costs
- ◆ Not a silver bullet

How do we get there?



Awareness of SPE Alternative

- ♦ Awareness of performance rework problem -> savings
 - ♦ No historical data on past costs
 - ♦ No communication paths to performance specialists
 - ♦ Professional peers unaware
- ♦ Important for both internal and contract development!



Barriers to Paradigm Change

- ♦ Unable to estimate magnitude of problem and/or the value of SPE
- ♦ Commitment to status quo or fear of change
- ♦ Wishful thinking or fatalism
- ♦ Procrastination and/or schedule pressure
- ♦ Unaware of SPE solution
- ♦ Push-back or buy-in problems
- ♦ Others?



Become a Change Agent

- ♦ Learn about the technology
- ♦ Make a business case. Quantify:
 - ♦ Magnitude of problem
 - ♦ Cost to implement
 - ♦ Value of solution
 - ♦ Reference: www.spe-ed.com/econ.htm
- ♦ Raise awareness
- ♦ Successful pilot project
 - ♦ Measureable results
- ♦ Tell the story



Lead The Field

- ♦ Earl Nightingale, 1921-1989
 - ♦ American motivational speaker, author, radio personality
 - ♦ "If the grass is greener on the other side, it's probably getting better care"
 - Success is a matter of sticking to a set of common sense principles anyone can master
 - 12 ideas to help you lead the field, any field you choose
 - The following slides summarize his ideas

1. The Magic Word

- ♦ Attitude - you are responsible for your life so develop a winning attitude
 - ♦ Be expectant, cheerful. Change, and your surroundings will change.
 - ♦ Think, act, talk, and conduct yourself as would the person you wish to become
 - ♦ Treat everyone as the most important person on earth
 - ♦ Act first - it has to start somewhere, let it begin with you.
 - ♦ Your attitude at the beginning of a difficult task, more than anything else, will bring about its successful outcome.



2. Acres of Diamonds

- ♦ The mind is the richest human resource - a gold mine of ideas
 - ♦ Farmer sold his property and went in search of diamonds, failed and eventually committed suicide. Meanwhile one of the largest diamonds ever found was in his old creek, and turned out to be the most productive diamond mine in Africa.
 - ♦ Thoroughly explore possibilities of better ways to do what you are presently doing.
 - ♦ Look through eyes of "intelligent objectivity."
 - ♦ Keep things stirred up, overcome!



3. A Worthy Destination

- ♦ By setting specific, attainable, worthwhile goals, you place yourself in the top 5% of people, achievers. The choice is yours.
 - ♦ Know exactly what you want, think about it every day. Your mind can achieve what it can conceive and believe.
 - ♦ Set worthy goals, aspire higher.
 - ♦ Success is progressive realization of a worthy goal. Not the destination but a journey.
 - ♦ Set your sail and adjust the course. Set new goals as you achieve them.
 - ♦ Decide on goals, insist on them, look at written goals daily. See yourself as having already attained them.



4. Miracle of Your Mind

- ♦ Most important aspect of man is his brain - think, choose, reason.
 - ♦ Successful people have learned to solve their problems by thinking. Most people don't think, few sit down, write their problem and deliberately begin to think.
 - ♦ Take time to think every day of ways to improve activities. Many ideas will be no good.
 - ♦ If your goals are deeply imbedded in your mind it will work for ways to accomplish it.
 - ♦ Spend one hour a day. Don't waste time on needless things.



5. Destiny In The Balance

- ♦ Working hard is not enough. Rewards always match service. For every action there is equal and opposite reaction.
 - ♦ Every time we use a product or service, someone is serving us. Rewards can be intangible - happiness and peace of mind. Whatever rewards you seek you must first earn in service.
 - ♦ Discontent is measured as distance between what you want and what you have. Can be constructive if you determine what you want and find ways of increasing your service.



6. It's Easier to Win

- ♦ Only 5% of people achieve unusual success.
- ♦ Everyone has the option to be on whatever layer of life's pyramid they choose. Easy to settle for lower levels, but there is less competition at top and view is better.
- ♦ Successful people follow independent paths, break away from crowd, use time constructively.
- ♦ Never too late - with purpose, worthy goal & motivation you can climb further in a few years than others might in a lifetime.



7. Person on the White Horse

- ♦ Be a leader
 - ♦ Any person who realizes importance of improving every day, takes responsibility of own growth, has cheerful helpful attitude
 - ♦ Be a vital part of your company, do more than you are paid to do, any job worth doing is worth doing well
 - ♦ Leader can work almost anywhere - does not ask for work but shows up and leads the way
- ♦ Specialist not jack of all trades
 - ♦ Become outstanding at one particular line of work - top 5% are always in demand
 - ♦ Be a sponge for information that will help you on your way



Others

8. Integrity - honesty and truth - is the seed for achievement. Be all you can be, do all you can do, have all you can have.
9. How much are you worth? - self-improvement, knowledge, extra effort lead to increased value.
10. Achieving money goals - set goals then work to match level of service to those amounts. Money cannot be sought directly - it is an effect and the cause is valuable service.

More

11. Knowledge is power - a ladder that lets you climb to top. Reading, language, general knowledge as well as studying your areas of interest.

12. Today's great adventure - success is attributable to consistent, persistent, succession of single days. Plan 6 prioritized, important things for tomorrow. Stay at them until done, do as well as you can.

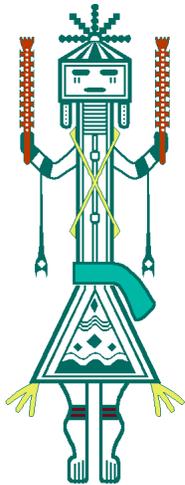


SPE Importance

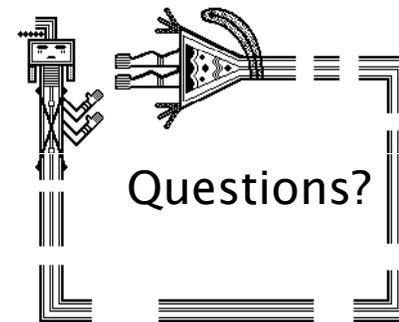
- ◆ SPE is technically viable
- ◆ Performance has a significant effect on cost, quality, and timeliness of software
- ◆ Vital that organizations adopt this new paradigm for software performance management
- ◆ You can be the change agent (spread the word)
- ◆ You can achieve your goals and lead the field in whatever you choose!



Summary



- ◆ A new paradigm?
 - ◆ What?
 - ◆ Why?
- ◆ SPE overview
- ◆ What can it do for you?
- ◆ Conclusions



www.spe-ed.com

