Obstacles and Opportunities for Model-Based Testing in an Industrial Software Environment

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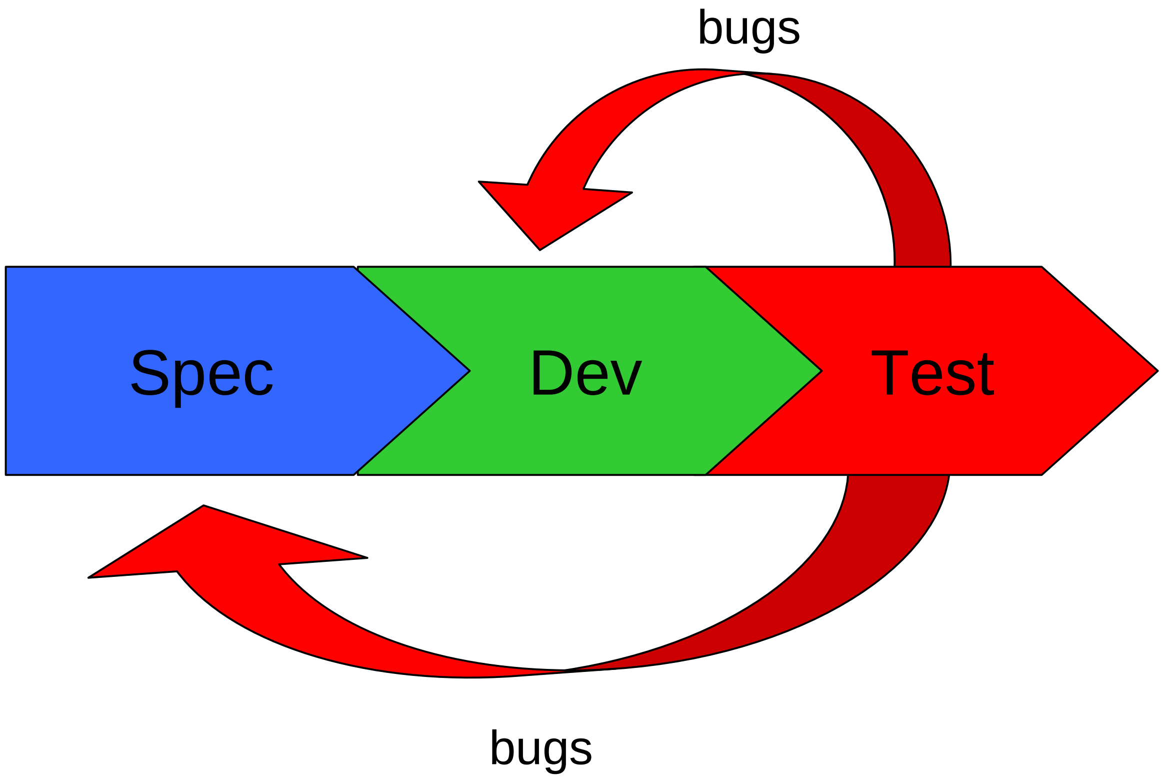
Of Mousetraps and Bugtraps

