Improved Software Project Certainty

Automated analysis of user stories for improved quality and measurement

December 13, 2018

bcs
The Chartered Institute for IT

Colin Hammond M.Eng MBCS CFPS

Project Manager
Portfolio Manager
Developer
Analyst
Solution Designer

Equitable Life · Royal Mail · Norwich Union · British American Tobacco · Waitrose
pwc · Pinpointers · KPMG · Sainsbury's
Ashridge · The Open University · Symantec.
Homebase · beazley

Failures Continue to Happen

1986 The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is to difficult as establishing the detailed technical requirements, including all the interfaces to people, to machines, and to other software systems. No other part of the work so cripples the resulting system if done wrong. No other part is more difficult go rectify later.

Fred Brooks, 1986

2018 $78Bn wasted on project failures USA p.a.* *Gartner 2018*

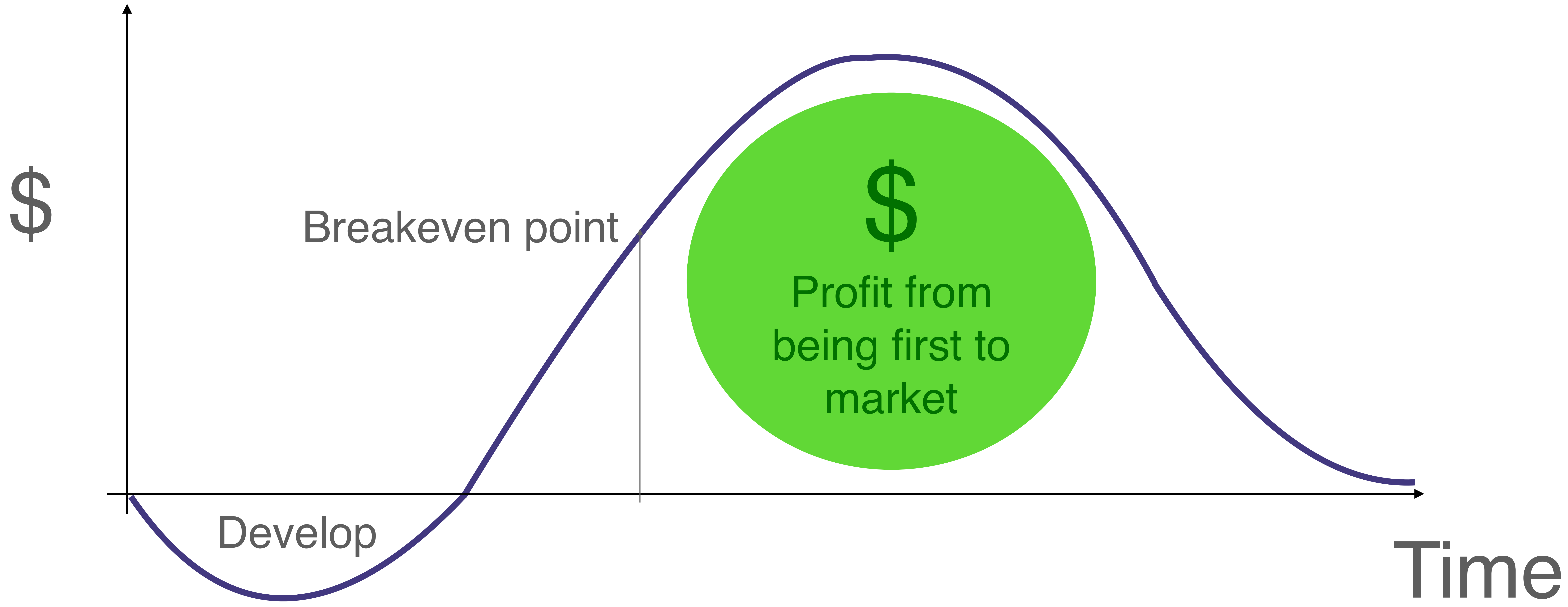
Failed software projects are a bigger problem now than ever!

Perspective

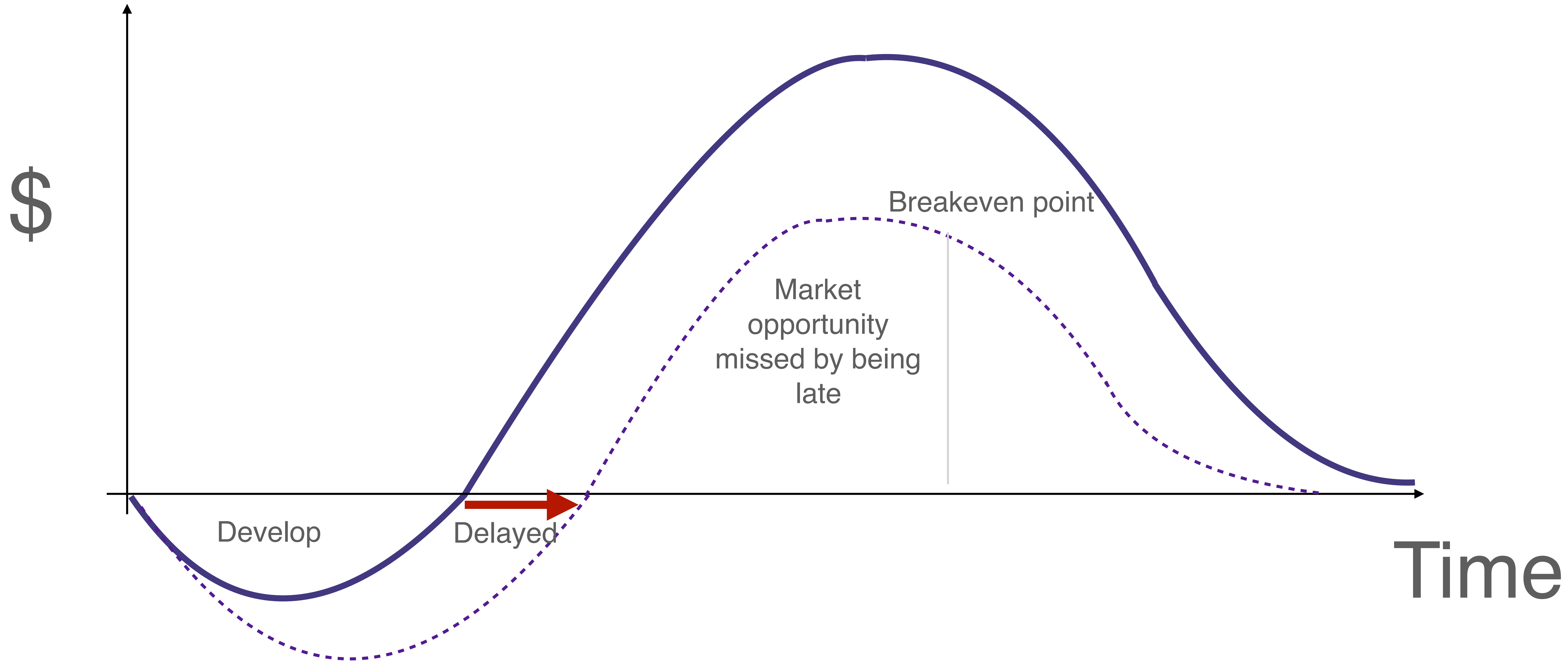
Executives hope to be delighted but are used to disappointment

