

Are you getting traction?

Tales from the tech transfer trenches

Satish Chandra, PhD

June 25, 2015

Acknowledgments: Saurabh Sinha (IBM), Leigh Williamson(IBM), Indradeep Ghosh (Fujitsu), Jim Larus (EPFL)



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Disclaimer

- Personal account
 - Not speaking for IBM
 - Nor for Samsung
- Talk material from published sources and from memory
 - Might have misremembered some details

Wearing two hats

- Industry research
 - Research
 - Business impact

<http://cacm.acm.org/blogs/blog-cacm/97467-research-in-the-wild-making-research-work-in-industry/fulltext>

“Phase 1. Hire PhDs
Phase 2. ???
Phase 3. Profit!”

My background

- 11 years at IBM Research
 - T. J. Watson Research Center and IBM India Research Lab
 - Multiple tech transfer efforts
 - Deployment of test automation in services
 - Shipping products involving static analysis technology
 - Internal deployment of bug-finding tools
 - and some more...
- Impact recognized by the company by corporate awards

Acknowledgements: This work was done by a large cast of people from IBM India and T. J. Watson labs, and with a lot of support from the respective management chains

Outline

- • Deployment of test automation in “services”
- Internal deployment of bug-finding tools

Some large software businesses



Product businesses



Lots of software engineers

Market size: several
hundred billion USD

Revenue from prepackaged
software sales

Differentiation based on
product features

Service businesses

Lots of software engineers

Market size: several hundred billion USD

Revenues from software engineering services to other businesses

Differentiation based on expertise and **cost/quality of service** provided



Cognizant



TATA CONSULTANCY SERVICES



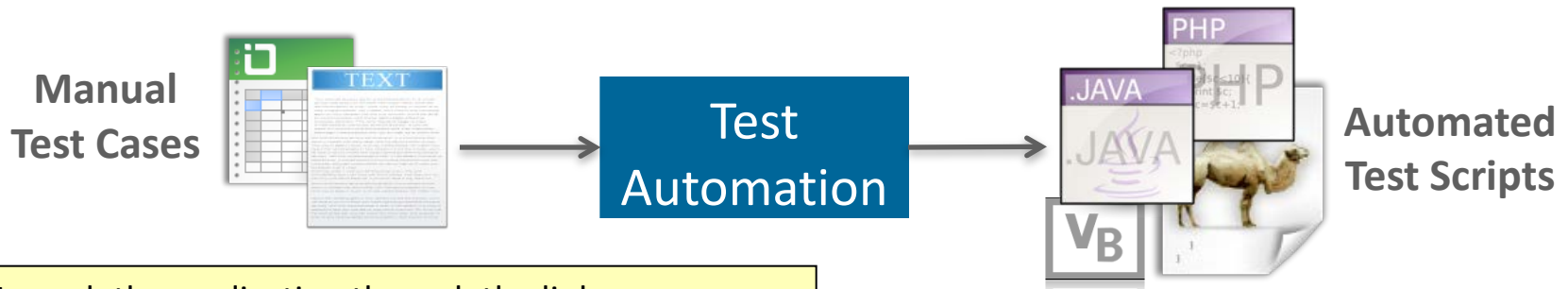
Bangalore, 2010

- Large services presence
- Of which, a large testing practice
- Selected test automation as a research topic
 - 1/3rd of the net testing services business
 - Many other problems (see paper below)

Test Automation

- Web sites have to be tested
- Over and over again ...
 - Change in application – UI or backend
 - Change in browser version
 - Across browser
 - Platform (PC, tablet, etc.)
- Not a core interest of companies, say, in financial or manufacturing sectors
 - Often candidate for sending to third-party service providers

What is Test Automation?



