

# Test-Driven Development & Projektet AVSATS

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# Agenda

- ✦ Test-Driven Utveckling: Vad vet vi?
- ✦ Presentation av Projekt AVSATS



# Empiriska studier på TDD

**Table 1** Controlled and Quasi-Controlled Empirical Experiments on TDD

Investigator	A/I	Subjects	Software Quality	Developer Productivity
Janzen and Saiedian (2008)	I	teams of 1-3	TDD had better coverage and smaller modules	N/A
Janzen and Saiedian (2008)	A	1-2 teams of 3	TDD had better coverage, smaller methods and modules, and less complexity	N/A
Madeyski and Szala (2007)	A	1	N/A	TDD had 87-177% better productivity initially
Siniaalto and Abrahamsson (2007)	A	13	TDD improved coverage	N/A
Gupta and Jalote (2007)	A	22	Inconclusive	Improved overall productivity
George and Williams (2004)	I	24	TDD improved test coverage, possibly reduced cohesion	N/A
Geras et al (2004)	I	14	TDD had better quality	No impact
Kaufmann and Janzen (2003)	A	8	N/A	50% improvement
Erdogmus et al (2005)	A	35	No change	Improved productivity
Muller and Hagner (2002)	A	19	Less reliable, but better reuse	No change
Pančur et al (2003)	A	38	No change	No change



# Empiriska studier på TDD

**Table 2** Empirical Case Studies on TDD

Investigator	A/I	Subjects	Software Quality	Developer Productivity
Janzen and Saiedian (2008)	I	team of 3	TDD had better coverage and smaller methods and modules	N/A
Sanchez et al (2007)	I	9-17	30% reduction in defect density	Increased effort 19%
Damm and Lundberg (2006)	I	100	5-30% reduction in fault slip-through, 55% reduction in fault costs	Project cost increased by 5-6%
Maximilien and Williams (2003)	I	9	50% reduction in defect density	Minimal impact
Williams et al (2003)	I	9	40% reduction in defect density	No change
Bhat and Nagappan (2006)	A	11	2-4 times reduction in defect density	35% and 15% more time
Edwards (2004)	A	59	54% fewer defects	N/A



# Sammantaget: TDD

- ✦ **Positivt:**

- ✦ 2-4 gånger färre defekter i 2 Microsoft projekt
- ✦ 50% förbättrad kvalitet i TDD transition hos ett IBM team
- ✦ Senaste studien: 40-90% färre pre-release defects

- ✦ **Negativt:**

- ✦ TDD tar något mer tid (15-35%), ibland ingen ändrad kvalitet
- ✦ I studentexperiment har det ibland gett sämre kvalitet
- ✦ Skillnader kan bero på att TDD är olika saker
  - ✦ Forskningen går nu mer in på att kvantifiera grad av TDD



# Effectiveness of Unit Test Automation

- Team at Microsoft, 32 persons

Tests written every 2-3 days, **after** coding

Ad hoc &  
Individual  
Unit Testing



NUnit Autotesting  
by everyone

**From**

**To**

- Results (version 2 of product compared to version 1):
  - 21% fewer defects
  - 30% added development time
- Worse results than if written iteratively



# “Agile” Kravhantering i praktiken

- ✦ Intervjuer med 54 personer i 16 företag
  - ✦ Använde XP eller SCRUM, helt eller delvis
- ✦ Frågor:
  - ✦ Hur jobbar “agile” utvecklare med kravhantering?
  - ✦ Vilka fördelar och nackdelar ger detta?