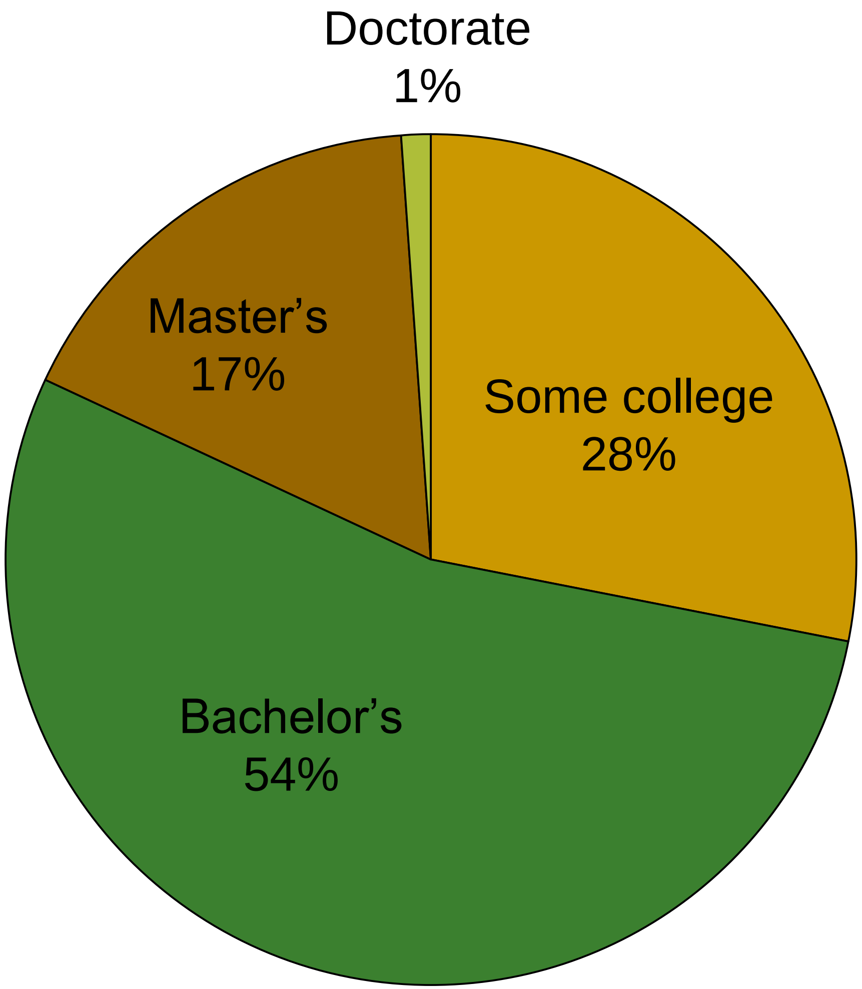
Build a better mousetrap
and the world will beat a path to your door.
- Ralph Waldo Emerson

… assuming the world understands good mousetraps…
- Harry Robinson

Typical Industry Lifecycle



Typical Industry Tester



Source: STQE Salary Survey 2002