1. Launch the application through the link <http://godel.in.ibm.com:8080/online-bookstore/Default.jsp>
2. Enter the intended book search name as “MySQL” at the “Title” Edit field and select “Category” as “All” by Drop down list and then Click “Search” Button
3. Select a title from the list of all Search Results displayed and then click either on the image of the book or on Name of the Book
4. Enter login “guest” and password “guest”, and click login
5. Enter the Quantity “1” and Click on “Add to Shopping Cart” Button

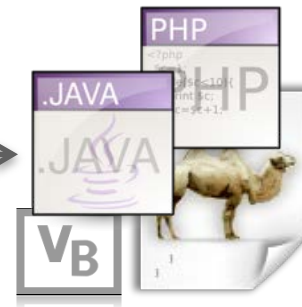
```
public void setUp() throws Exception {  
    driver = new FirefoxDriver();  
    driver.manage().timeouts().  
        implicitlyWait(30, TimeUnit.SECONDS);  
}  
  
public void test() throws Exception {  
    driver.get("/online-bookstore/Default.jsp");  
    driver.findElement(By.name("n")).clear();  
    driver.findElement(By.name("n")).sendKeys("mysql");  
    driver.findElement(By.cssSelector(  
        "input[type='submit']")).click();  
    driver.findElement(By.xpath("//tr[2]//font")).click();  
    driver.findElement(By.name("Login")).clear();  
    driver.findElement(By.name("Login")).send("guest");  
    driver.findElement(By.name("Pass")).clear();  
    driver.findElement(By.name("Pass")).send("guest");  
    ...  
}
```

Is Test Automation a Significant Problem?

Manual
Test Cases



Test
Automation



Automated
Test Scripts

1. Launch the application through the link
<http://godel.in.ibm.com:8080/onlinebookstore/Default.aspx>

2. Enter the intention
at the “Title” E
“All” by Drop d
Button

3. Select a title fro
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4. Enter login “gu
login

5. Enter the Quantity “1” and Click on
Shopping Cart” Button

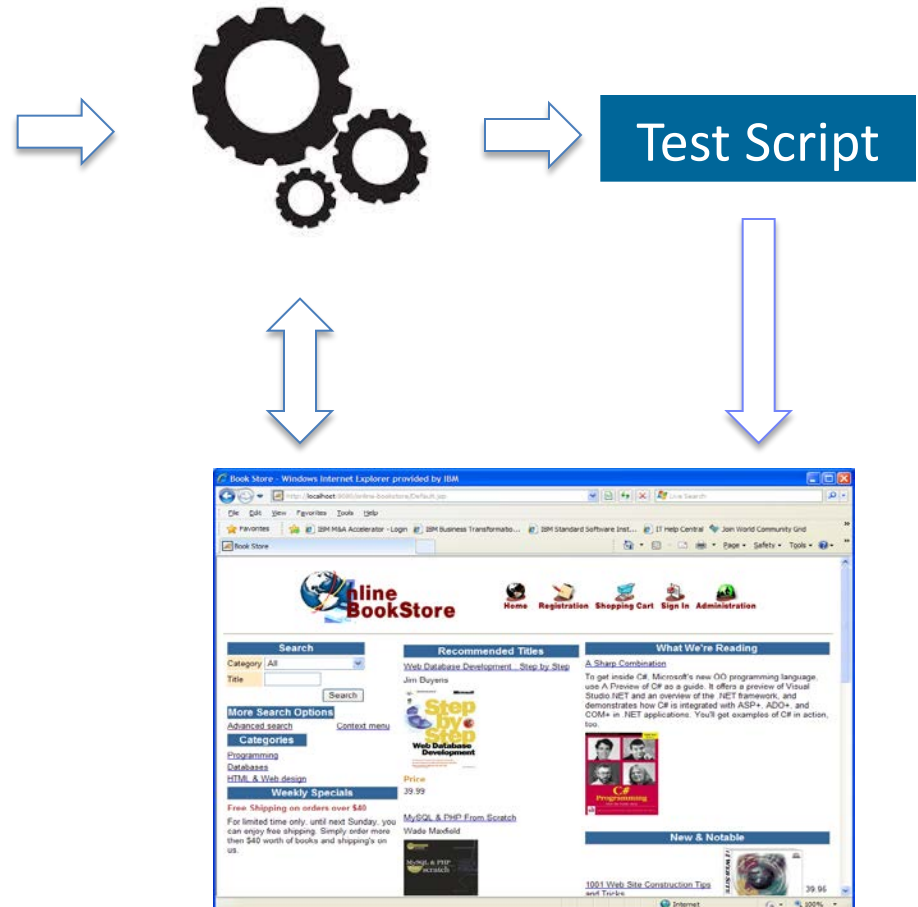
- Real applications can have thousands of manual tests (≈ 30,000 manual tests), requiring regression cycles that can run into a few months
- Efficient and effective regression testing requires **automated test execution**
- However, test automation comes with costs
 - **Initial cost:** automation is time-consuming and requires specialized skills
 - **Maintenance cost:** small changes in the user interface can break the automated scripts

```
driver.findElement(By.name("Password")).sendKeys("guest");  
driver.findElement(By.cssSelector("input[type=\"submit\"]")).click();
```

```
mysql");  
submit\"]').click();  
)).click();  
guest");
```

