

Krav \leftrightarrow test - vad gör forskarna?

Robert Feldt, 2008-11-20, SAST

SWELL Research School, swell.se

BTH/SERL

- SERL = Swedens largest SE research group
 - Req Eng, Automated V&V, Empirical
- 1 Professor (top 5 in world), 6 PhDs, 8 PhD students
- BTH = Blekinge Tekniska Högskola
 - Focused on IT & Sustainability
 - Largest number of international students
 - Bachelor SE, MSc, Master SE, EuroMaster SE

SWELL - Swedish V&V Excellence

Research School

7 PhD students and growing

4 Universities

10+ Companies



MdH, Västerås

ITUniv & Chalmers,
Göteborg

LTH, Lund

BTH, Ronneby

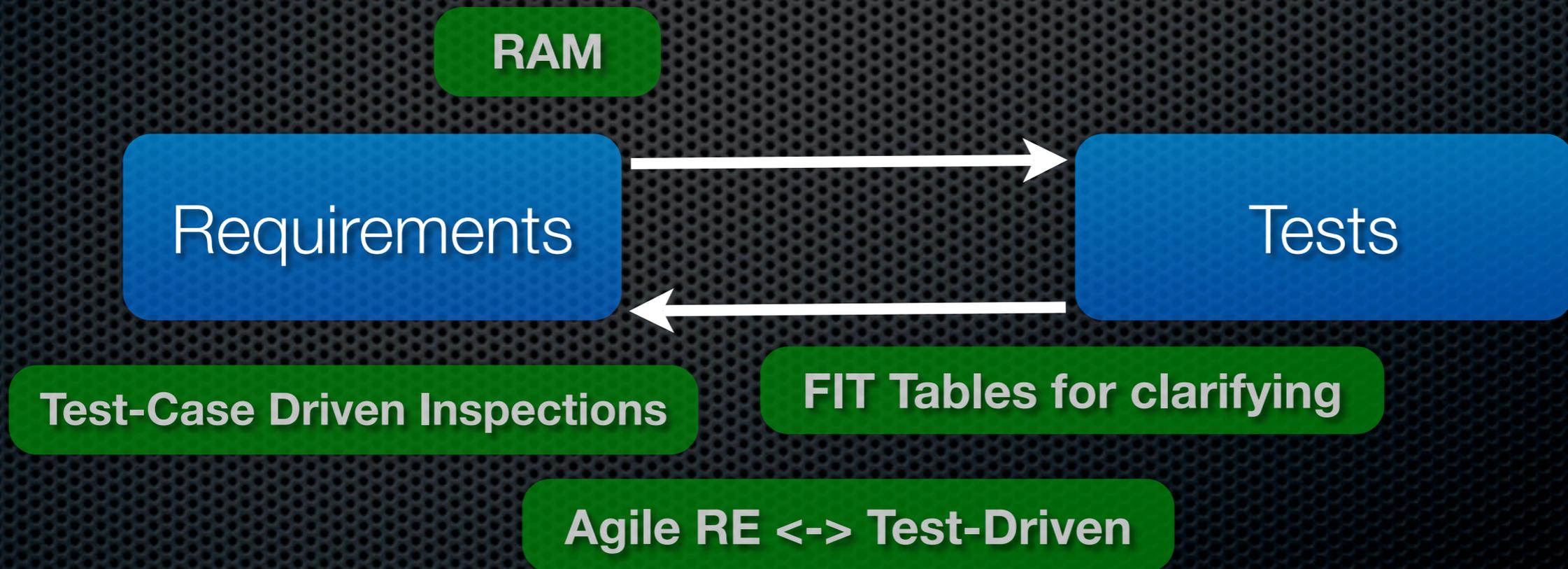
SWELL Goals

- Sweden leads in SW Verification&Validation
 - National Innovation Driver in V&V&Test
- Drive VV knowledge innovation
 - **Develop:** Industry-relevant & -close research
 - **Promote:** Spread and help implement
 - **Commercialize:** Services and tools
- SWELL Phds = top-class V&V intra/entrepreneurs!

What can you do?

- Sign up on swell.se
 - Blog / RSS feed
- Take part in VV Innovation Workshops
- Contact us for collaboration
 - Master thesis & Research projects
 - We can give courses & “heads-ups”
- We want to do this together with you!