Time to delivery is typically the most important factor for them

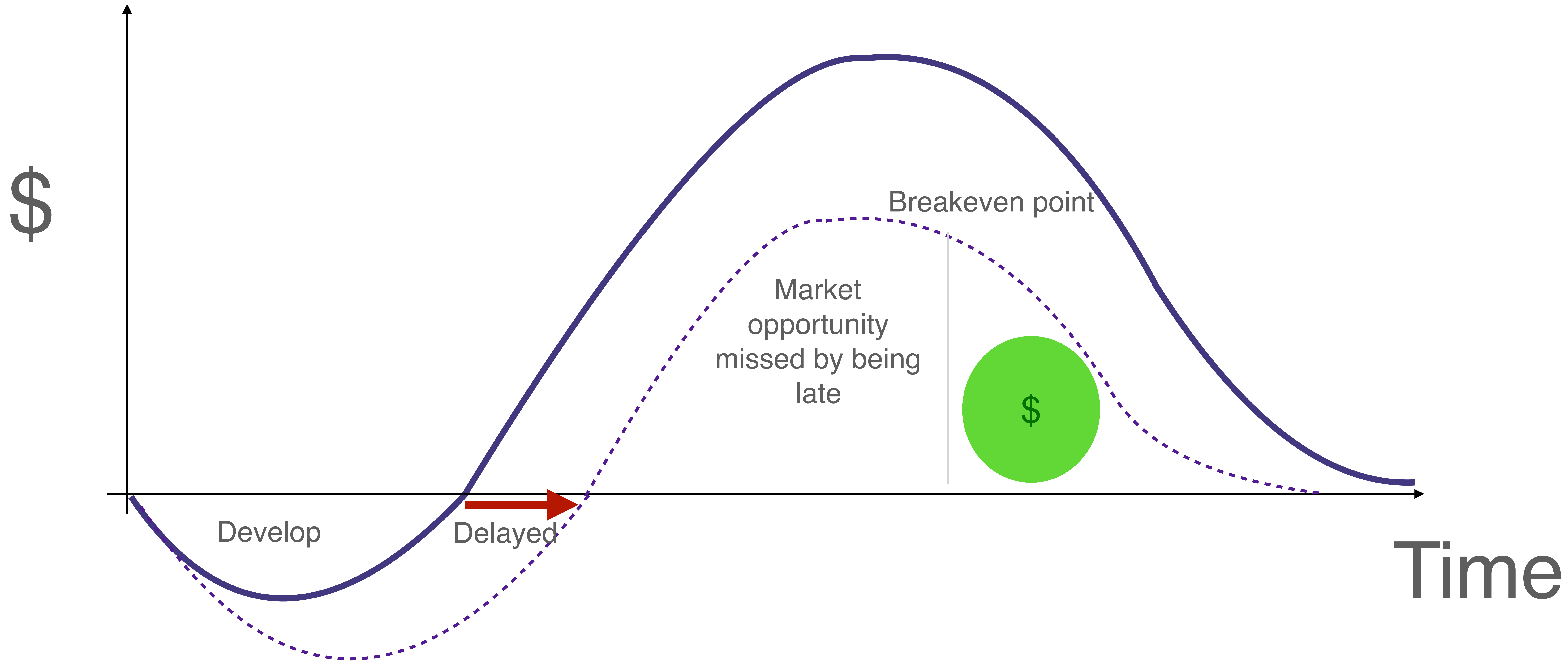
Early to Market with Strategic IT innovation



Impact of delay is compound



Impact of delay is compound



Software Project Managers

To avoid failure on large software projects…

"Do all these well and you'll be fine!"