Automating Test Automation (ATA)

1. Launch the application through the link <http://godel.in.ibm.com:8080/online-bookstore/Default.jsp>
2. Enter the intended book search name as “MySQL” at the “Title” Edit field and select “Category” as “All” by Drop down list and then Click “Search” Button
3. Select a title from the list of all Search Results displayed and then click either on the image of the book or on Name of the Book
4. Enter login “guest” and password “guest”, and click login
5. Enter the Quantity “1” and Click on “Add to Shopping Cart” Button
6. Verify whether Order # and Total are displayed



ATA

- *Semi*-automatic conversion of English sentences to scripts
 - Using lightweight NLP
 - Program synthesis approach
- Addressed the script fragility problem
 - A robust, mostly DOM-independent script representation

Pros:

- Lower cost entry to test automation
- Reduced need for test maintenance

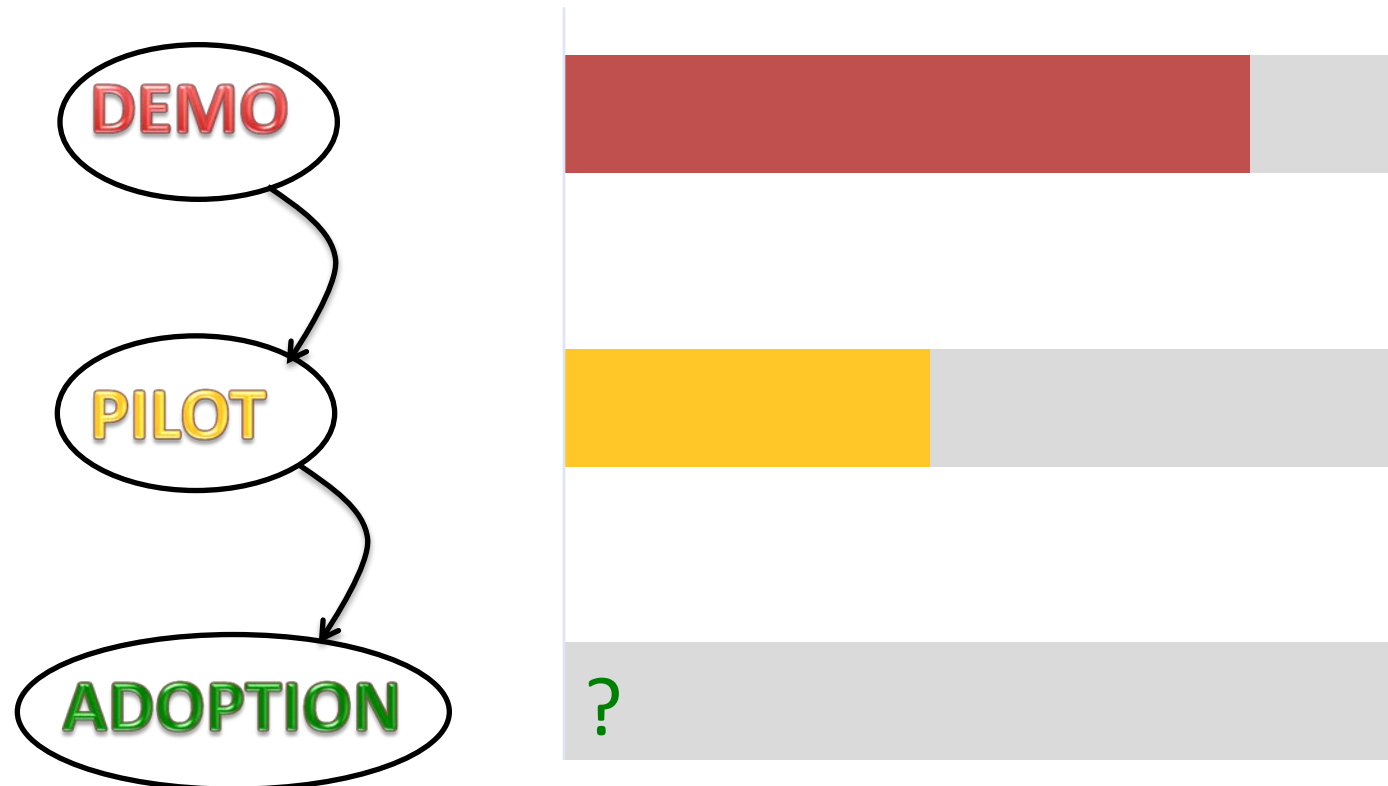
[Automating Test Automation](#) in International Conference on Software Engineering, 2012