Outline



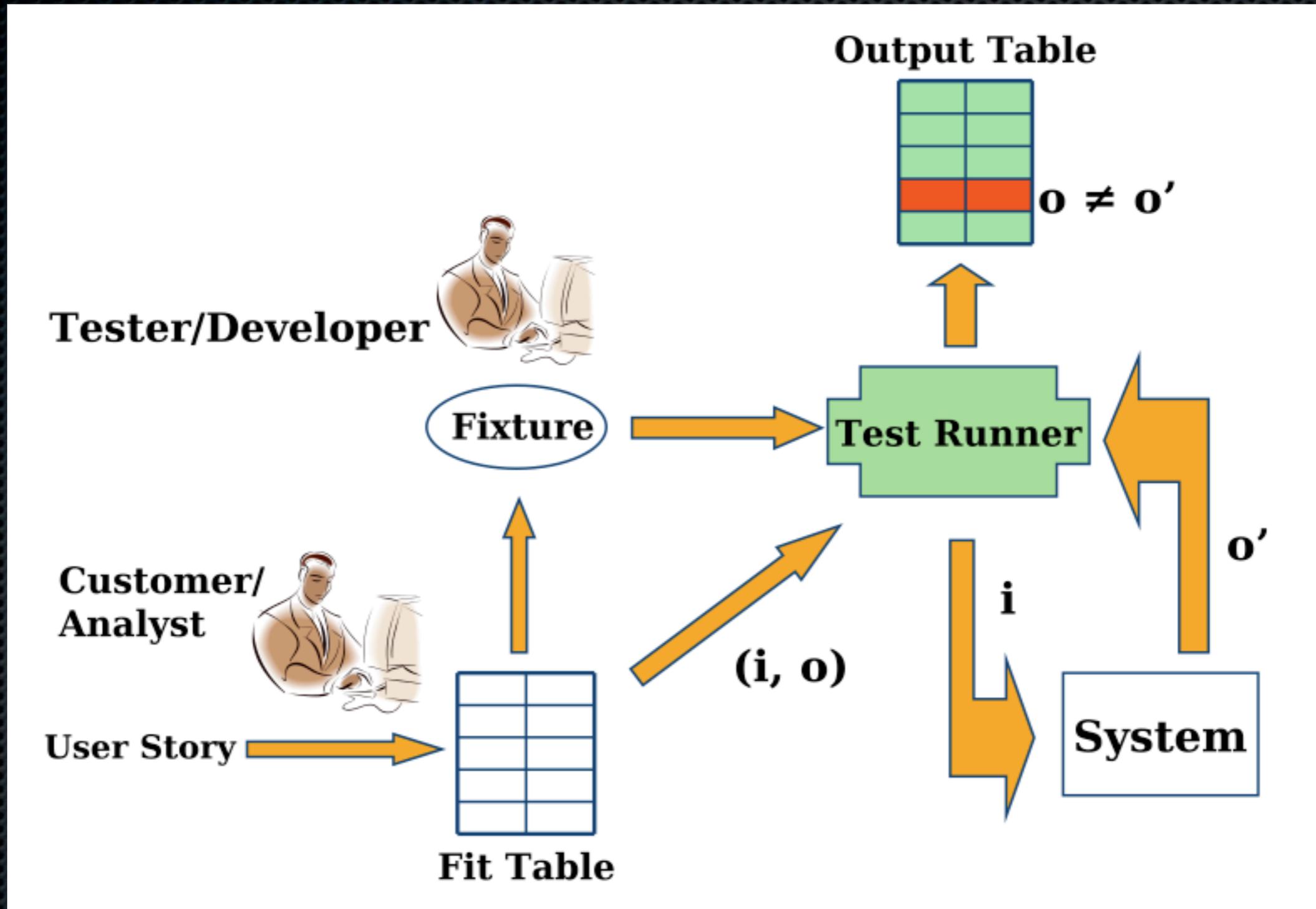
Acceptance Tests for Clarifying Requirements

- ✦ Study at two Italian universities, 30 students [1]
- ✦ Goal: Evaluate effect of FIT tables on comprehension level and effort
- ✦ Compare:
 - ✦ Group 1: Textual requirements
 - ✦ Group 2: Textual requirements + FIT tables
- ✦ Which group understood requirements best?
- ✦ Which group spent most effort?