Requirements

Software Dev

Integration

Prioritisation

Estimation

Dependency analysis

Agile methodology

Sponsorship

Environment planning

Architecture

Static analysis

Complexity measurement

Prototyping product owners

Business Case

Achieving Quality

Defect management

Design

Re-use

Database

Package choice

Package config

SLA's

Change requests

Test Management

Seeking reusable components

Config Management

Business Analysis

Master data management

Earned value measurement

Project assurance

Contract negotiation

Engagement

Resourcing

Risk Management

Test management

tooling

Using Cloud services

Non-functional requirement

Skills

Outsourcing

Security testing

Governance

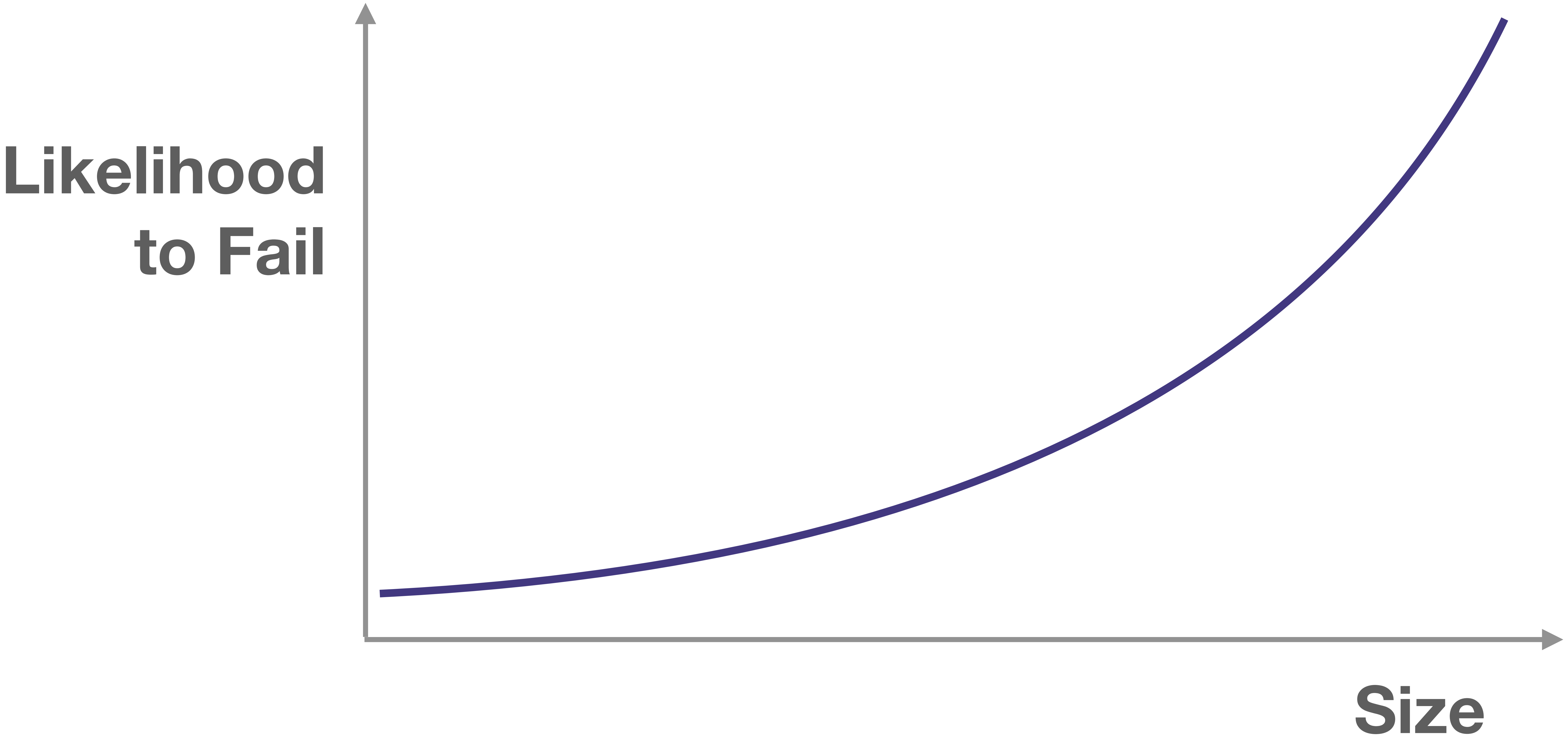
Service transition

Focus

Let us focus on two aspects

Size & Quality

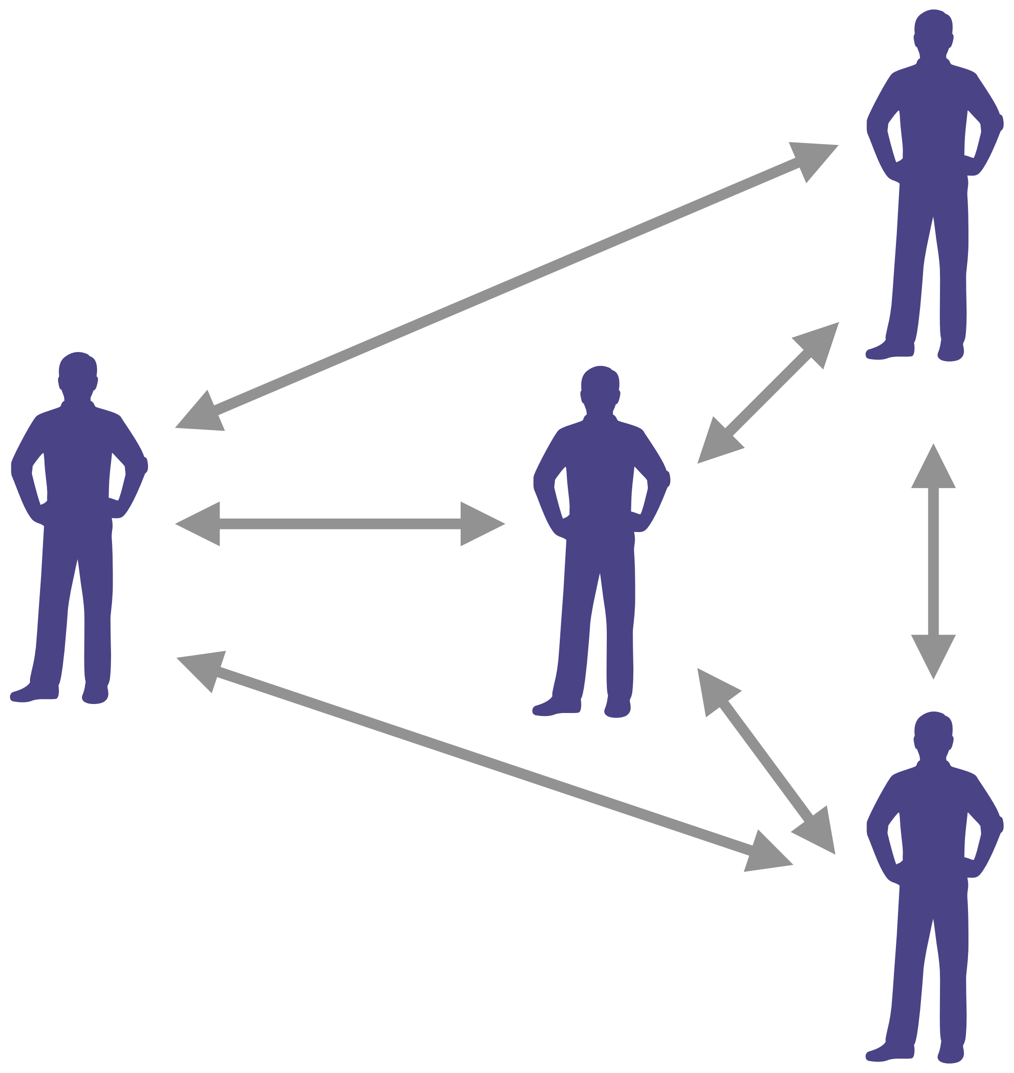