And that was the start of our troubles ...



The sales job

- Research 'cred' opens the doors
- Contacted a large number of client accounts



Where the rubber meets the road ...

- Real world situations
 - Badly written manual tests, missing steps
 - Conditional flows, exceptions
 - Verification steps
 - UI change resilience
 - ...
- “ATA can’t handle this” was a deal breaker

The pushback

- Delivery managers are conservative
 - *“Client will not allow this new tool”*
 - *“Already have a framework”*
 - *“We might need to work with other vendors”*
 - Incentivized for what? Predictable, timely delivery
- The “Look, how easy” pitch wasn’t working
 - Need to articulate the value – R.O.I. analysis
 - Chicken and egg problem

Vive le ROI

- Costs
 - How long does it take for a tester to be trained in ATA?
 - Unproven research tool, produces non-standard artifacts, risk of wasted work – financial repercussions
 - Are we billing for person hours or for number of tests?
- Benefits
 - How much more effective is a tester on ATA, relative to status quo
 - Tests automated / tester / day
 - How much does ATA reduce the need of test repair?

The first sale is the hardest ...

- Found one sympathetic team for an internal account (non customer)
 - Needed to automate ~ 7000 test cases in a short amount of time
 - Allowed us to collect some citable data ... even if there are a lot of caveats
- We provided excellent customer support
 - This proved to be a very good thing ...

Evaluation in a Production Environment

Previous Automation Experience	The ATA Experience
939 scripts automated at the rate of 3 to 5 test cases per tester per day (in 10 months)	583 test cases automated at the rate of 10 test cases per tester per day (2X productivity gain)
Longer learning curve before test engineer can start automating	Very short (roughly 1 to 2 days) time required to start contributing
Scripts break when UI elements are moved	Scripts are automatically repaired during execution if UI elements are moved
...	...

Your mileage *will* vary

[Efficient and change-resilient test automation: an industrial case study](#) in ICSE 2013