Acceptance Testing

- ✦ Validating the systems behavior before release
- ✦ Often informal - “Demo” for customer
- ✦ Scenarios/User stories =>
- ✦ Input/output sequences for main/alternative/exceptional paths
- ✦ FIT tables give customer easy specification format

Acceptance Testing with FIT tables



Acceptance Tests for Clarifying Requirements

| | Correct | Wrong |
|----------|---------|-------|
| FIT+Text | 56 | 34 |
| Text | 25 | 65 |

- ✦ Results:

- ✦ FIT Tables gave 400% better odds at answering requirements questions correctly

- ✦ Same effort (i.e. no increased cost)

- ✦ However:

- ✦ FIT tables not suited to all requirements

Evaluations of Test-Driven Development

- ✦ 1. Industrial TDD users [2]
 - ✦ produced code that passed 18-50% more tests
 - ✦ took 16% more time
- ✦ 2. TDD use at IBM reduced defect density 50% [3]
- ✦ Results from student experiments more mixed [1]

Agile RE practices in industry

- ✦ Interviews with 54 practitioners in 16 companies [4]
 - ✦ Companies used variants of XP or SCRUM
- ✦ Questions:
 - ✦ What RE practices do agile developers follow?
 - ✦ What benefits and challenges do these practices present?

Agile RE practices in industry

- 7 actual practices found:

- Face-to-face communication over written specs

Saves time

Lack of trust

User stories, no formal docs

Customer steers

Customer groups

On-site customer

- Iterative Requirements Engineering

High-level first, details in iterations

Better customer relation

Minimal docs

Clearer reqs

Cost estimates

Nonfunc Req

- Requirements Prioritization goes Extreme

Recurrent prioritization

Focus: business value

Clearer view on reasons

Instability

Business value too narrow

- Manage Req change w. constant planning

Few & small changes

Inappropriate architecture

Refactoring not enough

- Prototyping

Quicker customer feedback

Customers unrealistic about dev time

- Test-Driven Development

Tests part of RE

Tests capture reqs

Requires tight customer interaction

Freedom / experimenting

Devs unwilling

- Reviews & Acceptance tests

Reviews for Req validation

Progress report to customer

Hard to develop ATs

QA personnel must help customer

Agile RE practices in industry

Agile requirements-engineering practices in 16 organizations

| Adoption level | Practice | | | | | | |
|----------------|----------------------------|--------------|------------------------|-------------------|-------------|-------------------------|-----------------|
| | Face-to-face communication | Iterative RE | Extreme prioritization | Constant planning | Prototyping | Test-driven development | Reviews & tests |
| High | 8 | 9 | 10 | 8 | 8 | 5 | 11 |
| Medium | 8 | 5 | 6 | 6 | 3 | 1 | 4 |
| Low | 0 | 2 | 0 | 2 | 0 | 0 | 1 |
| None | 0 | 0 | 0 | 0 | 5 | 10 | 0 |

Test-Case Driven Inspection

- ✦ Perspective-Based Reading technique for inspections
 - ✦ Perspective: Can (high-level) test cases be written?
 - ✦ Reader: Test engineer
 - ✦ Checks: Testability, Completeness, Conflicts
 - ✦ Testers often better at this than Req Engs
- ✦ Study compared TCD with Checklist-Based Reading [5]
 - ✦ TCD found more major faults, but took longer time
 - ✦ Test cases could often be created in parallel

RAM

- ✦ Utilize abstraction levels to trace from strategic goals to implementational details
- ✦ Any requirement coming in has to be worked-up to product level -> compared to the strategies
=> YES / NO, if YES -> requirement is broken down, if NO -> dismiss (fast triage)