Size and failure - diseconomy of scale



Size is important

Team size - communication overhead

One of the reasons why size matters



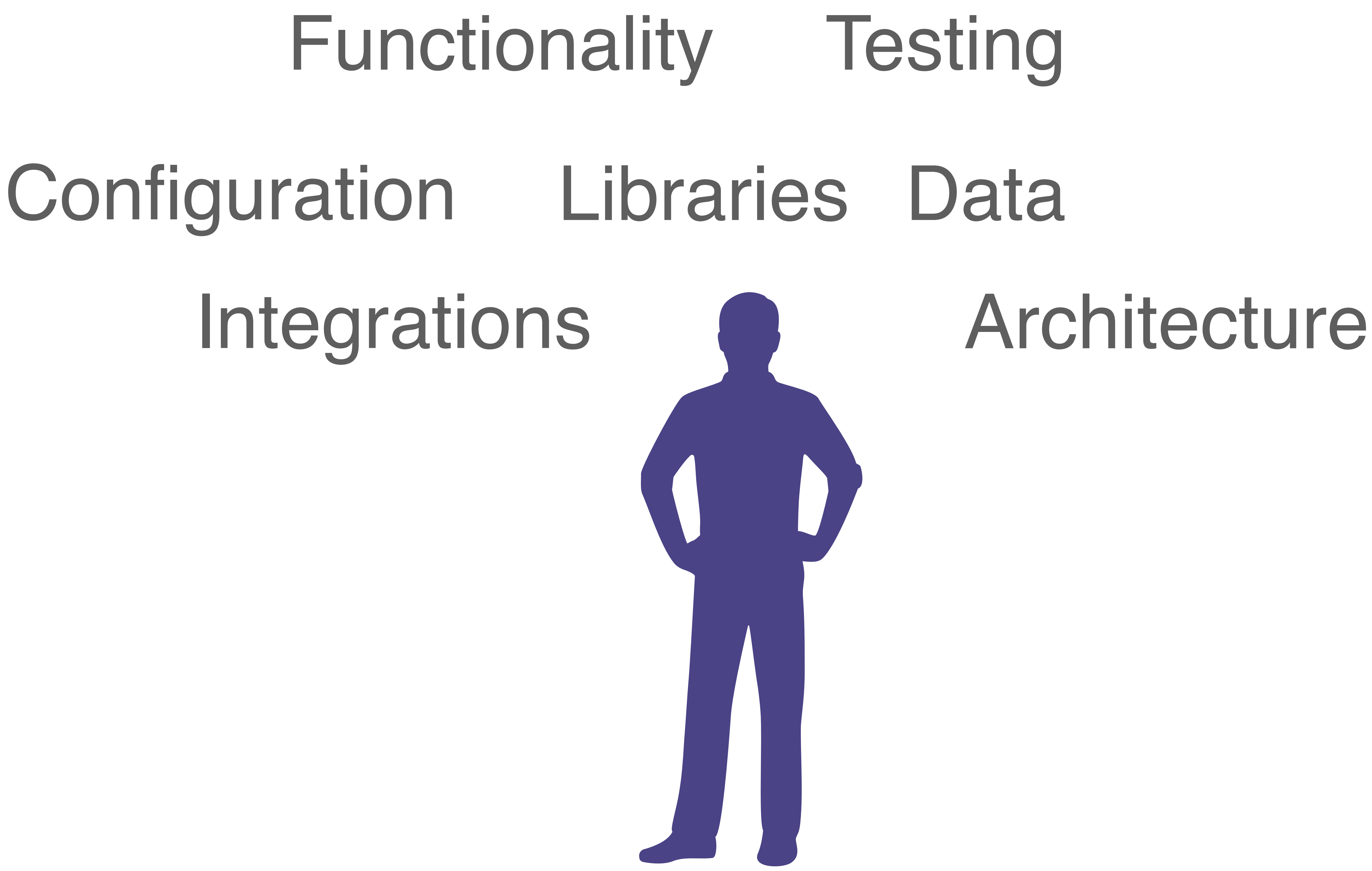
$$(n^2 – n) / 2$$

Lines of communication

Keep your team small!

How many people?

Limited by the mental capacity of the developer



Functionality Testing

Configuration Libraries Data

Integrations Architecture

This is an example of functional sizing in action.

Rule of thumb: Approx 150 - 250 FP per developer

Engineering Disciplines Need Consistent Measurements

Other “Engineering” disciplines rigorously adopt universal, reliable measurements

Size for Software Engineering

Story Points Ok for sprint planning but not project metrics

Lines of Code

Number of Interfaces / modules

Use case points

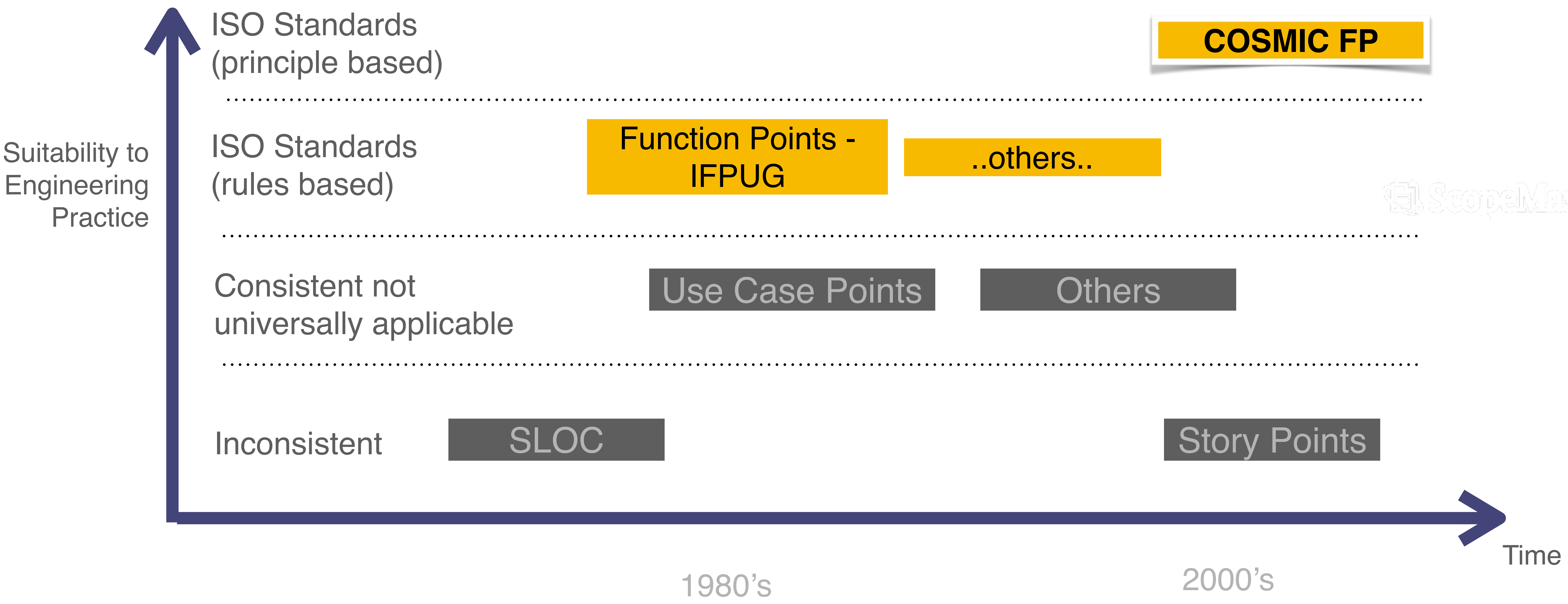
Function points (IFPUG)