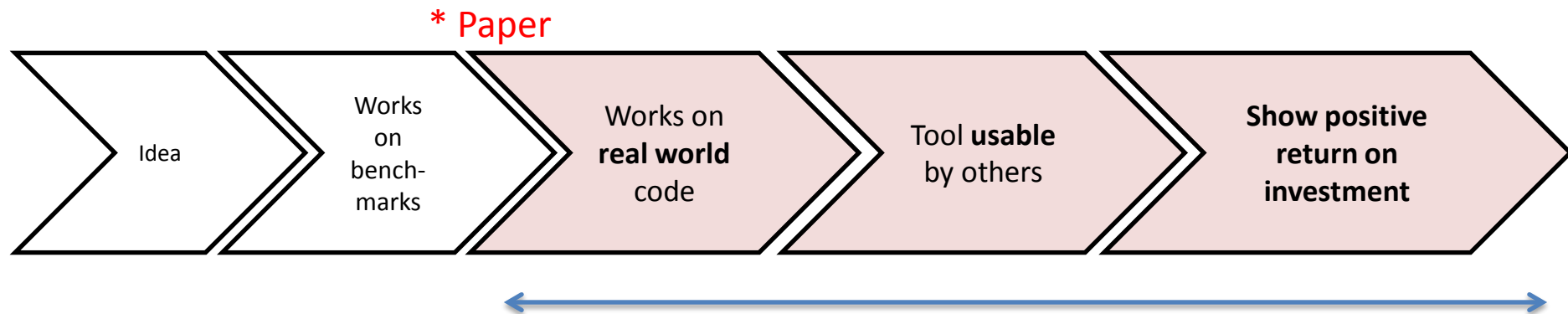
Connecting with new accounts

- Get the sales team on board with the idea
 - Their incentive is to sell the client on service quality
 - Negate the “*client does not want it*” argument
- Much better scaling of sales job
 - We graduated from talking to measly delivery managers to high powered CIOs or their delegates
 - Heady stuff
- Better traction

The last mile?

- Significant overhead in customizing the tool to each client's liking
 - Tool and process compatibility
 - *Research tools do not control end-to-end processes; they only solve a slice of the problem*
 - Export to XXX
 - Interoperate with YYY
 - Lot of installation, handholding, workshops etc.
 - Much more demanding of in-house tools than of off-the-shelf tools!
 - On call

The last N-1 miles



Retrospective

- *Identified the right problem to work on*
- *Measurable positive ROI was the key to acceptance*
- *Impact on the practice – production usage of the tool*

- *Vastly underestimated the “last” mile*
- *Top-down vs. bottom up adoption*
- *Took a long time to truly transfer the technology ... off our hands*

The conundrum of services

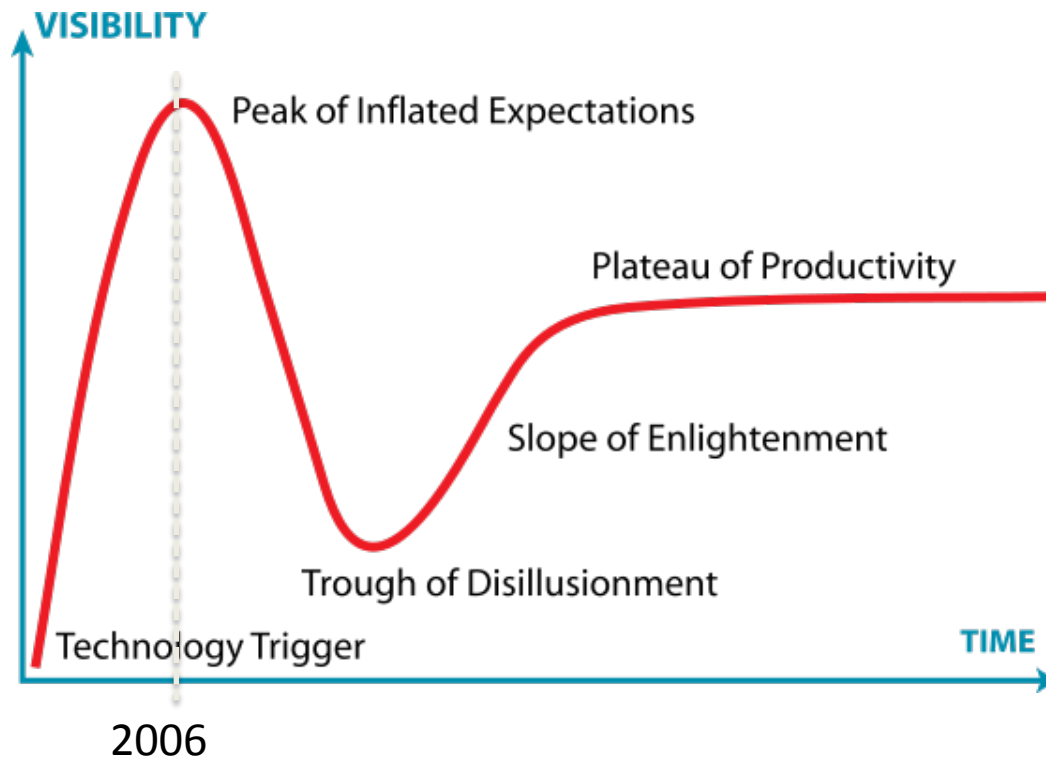
- Clients want innovation, but also want predictable delivery of a project
- Researchers are expected to build tools that
 - Have zero learning curve
 - Cause no change to process
 - Are *magical* in their effectiveness
- Differentiating, home-grown technology sounds good, but doesn't always match the business