Organizational Strategies

Product Strategies

RAM - Abstraction Levels

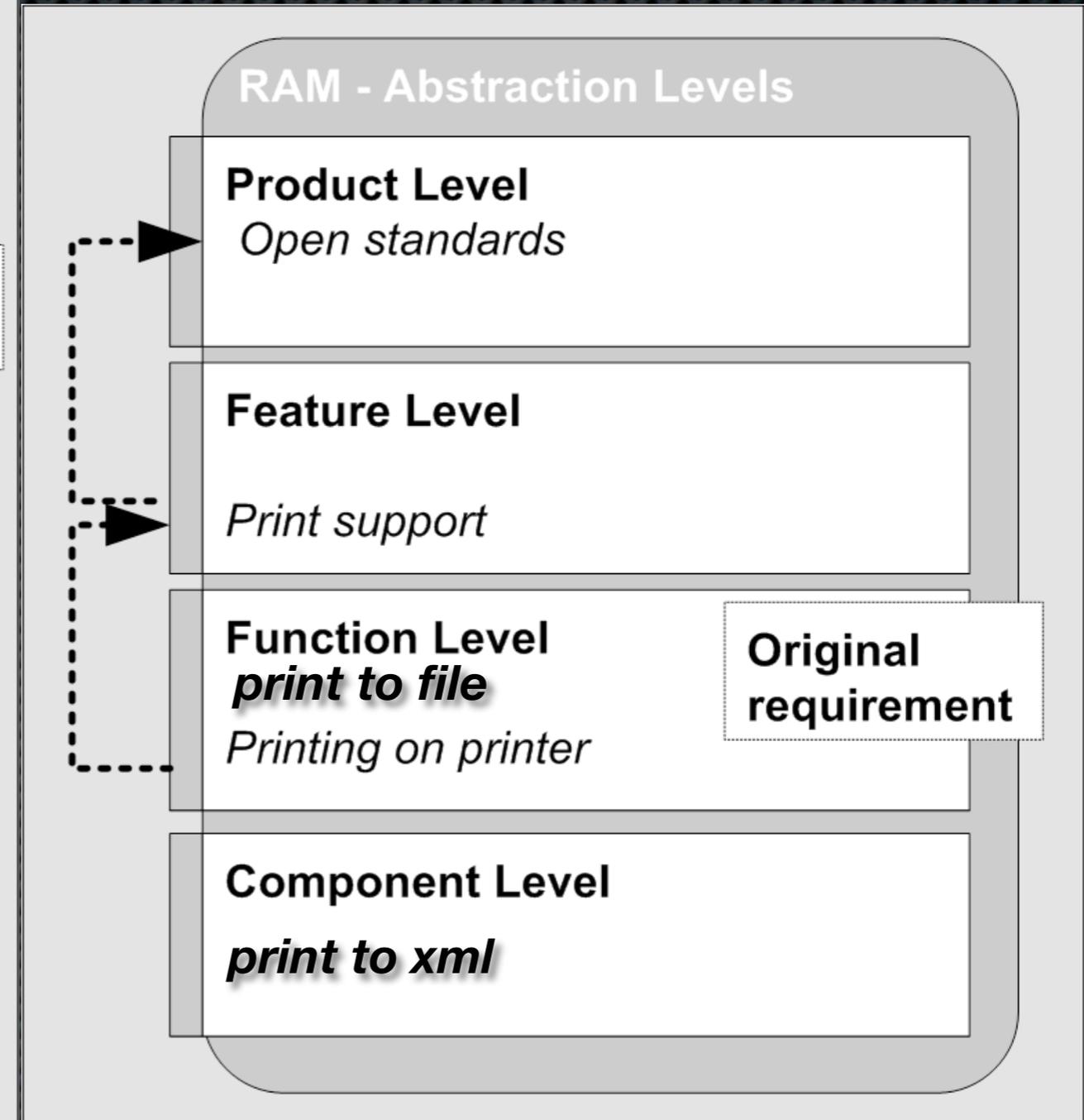
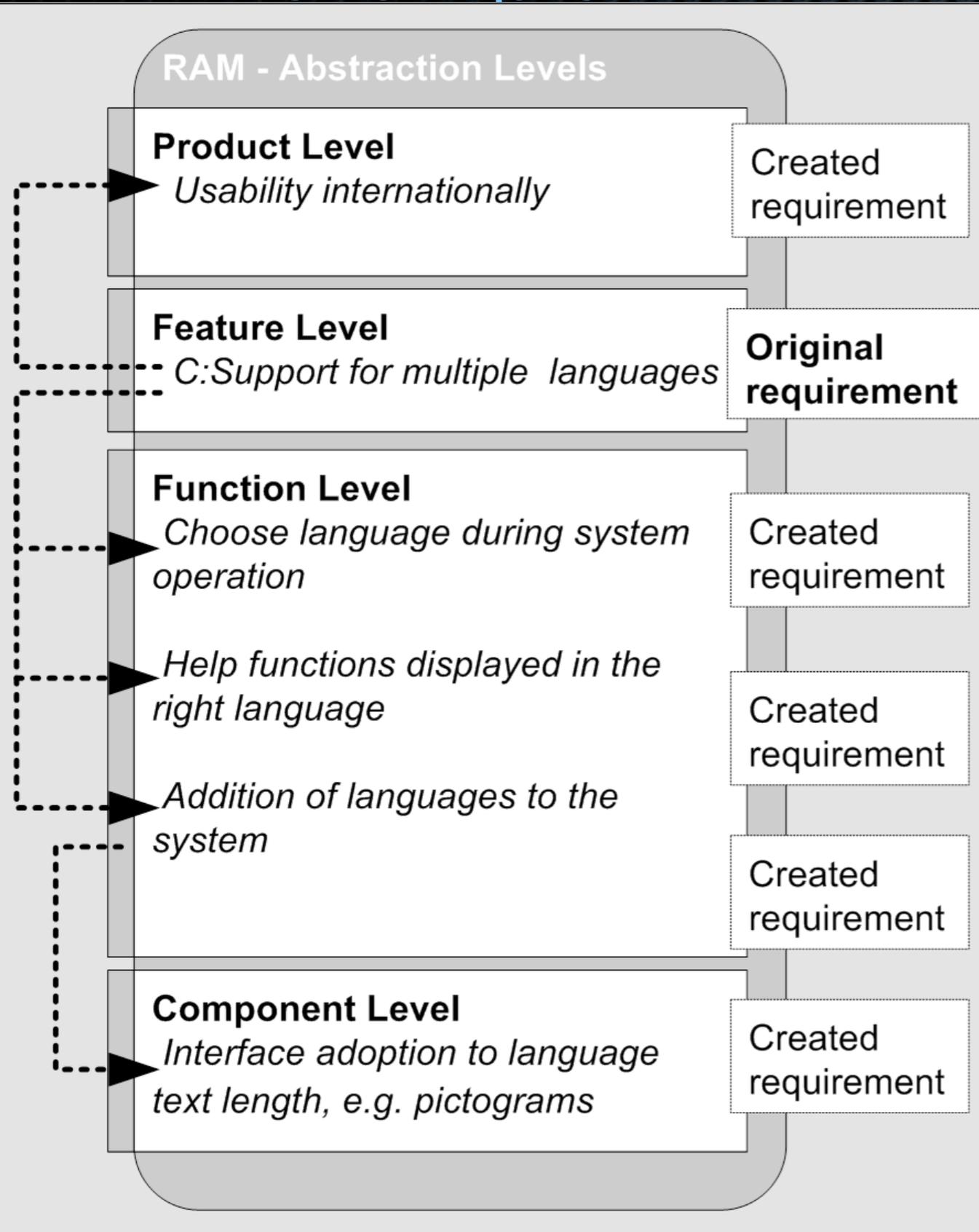
Product Level (goal)