Introducing MBT into the Industry

- Relative Advantage
- Compatibility
- Complexity
- Trialability
- Observability

(from Diffusion of Innovations, by Everett Rogers)

Relative Advantage

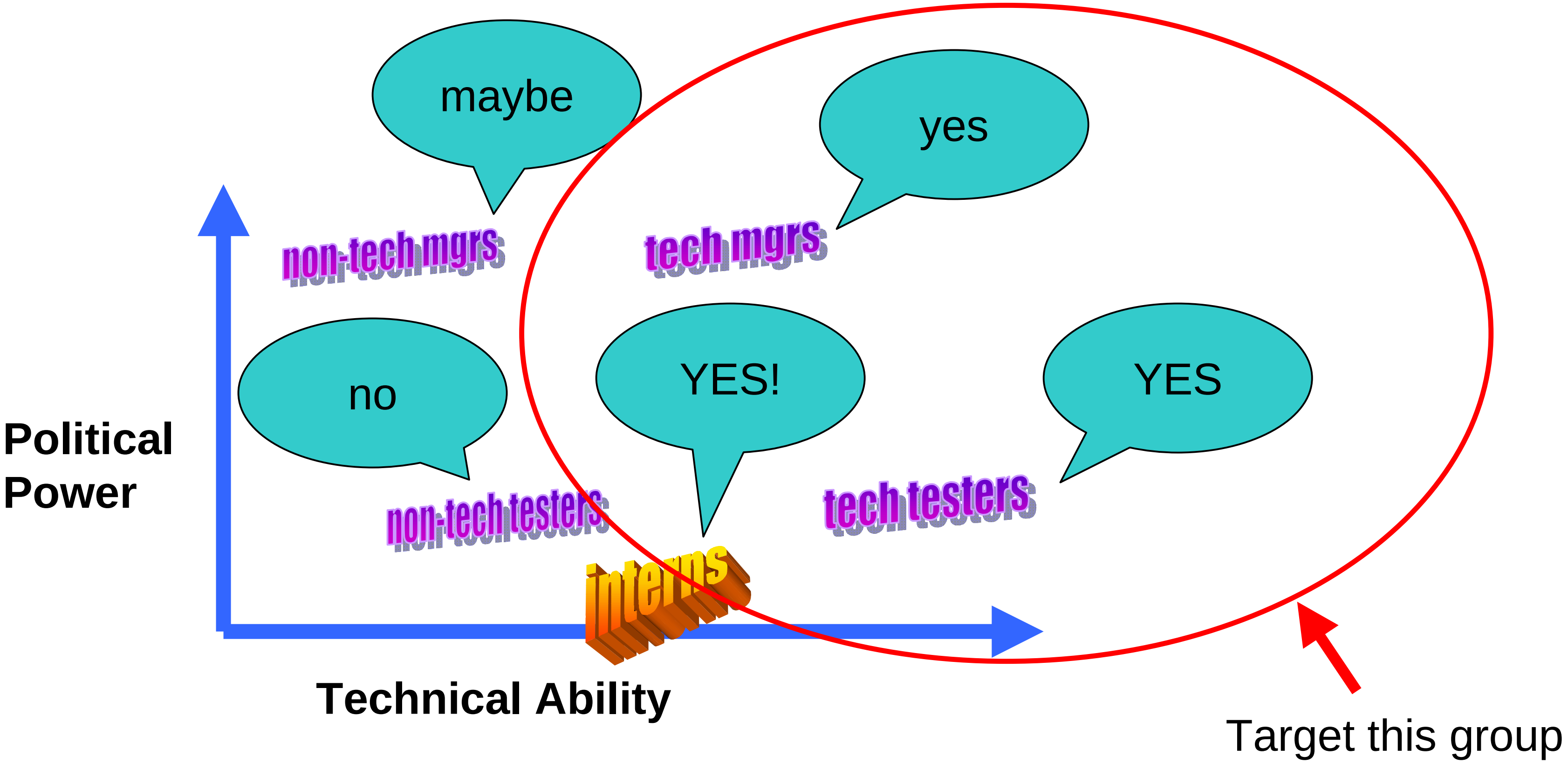
“the greater the relative advantage of an innovation,