Outline

- Deployment of test automation in “services”
- • Internal deployment of bug-finding tools

New York, 2006

- Bug finding was in the air
 - Every interview talk referred to a certain NIST study – 50B USD lost annually to bugs!



Rational. software



Klocwork.



DEVELOP SOFTWARE
WITH CONFIDENCE



Perception

- What are the inhibitors to adoption?
 - Too many false positives
 - Not all reports may be actionable
 - Too many tools out there, which ones to pick
 - Too much overhead in installing and maintaining tools
 - Developers don't understand the reason for bug report
- What if we mitigated all of these issues?

Khasiana: A bug catching portal

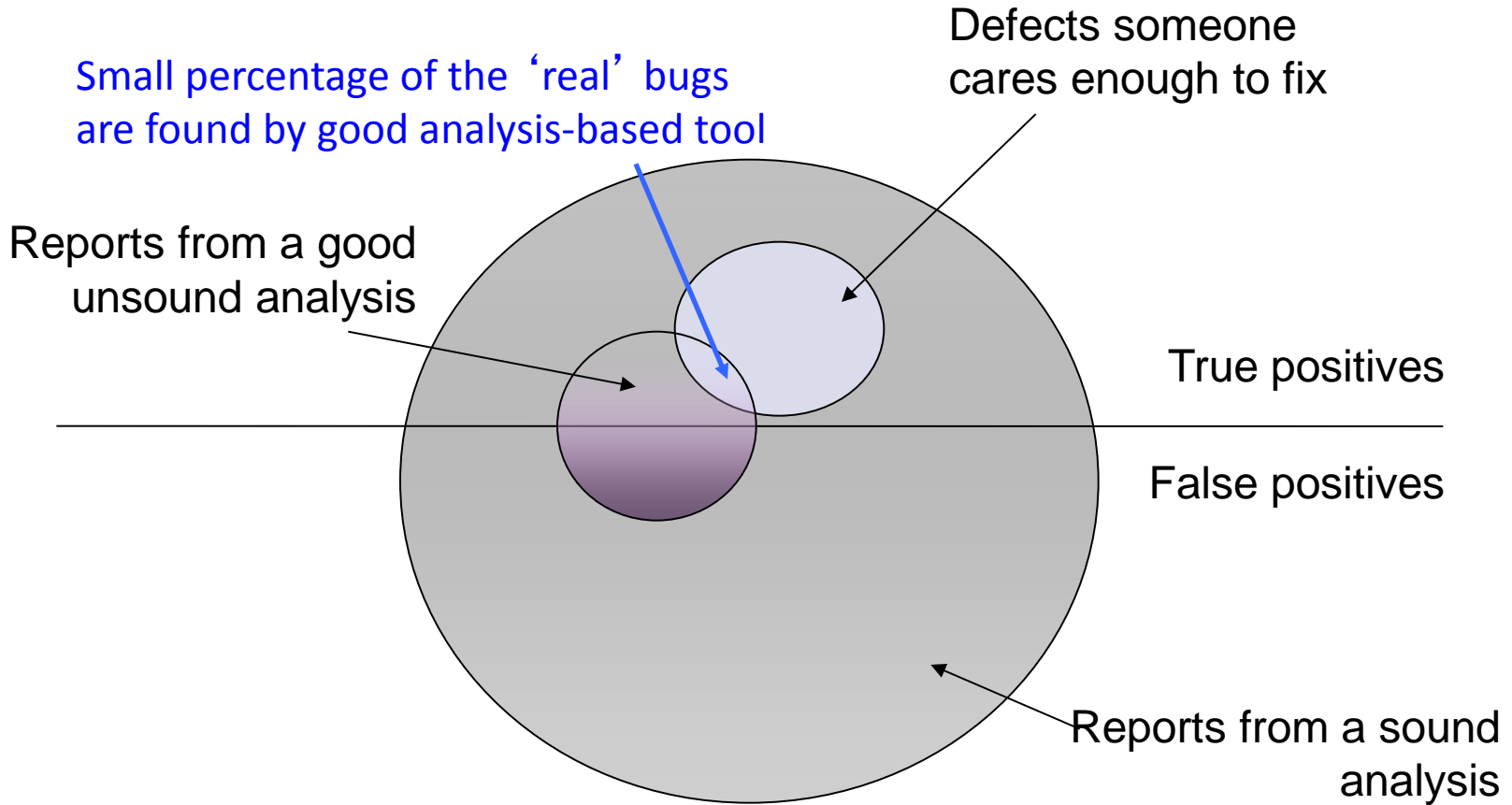
- Bug finding as a service on the cloud
- Easy upload from code repositories
- Integrated presentation of output of multiple tools
 - FindBugs, SAFE, Xylem
- Symbolic analysis to filter out false positives
- Bug explanation
- Heuristic ranking of bug severity
- We assumed if you build it, they will come