COSMIC Function points

COSMIC

14 reasons why CFP are better than SP

Software Size Measurement - history



COSMIC Functional Sizing - Oversimplified

COSMIC

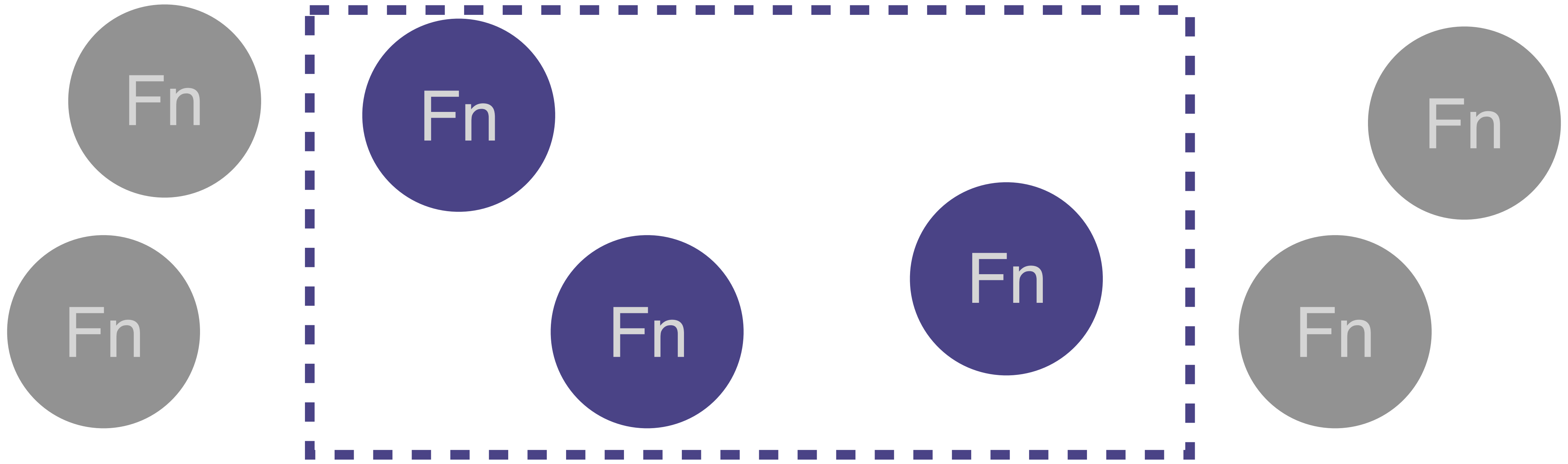
Open Source
Principle based technique
ISO standard
Easy to learn
Suited to modern s/w architectures
Technology Agnostic
Methodology Agnostic
Mature
Better effort correlation than SP
Ideal for benchmarking

Technique: Cosmic functional sizing
Metric: Cosmic Function Points
COSMIC: Common Software Measurement International Consortium

