Ten Years of Model Based Testing
A Sober Evaluation

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Alan Hartman
IBM Israel – Haifa Research Laboratory
Joint work with Kenneth Nagin, Sergey Olvovsky, Andrei Kirshin and others

Agenda

- What is Model Based Testing
- Value of Model Based Testing
- Selected highs and lows from ten years in MBT
- Barriers to Model Based Testing
- Where do we go from here

What is Model Based Testing

- All testing is based on a model
- MBT occurs when the model is:
  - formalized
  - recorded in some form
  - used for generating test cases or oracles
- Model Driven Testing is a special case of MBT
  - Abstract models
  - Automated test transformations

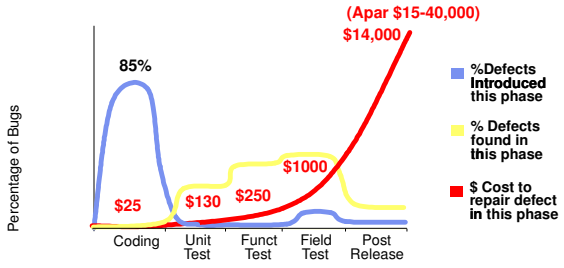
The testing value proposition

- Testing is expensive
  - 30-50% of development costs
- Poor testing is VERY expensive
  - Down time
  - Maintenance costs
  - Rework
  - Law suits
- Model Based Testing promises
  - Increased effectiveness of testing
  - Similar or decreased costs
  - Reuse of design artefacts

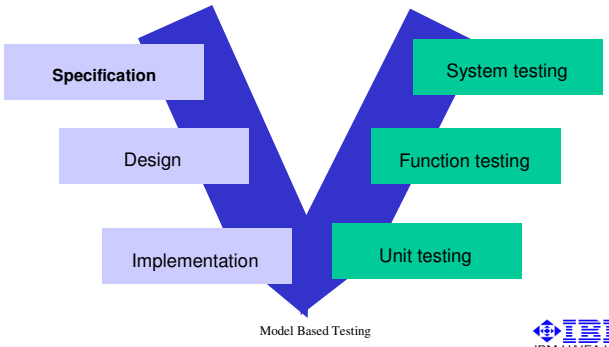
Downtime Costs (per Hour)

• Brokerage operations	$6,450,000
• Credit card authorization	$2,600,000
• Ebay (1 outage 22 hours)	$225,000
• Amazon.com	$180,000
• Package shipping services	$150,000
• Home shopping channel	$113,000
• Catalog sales center	$90,000
• Airline reservation center	$89,000
• Cellular service activation	$41,000
• On-line network fees	$25,000
• ATM service fees	$14,000

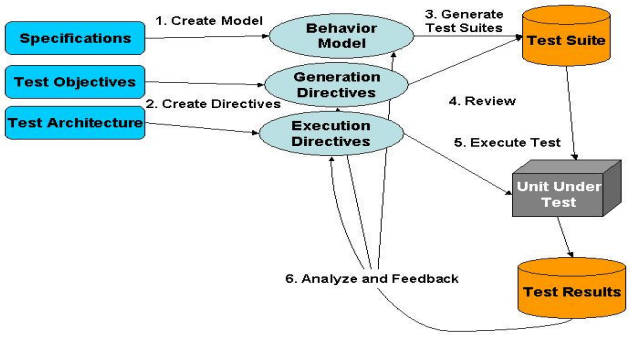
Costs of fixing a bug



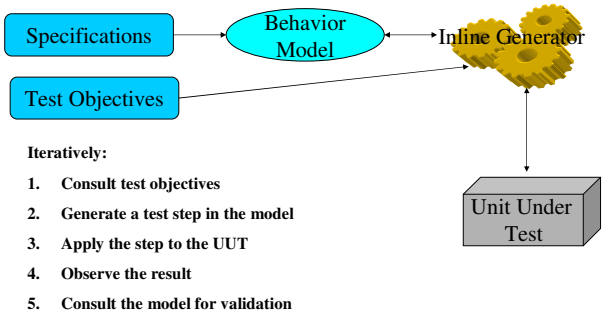
Classical V Process



Offline Model Based Testing



Online Model Based Testing



Iteratively:

1. **Consult test objectives**
2. **Generate a test step in the model**
3. **Apply the step to the UUT**
4. **Observe the result**
5. **Consult the model for validation**

Values of Model Based Testing

- Starting from specification
  - Involves testers early in the development process
  - Teams testers with developers
  - Forces testability into product design
- Building the test interface
  - Finds design and specification bugs - before code exists
  - The model is the test plan - and is easily maintained
- Automated test suite generation
  - Coverage is guaranteed - increases testing thoroughness
  - Zero test suite maintenance costs
- Automated test suite execution
  - Finds code and interface bugs
  - Includes a framework for the testing of distributed applications
  - Reduces test execution costs

What is the reality?