the more rapid the rate of its adoption will be.”

Relative Advantage

(obstacles)

Is model-based testing better than existing methods?



Relative Advantage

(opportunities)

Ways of demonstrating relative advantage
(in order of increasing credibility)

- Demos

- External case studies
- Internal case studies
- Working code

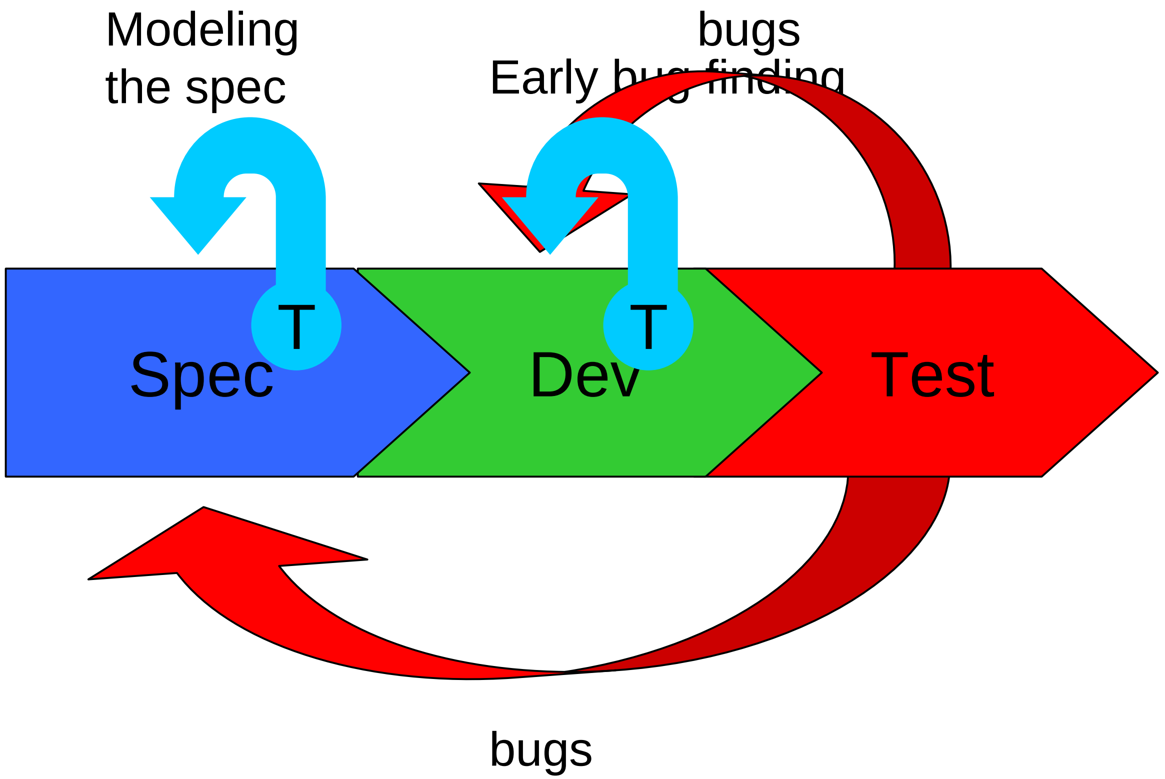
Compatibility

“an idea that is not compatible with the prevalent values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.”

Compatibility

(obstacles)

Does model-based testing integrate with existing methods?

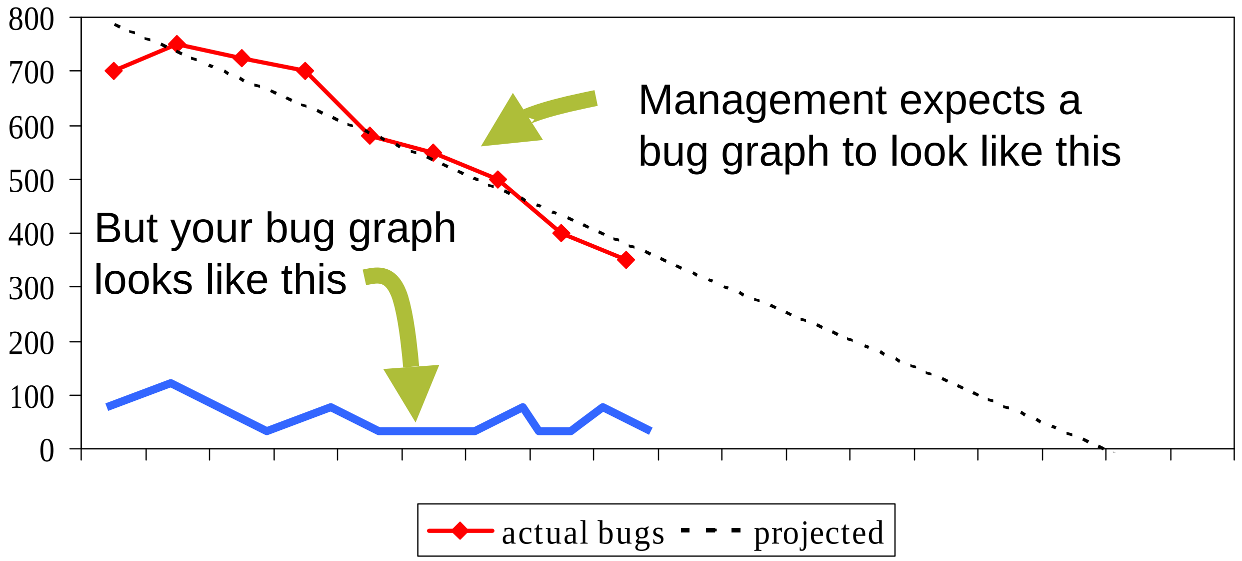


“…the primary function of the test group is to find bugs…” - Cem Kaner

Compatibility

(obstacles)

Does model-based testing integrate with existing methods?



Management expects a bug graph to look like this

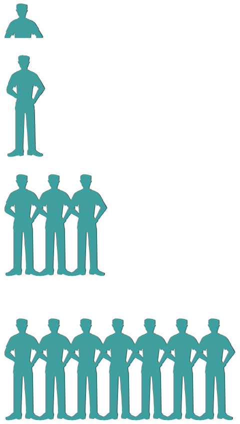
But your bug graph looks like this

“The higher you go in management, the more you rely on numbers.“ - Richard Bender

Compatibility

(opportunities)

- Target the most technical people
- Target the least invested people
- Start very, very small:
  - nano-pilot
  - micro-pilot
  - mini-pilot
  - pilot