# Vad använder de?

## 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



# Fördelar/Nackdelar

## Prototyper

Snabbare feedback

Orealistisk förväntan på utv.tid

## Test-driven Utveckling

Tester fångar krav

Kräver nära kundkontakt

Frihet att experimentera

Utvecklarna spjärnar emot

## Granskningar & Acceptanstester

Statusrapport till kunder

Svårt ta fram acceptanstester

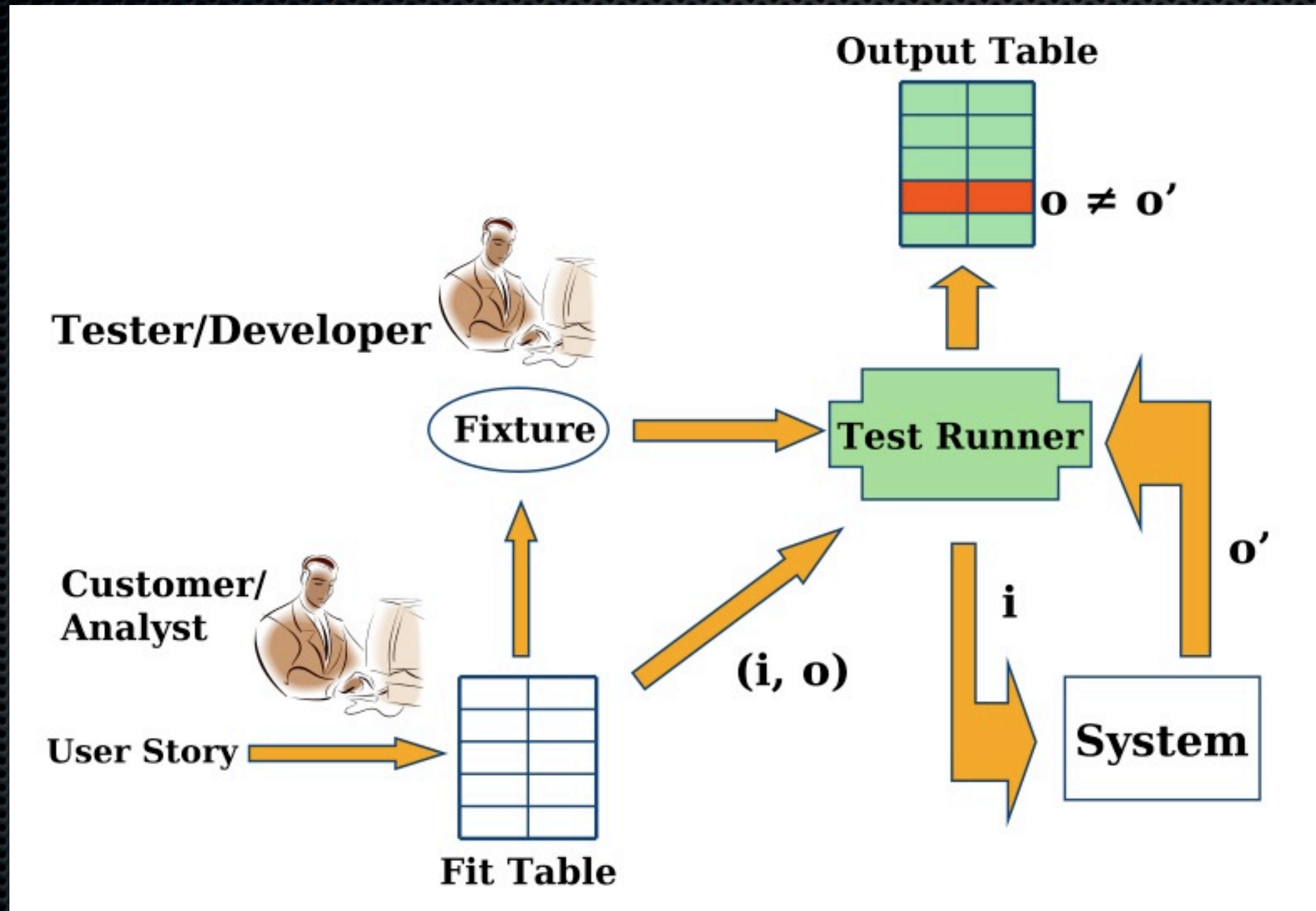


# Acceptanstester förtydligar krav

- ✦ Studie på två italienska universitet
- ✦ Mål: Utvärdera hur FIT tabeller påverkar förståelse av krav
- ✦ Jämför:
  - ✦ Grupp 1: Traditionell krav i text
  - ✦ Grupp 2: Krav i text + FIT tabeller



# Acceptanstestning med FIT





# Acceptanstester förtydligar krav

- Resultat:
  - FIT tabeller gav 400% ökat odds att besvara frågor om kraven korrekt
  - Det tog lika lång tid för båda grupperna
- Men:
  - FIT tabellerna passar inte alla krav

Exempel på konkreta indata hjälper kravförståelse

Information av flera typer ger bättre förståelse



# Projekt AVSATS

- Partners:



- Chalmers (Göteborg)
  - SAAB Security ATM (Göteborg&Växjö)
  - SAAB Systems (Järfälla)
- 4.8MSEK på 4 år, November 2009 - November 2013
  - Vinnova, Nationella FlygForsknings Programmet (NFFFP)





# Goals

Higher Quality, Testing, In-lives or lots of money at  
in Quality, Audits, Alignment, ... stake...

Improve Verification of Safety-Critical Software

In context of:

~“Aero”

Air-Traffic Control Software

Agile Development Processes and Practices

SESAR project (renewed EU Air-Traffic Control)

Legacy Software and Systems



# Driving forces

Better Dev Methods

Automation

SW Flexible & Malleable

More SW

Larger SW

SW gets More Responsibility

Market maturing

SESAR project

SW Market in general maturing

Higher Quality

Trusted Quality

Reduced Cost

Shorter Lead  
Times



