

Model-based Testing in practice



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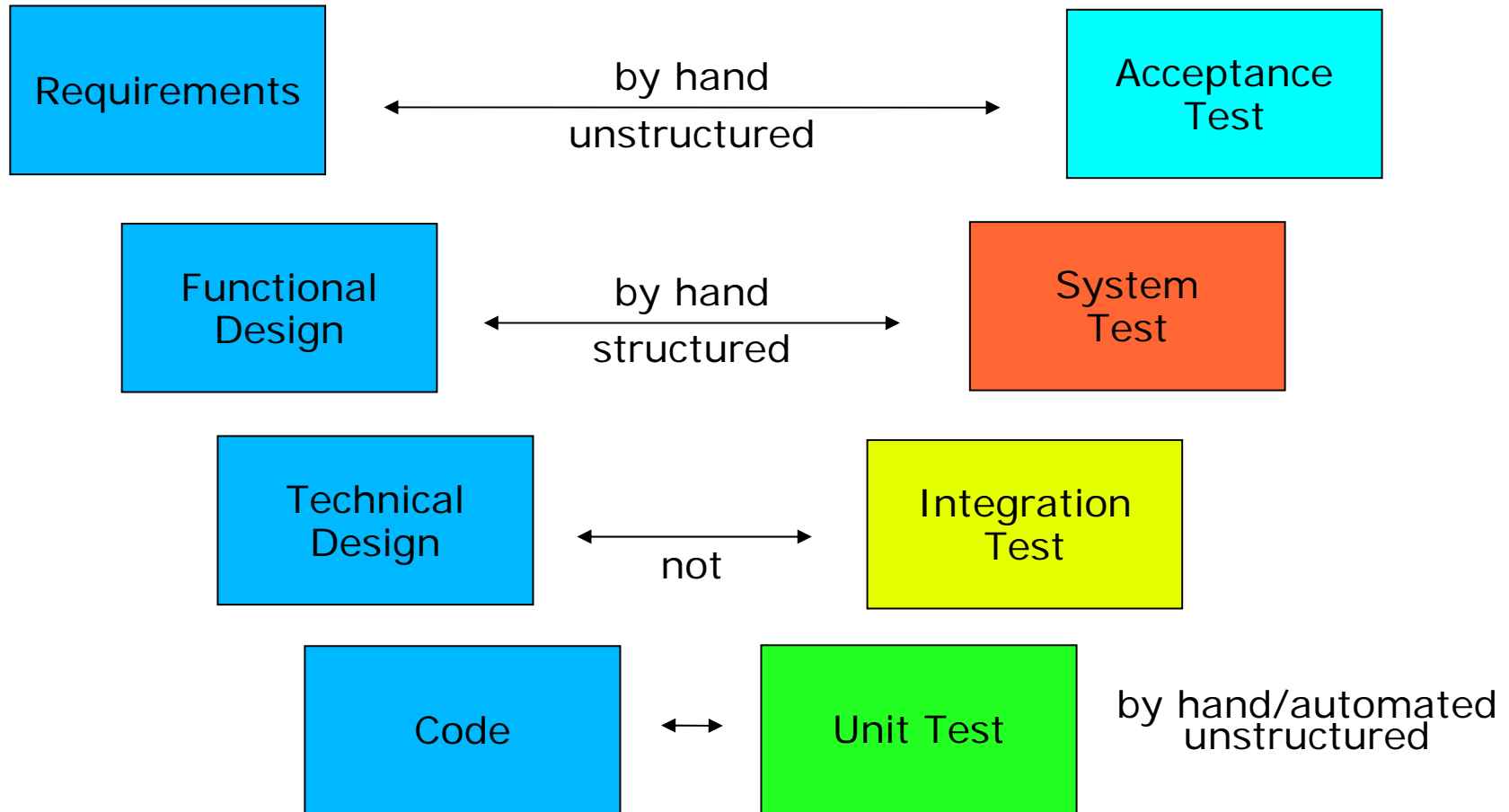
Automatically generate, execute
and evaluate the outcome of
tests

Machiel van der Bijl

Overview

- Some observations from practice
- Model-based Testing
 - why?
 - how?
 - demo
- Conclusions

Some observations



Manual testing: quantity

- Manual
 - test creation
 - test execution
 - evaluation of test outcome
- Low coverage
- Takes a lot of time/effort
- Hard to repeat

What about test automation?