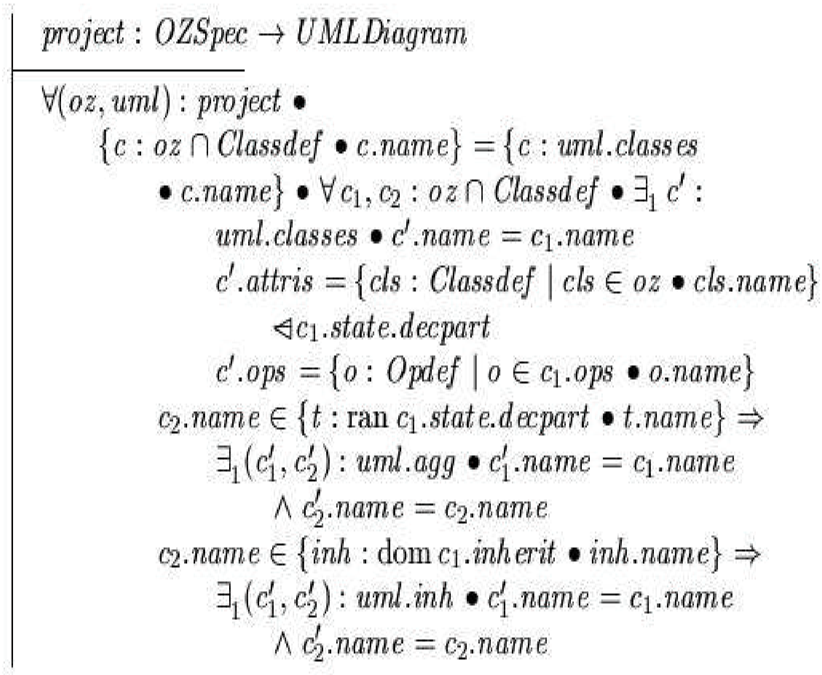
Complexity

“new ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills.”

Complexity

(obstacles)

Is model-based testing difficult to understand?



$$
\begin{array}{l}
\mathit{project} : \mathit{OZSpec} \rightarrow \mathit{UMLDiagram} \\
\hline
\forall (\mathit{oz}, \mathit{uml}) : \mathit{project} \bullet \\
\quad \{c : \mathit{oz} \cap \mathit{Classdef} \bullet c.\mathit{name}\} = \{c : \mathit{uml}.\mathit{classes} \\
\qquad \bullet c.\mathit{name}\} \bullet \forall c_1, c_2 : \mathit{oz} \cap \mathit{Classdef} \bullet \exists_1 c' : \\
\qquad\quad \mathit{uml}.\mathit{classes} \bullet c'.\mathit{name} = c_1.\mathit{name} \\
\qquad\quad c'.\mathit{attris} = \{\mathit{cls} : \mathit{Classdef} \mid \mathit{cls} \in \mathit{oz} \bullet \mathit{cls}.\mathit{name}\} \\
\qquad\qquad \lhd c_1.\mathit{state}.\mathit{decpart} \\
\qquad\quad c'.\mathit{ops} = \{o : \mathit{Opdef} \mid o \in c_1.\mathit{ops} \bullet o.\mathit{name}\} \\
\qquad c_2.\mathit{name} \in \{t : \mathrm{ran}\, c_1.\mathit{state}.\mathit{decpart} \bullet t.\mathit{name}\} \Rightarrow \\
\qquad\quad \exists_1 (c'_1, c'_2) : \mathit{uml}.\mathit{agg} \bullet c'_1.\mathit{name} = c_1.\mathit{name} \\
\qquad\qquad \land\ c'_2.\mathit{name} = c_2.\mathit{name} \\
\qquad c_2.\mathit{name} \in \{\mathit{inh} : \mathrm{dom}\, c_1.\mathit{inherit} \bullet \mathit{inh}.\mathit{name}\} \Rightarrow \\
\qquad\quad \exists_1 (c'_1, c'_2) : \mathit{uml}.\mathit{inh} \bullet c'_1.\mathit{name} = c_1.\mathit{name} \\
\qquad\qquad \land\ c'_2.\mathit{name} = c_2.\mathit{name}
\end{array}
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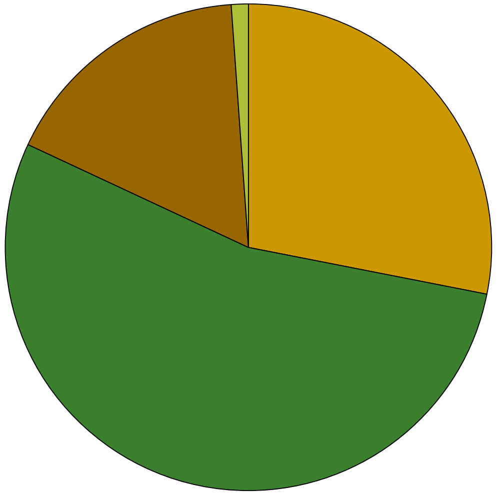
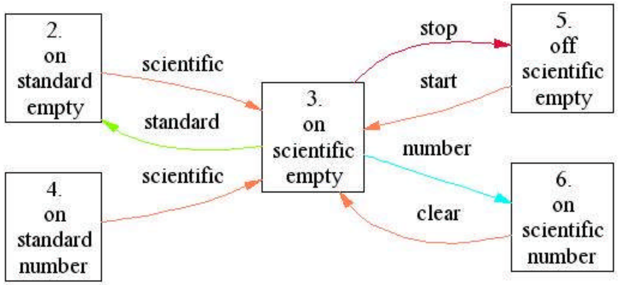