COSMIC Functional Sizing - Oversimplified

1 Define what you are measuring

Define Application Boundary



2 Identify users

Identify the users (human and other systems) and the functions

3 Add up the unique data movements

$$\sum Inputs + Outputs + Reads + Writes$$

Using Size as the Core Metric

The Recommended Metric for Software Project Management

Size

e.g. Scope in CFP

Quality

e.g. Defects found per CFP

Resources

e.g. CFP can a tester test

Schedule

e.g. CFP per month delivered

Risk

Doesn’t help directly

Focus

Now let’s look at quality

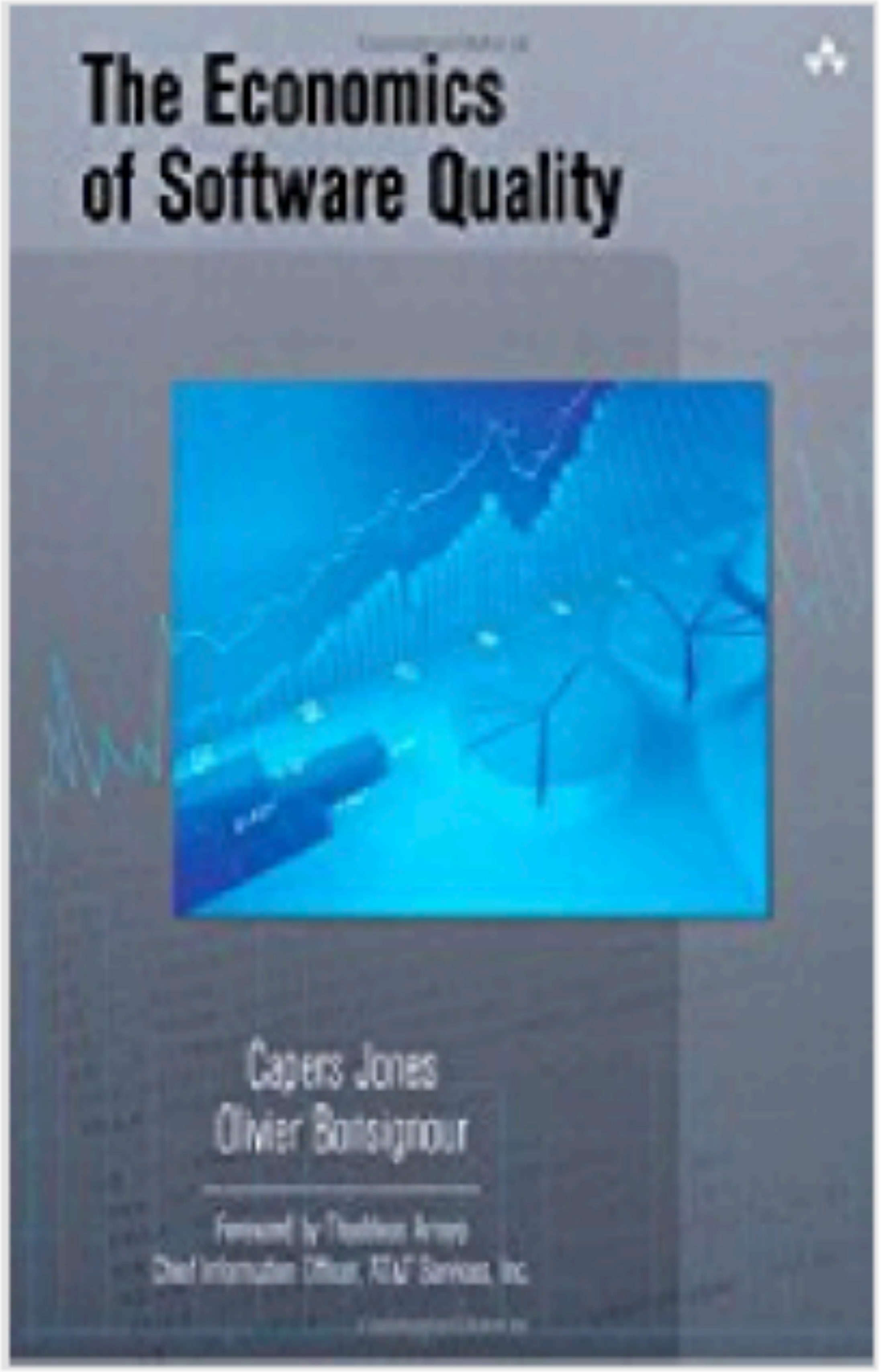
Size &
Quality

Quality

On most large software projects

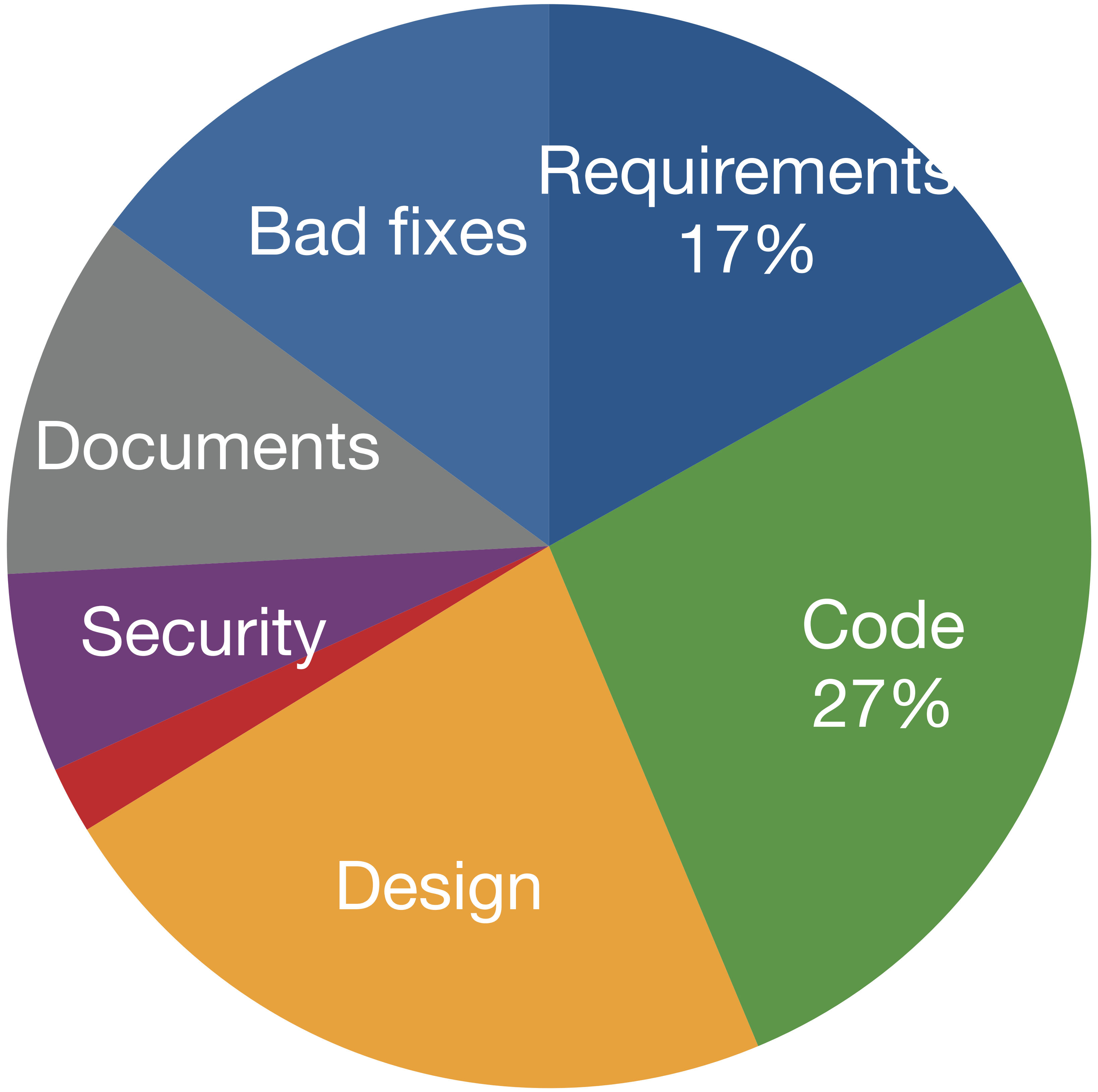
1. **Bug fixing is the single biggest activity**

2. **Delays nearly always caused by extended bug fixing**


The Economics of Software Quality
Capers Jones
Olivier Bonsignour
Foreword by Thaddeus Arroyo
Chief Information Officer, AT&T Services, Inc.

Focus on Quality

Root source of defects



Most Activity

Unit testing

Systems testing

Functional testing

End to end testing

Acceptance testing

1,000 FP Application
Source Capers Jones

Achieving Quality

Testing → **Quality**

80% 1,000 left

✓ Test

Quadruple defect removal

95%+ 250 left

✓ Prevention

✓ Pre-test removal

✓ Test

Quality cannot be achieved through testing alone

1000 FP Solution

Focus on Quality

Goal: Defect removal efficiency is **>95%**

Problem: Defect Potential is FP$^{1.2}$ *

1,000 FP Application
Source Capers Jones

Observations

Agile

1. Most organisations are **not mature in their Agile** software journey.
2. **User stories** are the main articulation of requirements
3. Outsourced agile developments are typically **T&M** based.
4. **Story points** are the main size measurement
5. It is very hard to establish a learning organisation based on a User Story metric.

Common Misconceptions

These are not true:

1 You have to compromise quality if you want it cheaper or sooner.

Generally speaking this is **wrong.** By doing the right things early in the project to achieve high quality you will usually deliver faster and at lower cost