They did not. (Not in droves.)

- Was the technology bad?
- Was the marketing bad?
- Was the deployment bad?
- Was the timing bad?

The same old R.O.I discussion

- Costs
 - Time to triage the bug reports – possible *increase* in time to release
 - Developers not incentivized on code cleanliness (deadline driven)
 - Opportunity costs – features vs. bug fixes
- Benefit
 - Reduction in likelihood of field defects
 - But we failed to present compelling evidence of this



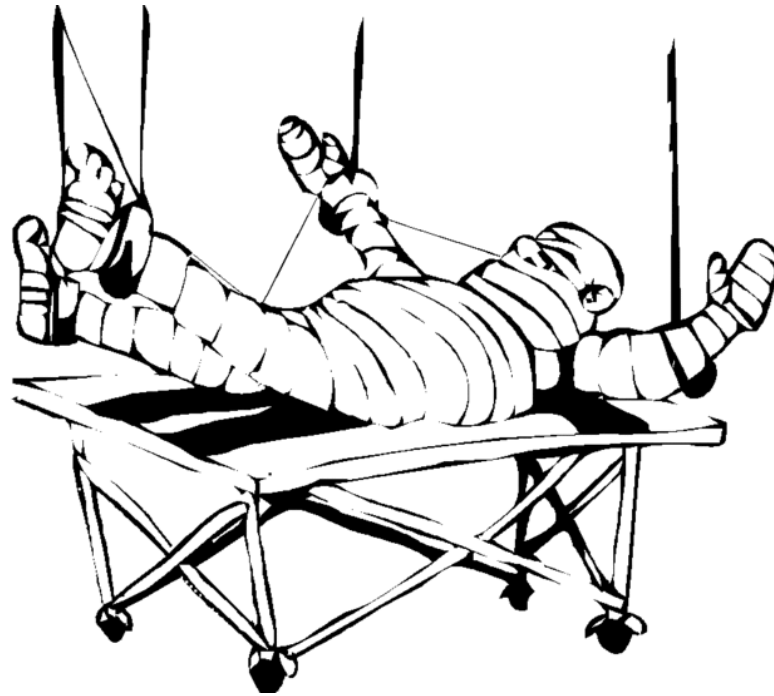
Some more observations

- IDE vs. build
- Top down vs. service vs. self-service
- Enterprise vs. safety-critical
- 'Old' vs. 'new' code
- Other defect categories? (performance, security, ...)

Getting software tools adopted is hard

- 1 Pick the right problem.
- 2 Someone will ask you about ROI. Have an answer.
- 3 The last N-1 miles will test your patience.
- 4 Be mindful of the incentive structures.

Are you getting traction?





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