- Current tools automate test execution
 - tests created by hand
 - outcome of test to be checked by hand (at least first time)

In other words: coverage depends on **manual labor**

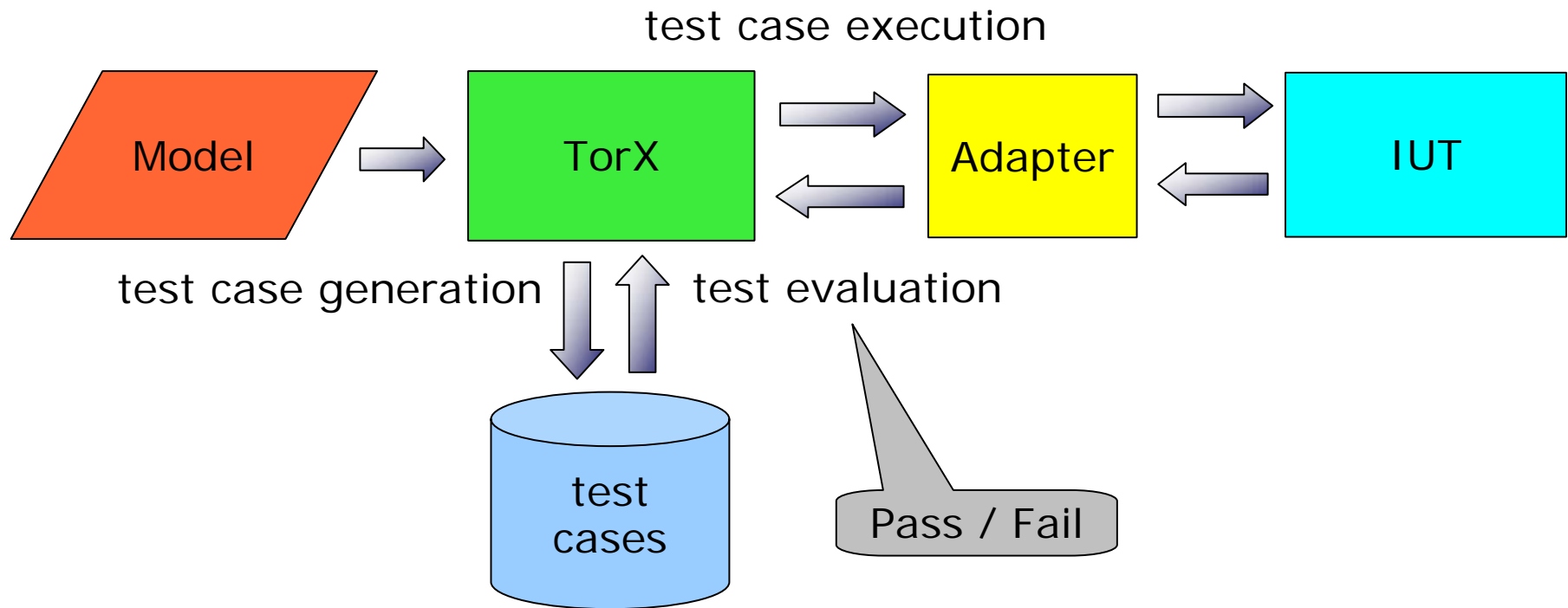
Model-based Testing

- Automatic
 - test case **generation**
 - test case **execution**
 - **evaluation** of test outcome
- Based on a model
 - specification of system under test
 - various languages (here Promela)