2 Measuring software size is impossible

3 Estimation requires the whole team to understand the epics/stories.

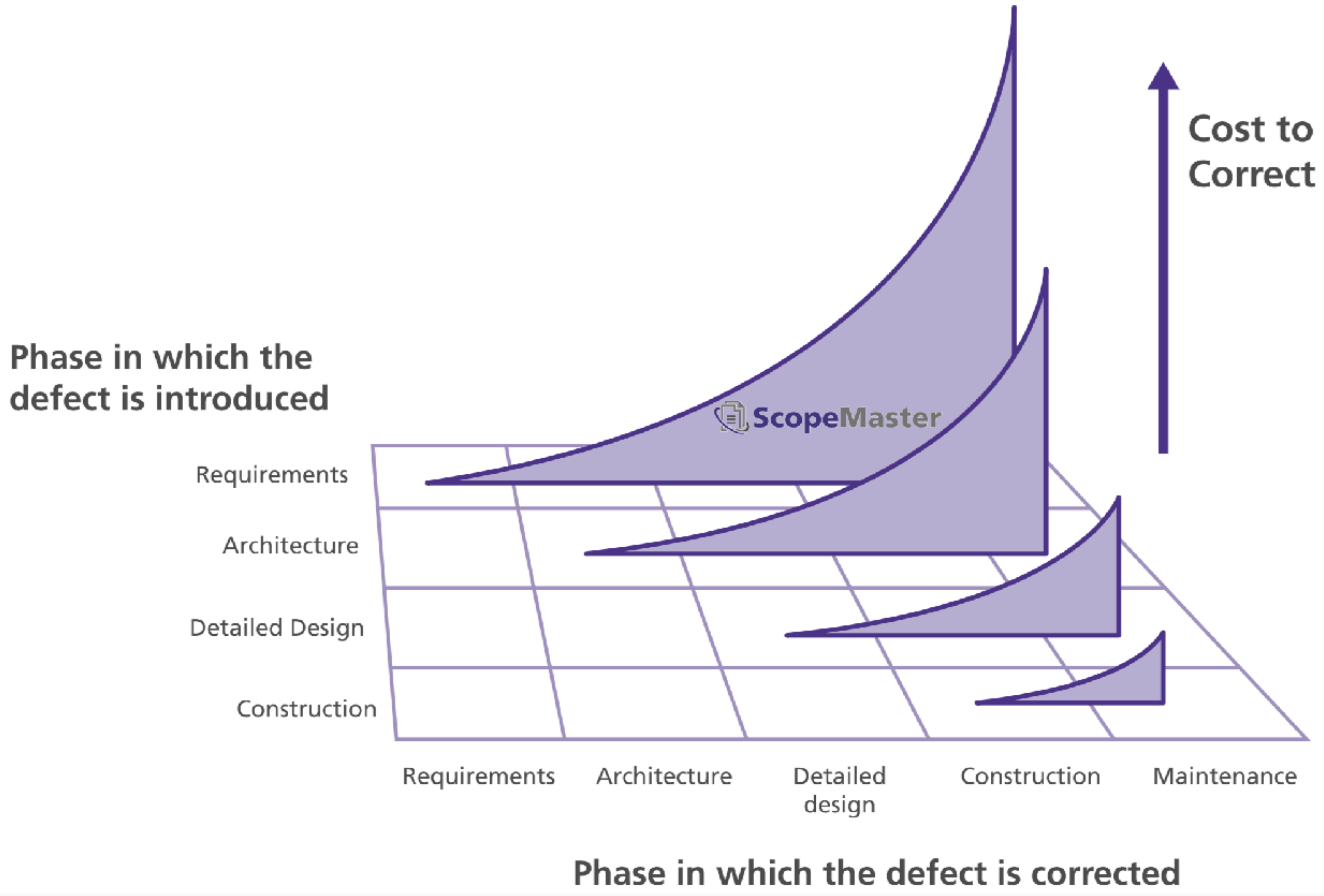
My Aspiration

My goal was to:

Automate (Functional) Sizing

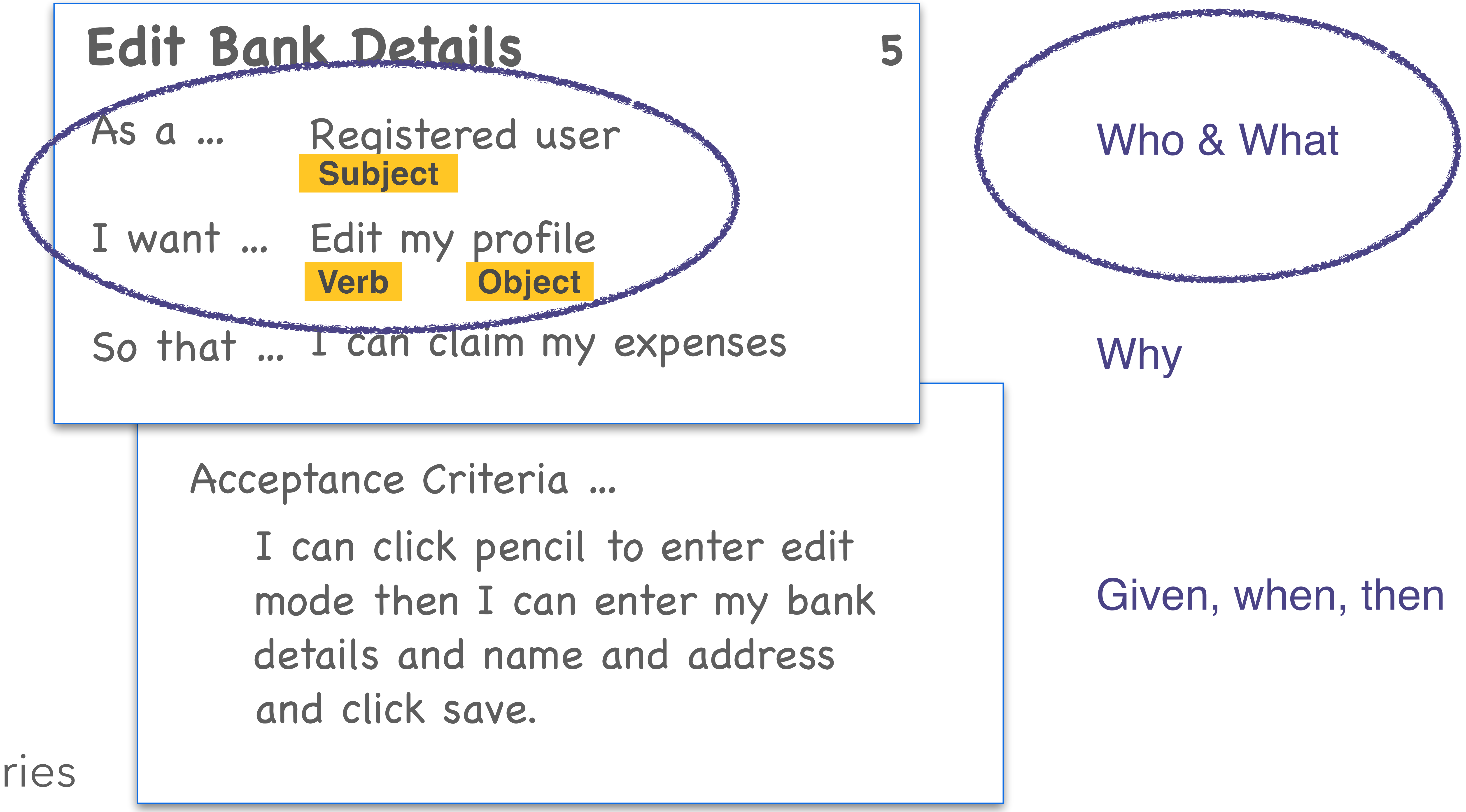
COSMIC

Value of finding defects early



Example User Story

Card, Conversation, Collaboration



Edit Bank Details 5

As a … Registered user
Subject

I want … Edit my profile
Verb Object

So that … I can claim my expenses

Acceptance Criteria …

I can click pencil to enter edit mode then I can enter my bank details and name and address and click save.

Who & What

Why

Given, when, then

Opinions:

Requirements = User stories

Requirements != User stories

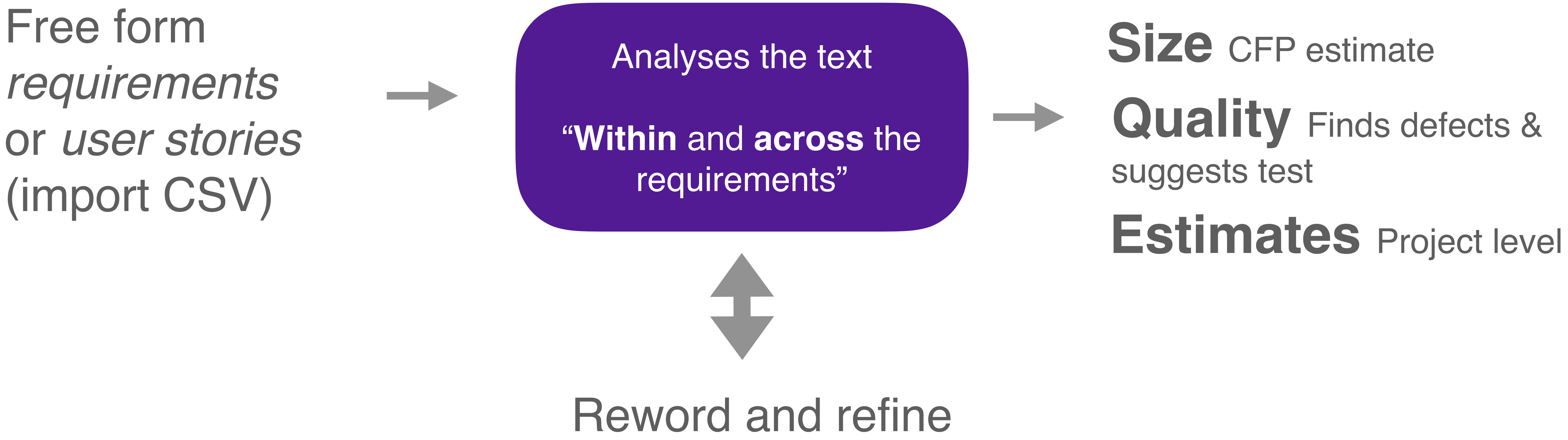
9 months of experimentation

Natural Language Processing (a branch of AI)
User Stories **and** Requirements Specifications
QA was an accident
Fishing

Expert endorsements:

What is it?