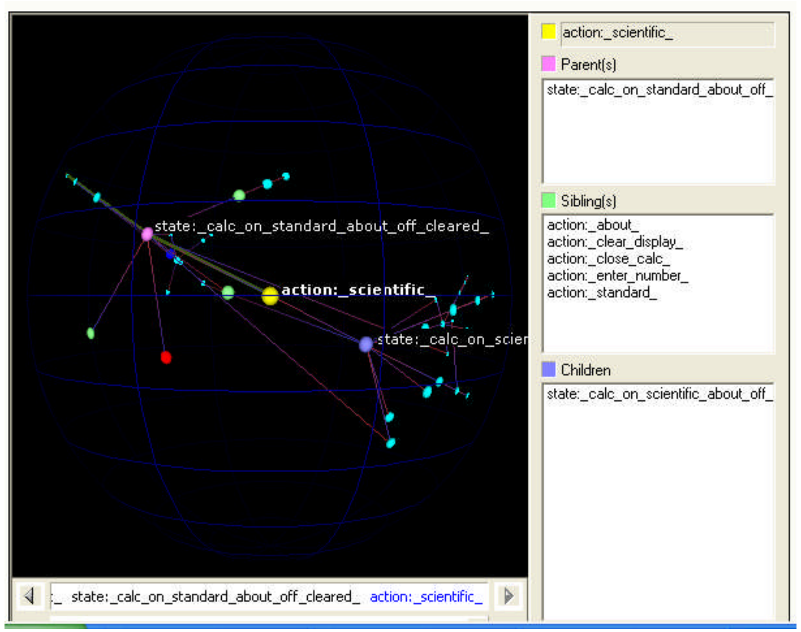
And remember this diagram!

Complexity

(opportunities)

- Courses/workshops
- Working examples
- Visualization/tools





🟨 action:_scientific_

🟪 Parent(s)

state:_calc_on_standard_about_off_

🟩 Sibling(s)

action:_about_
action:_clear_display_
action:_close_calc_
action:_enter_number_
action:_standard_

🟦 Children

state:_calc_on_scientific_about_off_

:_ state:_calc_on_standard_about_off_cleared_ action:_scientific_

Trialability

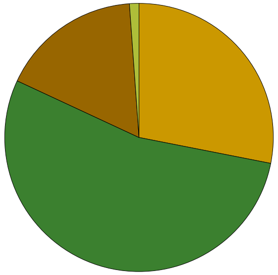
"new ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible."

Trialability

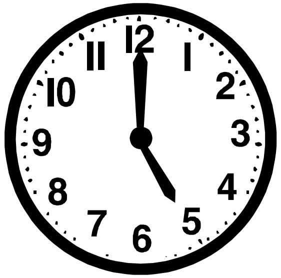
(obstacles)

Is it easy for people to experiment with model-based testing?

