



Crystal Ball



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8/1/08



Problem



- ➔ How to plan for the future?
- ➔ How are we to assess the benefits vs cost trade-offs of different software methods?
- ➔ How are we to make future plans for the agency, given some much change in current practices?



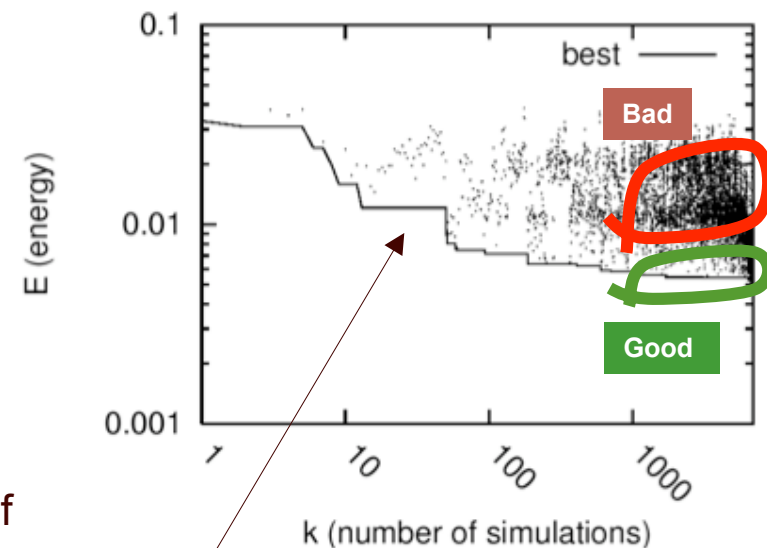
Approach



- ➔ Using traditional methods, there are no answers to these questions.
- ➔ The local tuning problem.
 - Software process models most accurate after local tuning
 - But, data required for local tuning is hard to obtain
 - Due to business sensitivity associated with the data
 - And differences in how the metrics are defined, collected and archived.
- ➔ New method
 - Stability analysis
 - Check for stable conclusions existing in that space of possible tuning.
 - If that works,
 - infer a set of software development policy recommendations to NASA

Approach (details)

- ➔ Implement USC software process models
 - COCOMO time / effort estimation,
 - COQUALMO defect prediction
 - MADACHY threats model
- ➔ Using
 - historical data, define space of past tunings
 - NASA experts, define standard project types
- ➔ Using simulated annealing, Monte Carlo simulation/optionation across intersection of
 - A particular project type
 - Space of possible tunings
- ➔ Rank options by frequency in **good**, not **bad**
- ➔ Test top ranked options for their median and variance effect. Smile if
 - Reduced median and variance in defects/ efforts/ time/ threats



Sample run
(after 10,000 runs, little improvement)

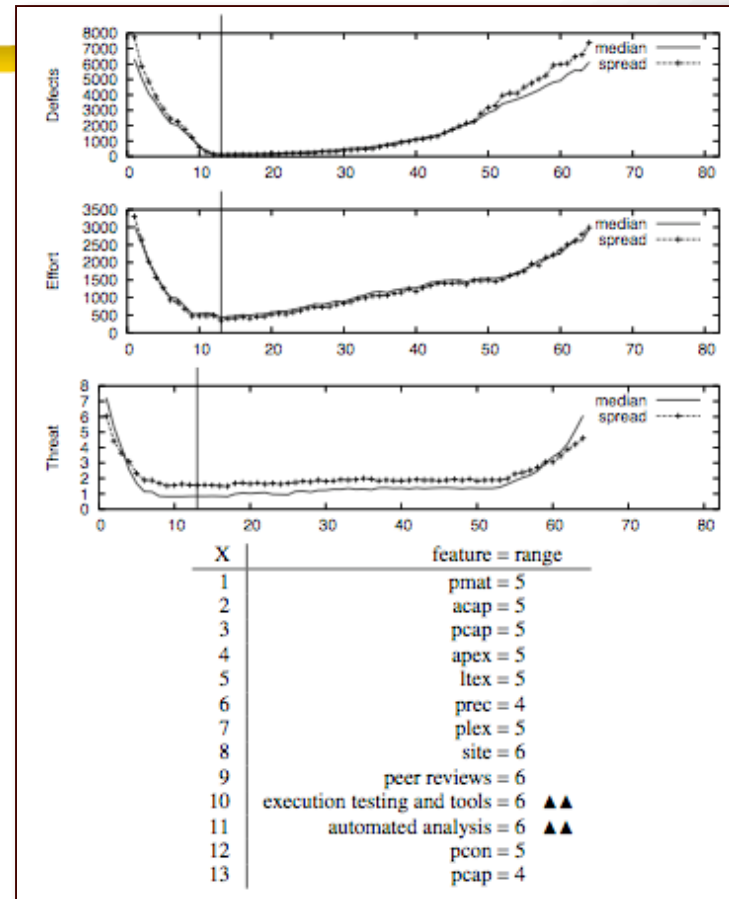


Relevance to NASA

- ⇒ NASA's software methods are rapidly evolving
 - NASA IV&V is the use of early lifecycle model-based validation.
 - Agile process,
 - Assertion-based analysis,
 - Eclipse-based programming,
 - Matlab-based automatic code generation,
 - Simulation-oriented development cycles,
 - etc.
- ⇒ Any stability in all that chaos?
 - Can we make any plans for the future?

Accomplishments

- ➔ After extensive interviews with...
 - SE research gurus
 - Experienced NASA developers/managers
 - ➔ ... clear evidence of variance in NASA software processes
-
- ➔ In numerous case studies...
 - ➔ ... massic reduction in
 - Defects/ effort/ time/ threats
 - Both median and variance
 - ➔ options required to reach minimum defects/ effort /time /threats
 - Are a small subset of all options





Next Steps



- ➔ Required: more NASA software gurus
 - Wanted: volunteers from SAS
- ➔ More simulation studies
 - To confirm / refute stability hypothesis
- ➔ Generation of recommendations
 - For different NASA project types