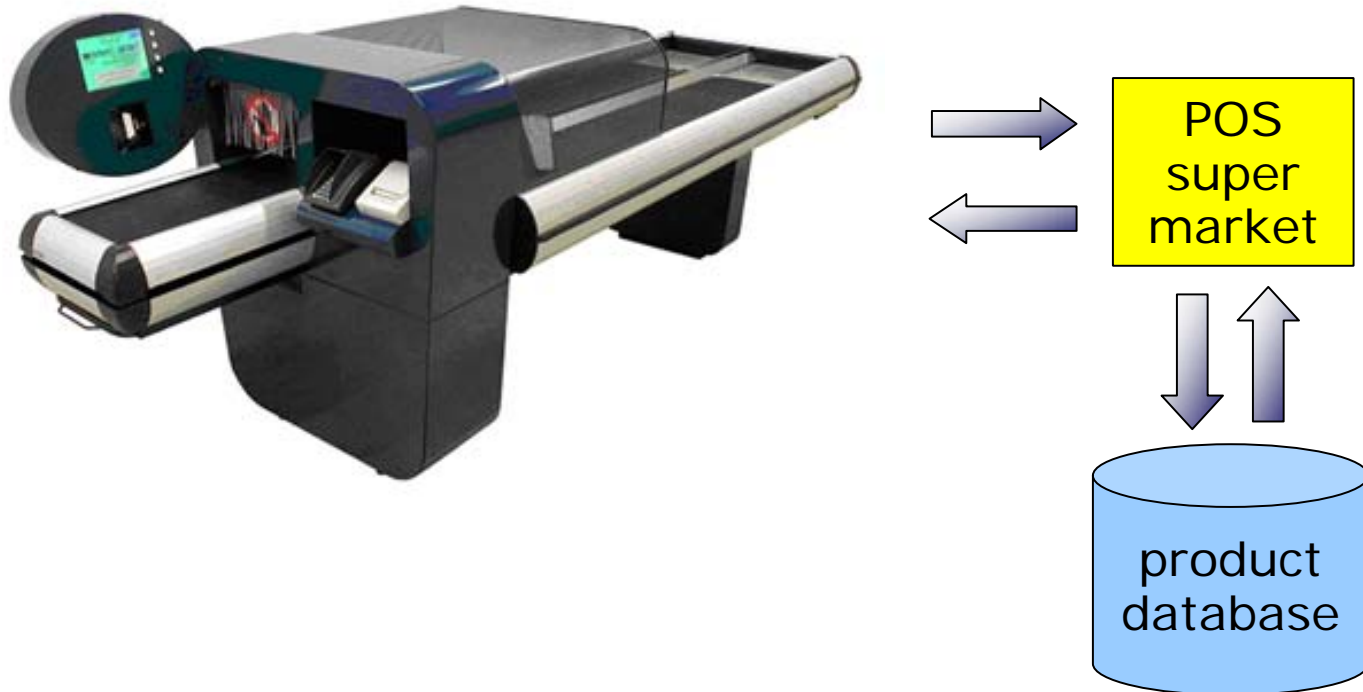
MBT: testing with better coverage

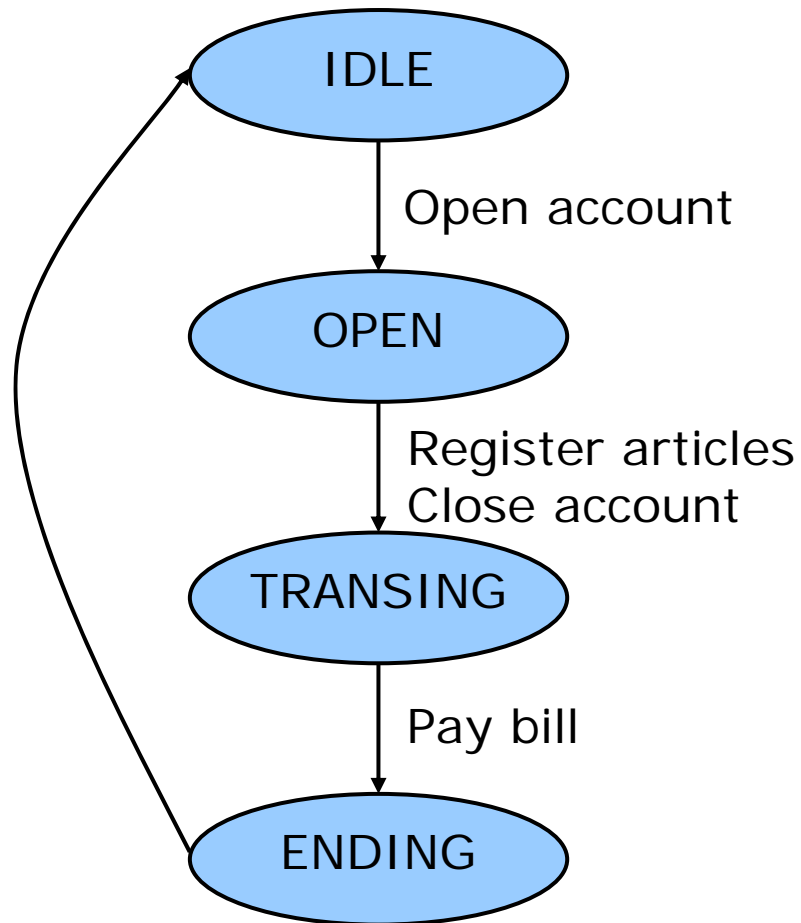
- Long history: Moore in 1955
- Last 20 years lot of research, e.g. University of Twente, INRIA, NASA
- Result: theory and tooling
- 2006: Axini, UT spin-off
 - 4 MBT-customers in 2007