- Education



- Time

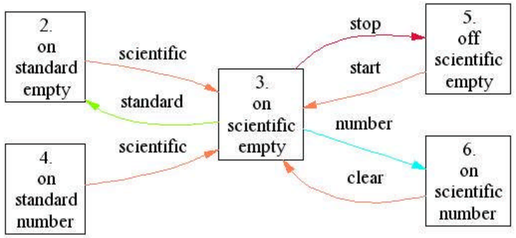


Trialability

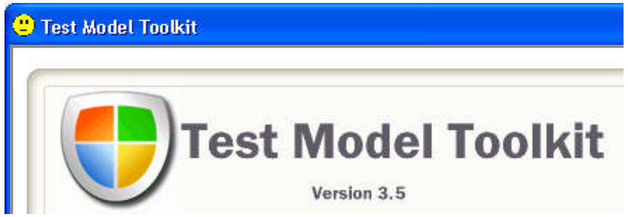
(opportunities)

Is it easy for people to experiment with model-based testing?

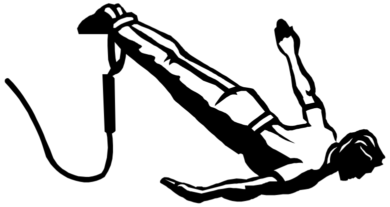
- Working models



- Tool support



- “Extreme modeling”



Observability

“the easier it is for individuals to see the results of an innovation, the more likely they are to adopt.”

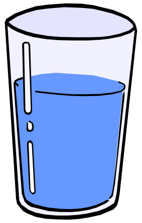
Observability

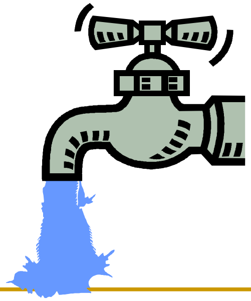
(obstacles)

Are the benefits of model-based testing easily visible?

- How can you count bugs you prevented?

- Should you count how many test cases you've generated?

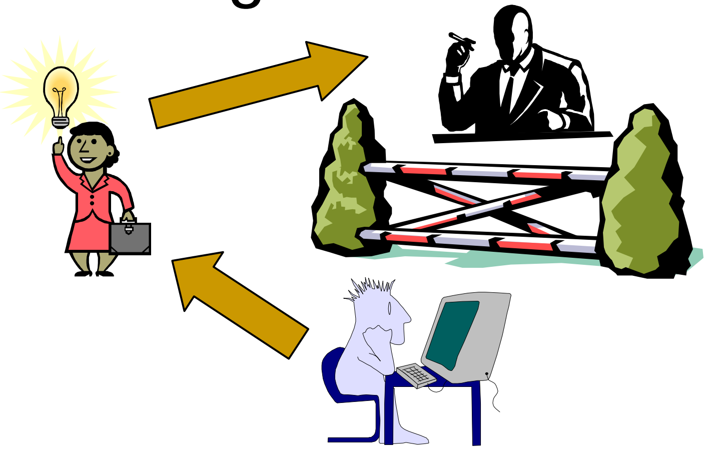




Observability

(opportunities)

- Emphasize end product, not in-process metrics
- Replace bad metrics with better metrics
  - Bad: bug counts, test case counts
  - Better: code coverage, spec coverage
- Sway technical advisors