- 1997 – GOTCHA for processor architecture verification
- 1998 – IBM US PoC with very experienced tester
- 1999 – IBM US file system test
- 2002 – AGEDIS project, FT, DB application, Messaging system
- 2001 – IBM Telephone company engagement
- 2003 – Health care ISV
- 2005 – IBM Java compliance

What is the reality?

- 1997 – GOTCHA for processor architecture verification
- Coverage driven testing
- Tools were used by Ph. D.s
  - "Successful" in the lab., not production
  - Hardware not software

What is the reality?

- 1998 – IBM US Proof of Concept with very experienced tester
- First funding for our under-cover project in SW testing
- Reality hits
  - Violent resistance
  - I can do better by hand
  - Bad UI

1999 – IBM US file system test

- Retest of functions
- Modelling and translation by testers
- Comparison
  - –Original test: 18 bugs,12 PM
  - –Pilot test: 15 original bugs + 2 escapes, 10 PM (INCLUDING learning curve)
- Conclusions:
  - –Efficient way to free the tester for creative testing
  - –Replaces a large part of the manual test case writing
- Reality:
  - –Never used again

DEFECTS BY SEVERITY	#	%
1	0	0
2	**10**	**58.8**
3	6	35.2
4	1	5.8

DEFECTS BY ODC TRIGGERS	#	%
Coverage	6	35.2
Variation	1	5.8
Sequencing	**8**	**47.0**
Interaction	1	5.8
Load	1	5.8

Was the problem our modelling language?

- GDL was clunky, looked like Pascal, came from hardware, not sexy
- 2002 – AGEDIS project - move to UML
- Tool collaboration
  - Produced a camel rather than a racehorse
- Three industrial teams
  - Another Ph. D.
  - A below standard test engineer
  - A genius with the heart of a toolmaker (the NIH - Not Invented Here - problem)

What is the reality?

- 2001 – IBM Telephone company engagement
- Rapid deployment
  - Team of five crack testers with a tight deadline
  - Enormous volume of testing
- Created an automated process for converting existing Cobol artifacts into GDL models
- The reality
  - Mountains of bugs uncovered
  - 60% of the bugs were documentation bugs
  - No repeated use of the tools

What is the reality?

- 2003 – Health care ISV
- Conversion of existing testing artifacts into GDL models
- Simplification of the UI
- Modelling using a spreadsheet
- Simplified coverage criteria
- The reality
  - Our champion at the ISV got a promotion
  - No repeat business

What is the reality?

- 2005 – IBM Java compliance
- Thousands of classes with a reference implementation
- Use reflection to generate models
- The tester never sees a model

Barriers to Model Based Testing

- Process shift
  - Up front investment in test
- Personnel shift
  - Higher education and sophistication
- Tools
  - Still bleeding edge

Modelling is not easy

- What details do you leave out?
- How do you check the model?
- There are no recipes for success

So where to now?

- I still believe in model based testing
  - But keep the models away from the (average) testers
- I believe less in model based toolkits for testers
  - MBT should be a service offering not a tool product
- Hide the complexities as far as possible
  - Automate whenever possible
  - KISS
- Reuse existing artifacts to generate models
  - Creative tooling
  - Domain specific

References

- ***Model driven testing – an infrastructure for custom-made solutions*** *(A. Hartman, A. Kirshin, S. Olvovsky) Proceedings of SVT06*
- AGEDIS Papers: www.agedis.de
- ***Using a model-based test generator to test for standards conformance*** *(E. Farchi, A. Hartman, S. Pinter) IBM Systems Journal 41 (2002) 89-110.*
- ***A study in coverage driven test generation****, (M. Benjamin, D. Geist, A. Hartman, G. Mas, R. Smeets, Y. Wolfsthal) Proceedings of the 36th Design Automation Conference (DAC) June 1999.*

Advertising

- *ECMDA workshop on Integration of Model Driven Development and Model Driven Testing*

  Bilbao – July 11th 2006
- *Submission Deadline: April 16th 2006*
- http://www.fokus.fraunhofer.de/event/imdt/