Model-based Testing with TorX



POS communication

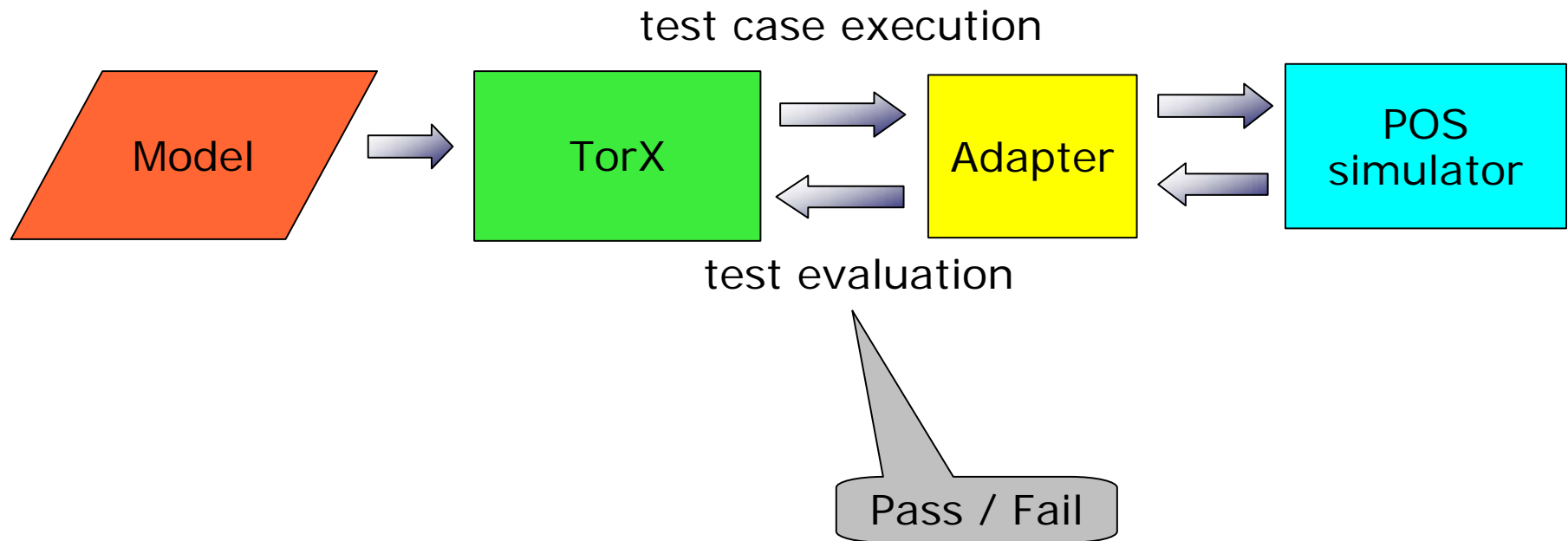


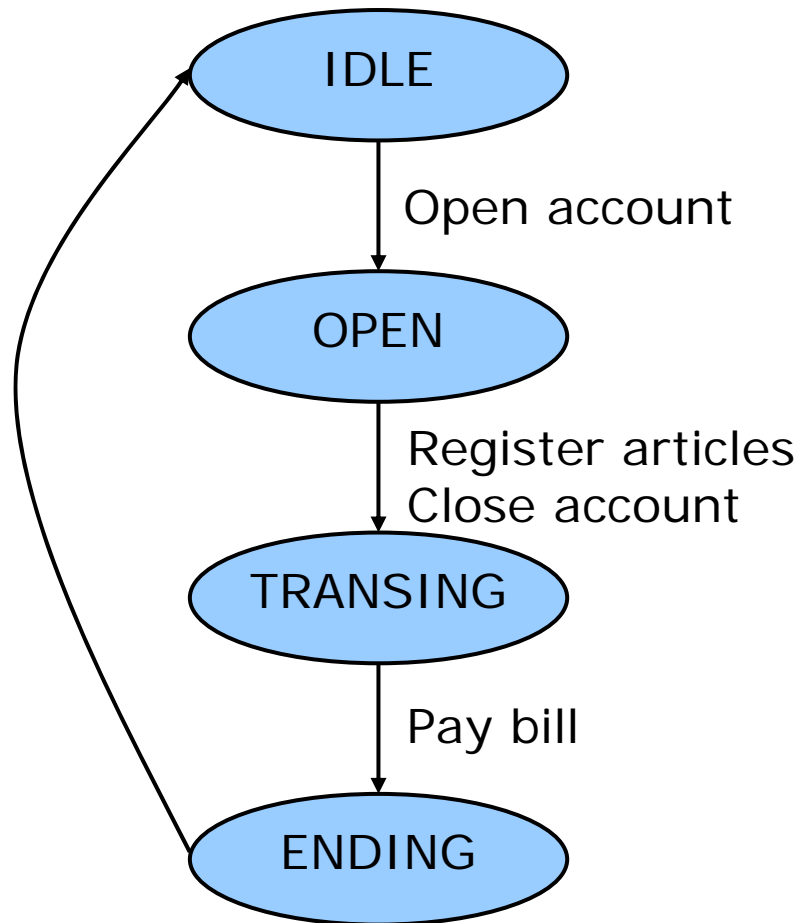


Model snippet

```
as_idle:
it
:: receive(OPEN);
   send(C231_ACCOUNT_OPENED,
        &accountnr);
   goto as_open;
:: receive(SIGNOFF);
   send(C250_SIGNEDOFF);
   goto ss_off;
:: receive(GET, CS_ACCNT);
   send(C210_VAR_RETURN, CS_ACCNT,
        AS_IDLE);
fi;
```

Model-based Testing with TorX





TorX 3.10.5d: Config: pos

File Preferences Primers Guides Mutants View Tools Help

Start Stop Seed: 236 Mode: Manual Auto, Steps:

Executed test steps:

```
7 output(out): (Quiescence)
8 input(in:in): env2pos ! GET ! CS_SIGN ! 999
9 output(out:out): pos2env ! 210 ! SS_OFF ! 999
10 input(in:in): env2pos ! SIGNON ! DUMMY_MTYPE ! 999
11 output(out:out): pos2env ! 251 ! DUMMY_MTYPE ! 999
12 input(in:in): env2pos ! GET ! CS_ACCNT ! 999
13 output(out:out): pos2env ! 210 ! AS_IDLE ! 999
```