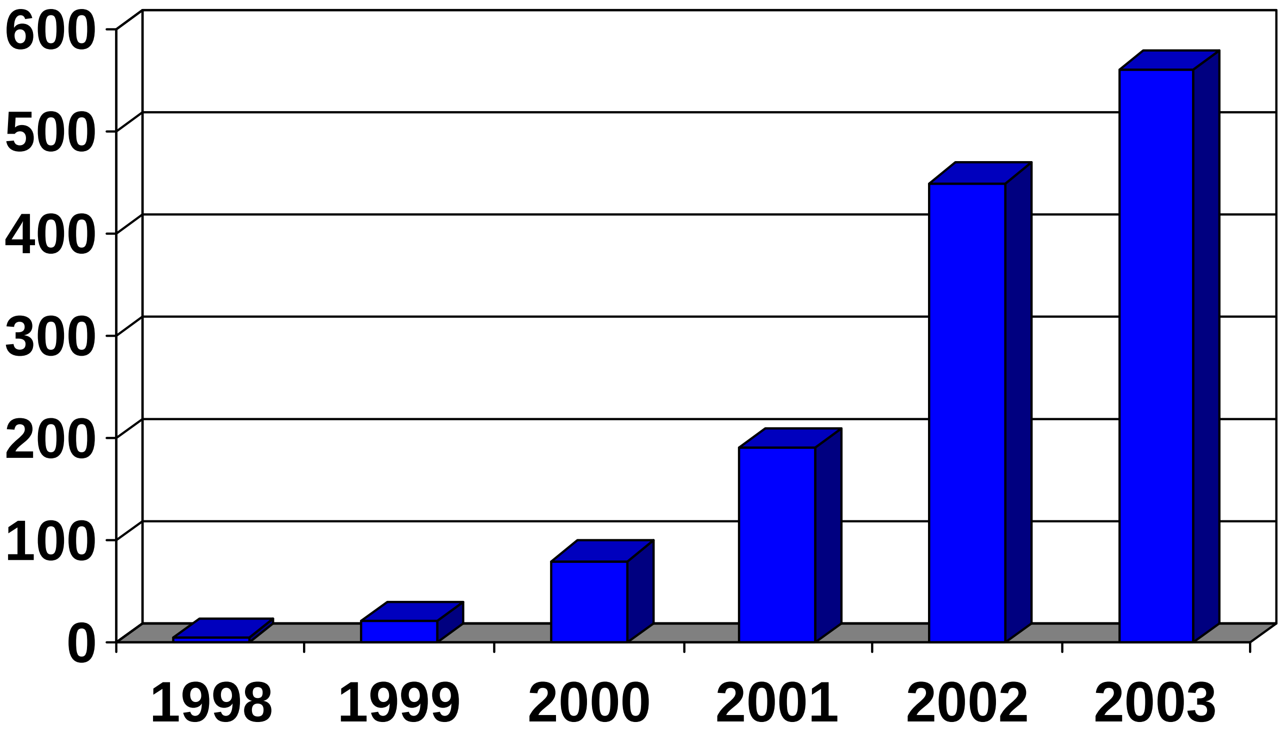


Surprises

- Process Improvement Groups
- Test Tool Groups
- Recruiters
- Skill Set Challenges

- Developers
- Researchers
- Volunteers
- Interns

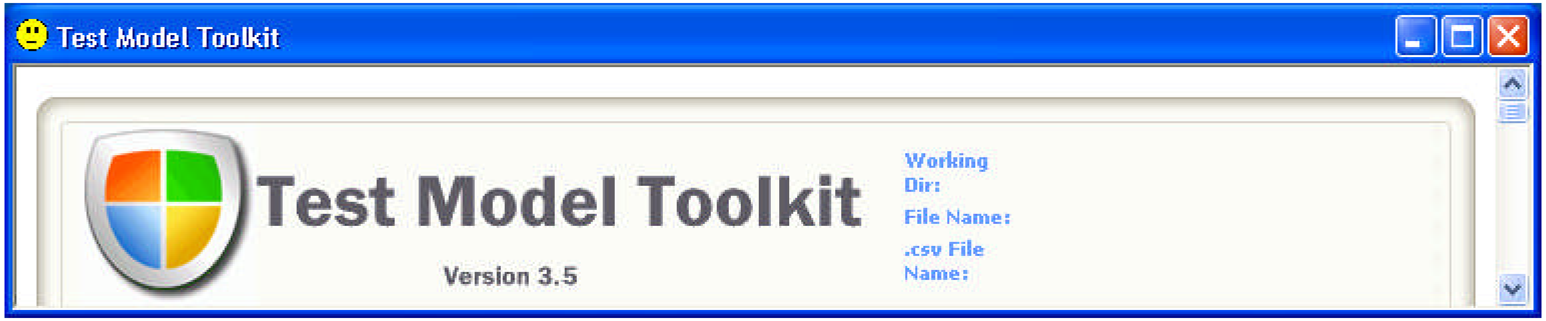
Where we've come from



Model-based testing email alias

Where we are now

Microsoft Best Practice Award in Software Testing 2001



What appears to be in our future

- More powerful modeling tools (e.g. AsmL)
- Increased integration into test infrastructure
- Better test generation tools
- Advanced test training
- Changes in recruiting

Some closing words …

As ease of use becomes increasingly important to customers, the complexity of generating complete test cases is also exploding and is a key challenge for test teams.

A systematic and automatic way of defining the test matrix is needed everywhere and that is exactly what model-based testing provides.

Model-based testing will be the primary method of creating test plans and test cases.

Craig Zhou

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thank you