Feature Level (features)

Function Level (functions/actions)

Component Level (details- consists of)

RAM example



~~Print to MSXML format~~

Print to XML format

User / Customer

Experience

Needs

Expectations



RAM

Requirements



Tests

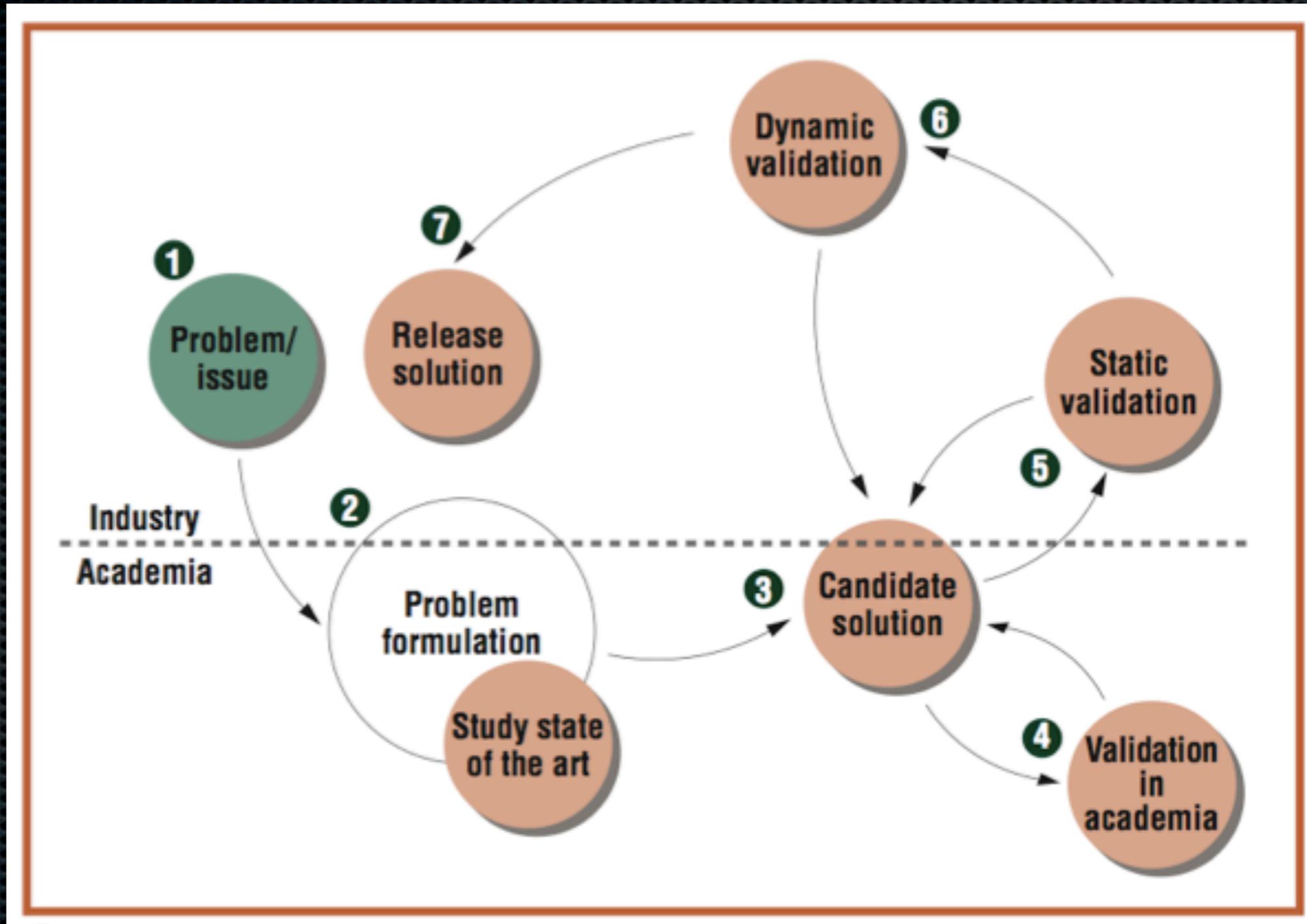


Test-Case Driven Inspections

FIT Tables for clarifying

Agile RE <-> Test-Driven

Research <-> Industry/Org



Papers

- [1] Filippo Ricca, Marco Torchiano et al, “Using acceptance tests as a support for clarifying requirements: A series of experiments”, Information and Software Technology, In Press, Corrected Proof, Available online 8 February 2008.
- [2] B. George, L. Williams, A structured experiment of test-driven development, Information and Software Technology 46 (5) (2004), pp. 337–342.
- [3] E. Maximilien, L. Williams, “Assessing test-driven development at IBM”, Int. Conf. on Software Engineering, IEEE Computer Society Washington, DC, USA, 2003, pp. 564–569.
- [4] Lan Cao. B. Ramesh, “Agile Requirements Engineering Practices: An Empirical Study”, IEEE Software, 25 (1), 2008, pp. 60-67.
- [5] Dzamashvili-Fogelström, Gorschek, “Test-case Driven versus Checklist-based Inspections of Software Requirements – An Experimental Evaluation”, 10th Workshop on Requirements Engineering (WER’07), Toronto, 2007.