History

Current state offers:

Inputs:	Outputs:
(in) env2pos ! OPEN ! DUMMY_MTYPE ! 999	(out) (Quiescence)
(in) env2pos ! OPEN_EXIST ! DUMMY_MTYPE ! 999	
(in) env2pos ! GET ! CS_ACCNT ! 999	
(in) env2pos ! SIGNOFF ! DUMMY_MTYPE ! 999	
(in) env2pos ! GET ! CS_EVENT ! 999	
(in) env2pos ! PRINT ! DUMMY_MTYPE ! 999	
(in) env2pos ! RHCOPY ! DUMMY_MTYPE ! 999	

Input Output

Selected Input Random Input Random Output

Verdict:

```
ADAPTOR: Encode abs: env2pos ! GET ! CS_SIGN ! 999
ADAPTOR: Encode cnc: GET CS_SIGN
ADAPTOR: Decode abs: env2pos ! GET ! CS_SIGN ! 999
ADAPTOR: Decode cnc: {env2pos ! GET ! CS_SIGN ! 999} in 0 in {1192550984 <Tue Oct 16 06:09:44 PM CEST 2007>}
ADAPTOR: Encode abs: env2pos ! SIGNON ! DUMMY_MTYPE ! 999
ADAPTOR: Encode cnc: SIGNON 1:01
```

So far any questions?

Results

	Previously	With MBT
Modeling	-	2 weeks
Adapter (once)	-	3 weeks
Partial test	2 hours by hand	5 minutes with TorX
Development cycle		60% reduction

- High coverage, lots of issues found
- Test often, test cheap

Road ahead

- User-friendly, web-based
- Modeling language

Test Manager *beta edition*

Tests

suites

runs

analyze

Administer

configurations

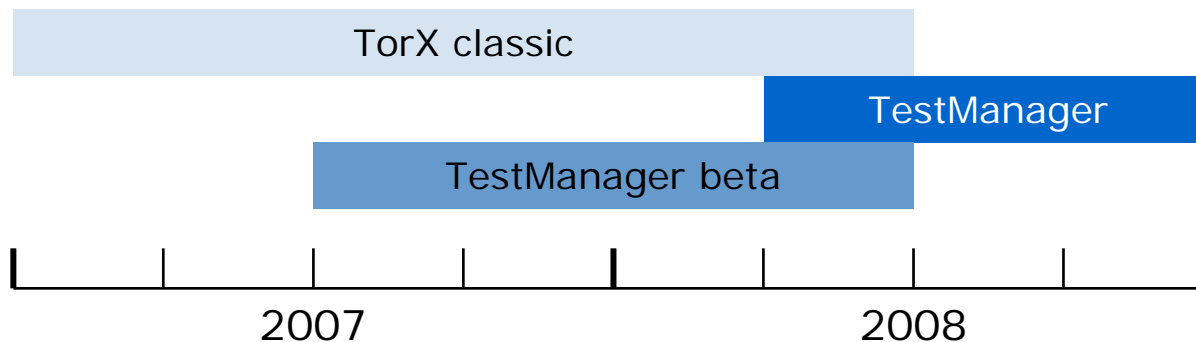
maintenance

v1143M

test runs

	suite	created	status	results	
5	Fully random	2007-11-27 22:32:27	passed	<u>2000</u>	details
4	Fully random	2007-11-27 22:32:12	passed	<u>100</u>	details
3	Iterated	2007-11-27 22:31:55	passed	<u>10</u>	details
2	Iterated	2007-11-27 22:31:37	passed	<u>10</u>	details
1	Iterated	2007-11-27 22:31:26	failed 9	<u>10</u>	details

Clicking on status shows failed test cases only; clicking on results shows all test cases.



Summary Model-based Testing

- Coverage!
- Speed up development
- Automates annoying part of testing

Especially for

- Complex systems
- High cost of failure