SAAS analyser of Software Requirements or User Stories



Free form *requirements* or *user stories* (import CSV)

Analyses the text

“**Within** and **across** the requirements”

Size CFP estimate

Quality Finds defects & suggests test

Estimates Project level

Reword and refine

"Static analyser for user requirements”

Helps

Not a cure, but it helps, think of it as:

“Ultimate in shift-left testing”

or

“Static analyser of user stories”

Early days

Experience so far

May - November 2018

> 100 projects

> 11,000 User stories

> 12,000 potential defects found

Finds more than one defect per story

Performance

< 2 seconds to analyse a story (typical)

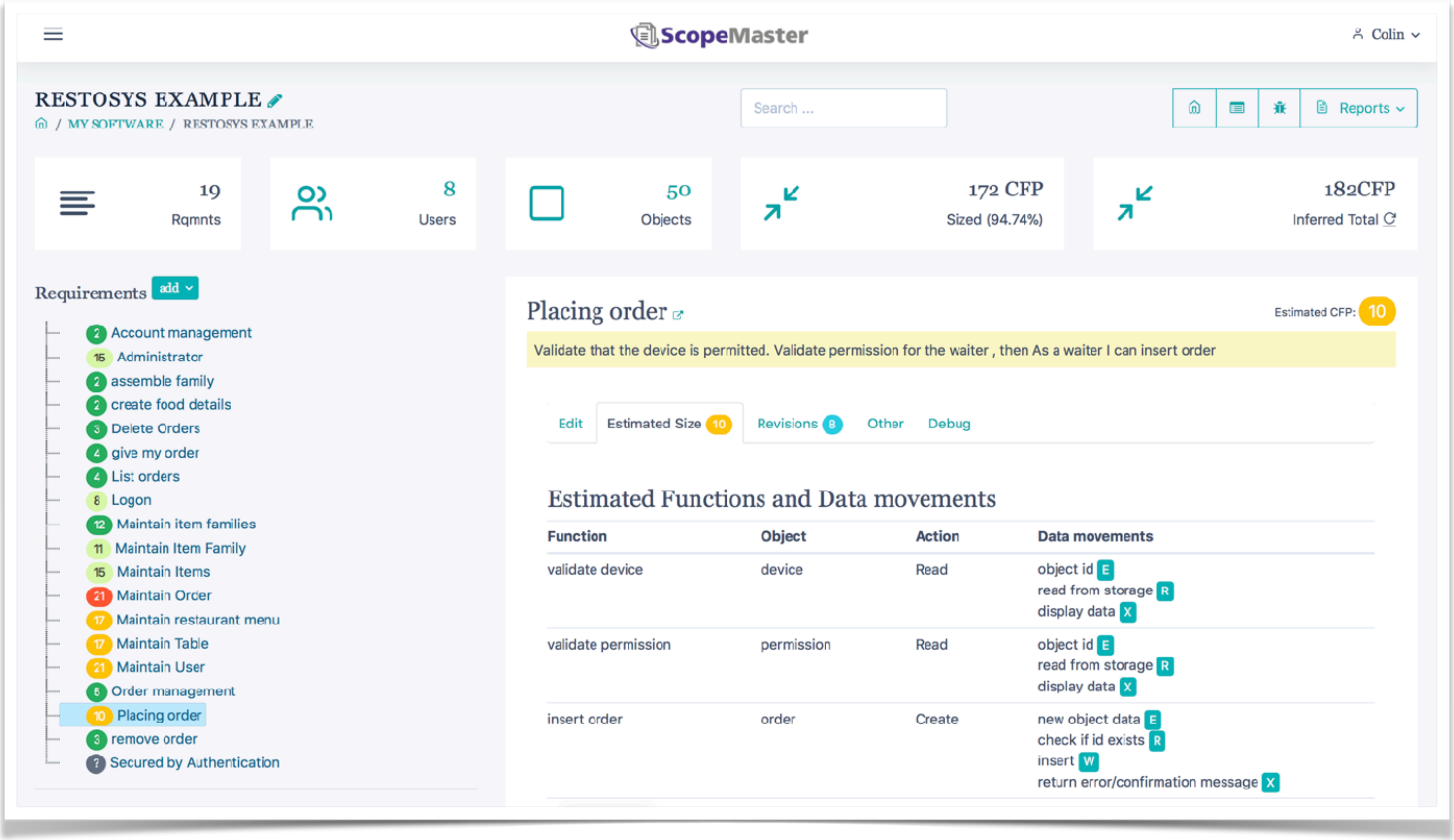
< 2 seconds to find a potential defect

"(Using ScopeMaster) is … out and out the most productive quality work you can do on a software project"

Features

English only
Does not need training
Detects parts of speech
Detects phrase dependencies
Detects singulars/plurals
Fixed list of verbs
Handles multiple steps per user story
Looks across requirements for reference to similar objects
Looks for a full set of CRUD operations
Uses a template of data movements for each of C,R,U and D
Very fast. 1- 5 seconds per user story.

Intelligent Interpretation of intended data movements



RESTOSYS EXAMPLE

/ MY SOFTWARE / RESTOSYS EXAMPLE

19 Rqmnts	8 Users	50 Objects	172 CFP Sized (94.74%)	182CFP Inferred Total

Requirements

- 2 Account management
- 15 Administrator
- 2 assemble family
- 2 create food details
- 3 Delete Orders
- 4 give my order
- 4 List orders
- 8 Logon
- 12 Maintain item families
- 11 Maintain Item Family
- 15 Maintain Items
- 21 Maintain Order
- 17 Maintain restaurant menu
- 17 Maintain Table
- 21 Maintain User
- 6 Order management
- 10 Placing order
- 3 remove order
- ? Secured by Authentication

Placing order

Estimated CFP: 10

Validate that the device is permitted. Validate permission for the waiter , then As a waiter I can insert order

Estimated Functions and Data movements

Function	Object	Action	Data movements
validate device	device	Read	object id E read from storage R display data X
validate permission	permission	Read	object id E read from storage R display data X
insert order	order	Create	new object data E check if id exists R insert W return error/confirmation message X

Shows:
Story quality, size, including functional steps.

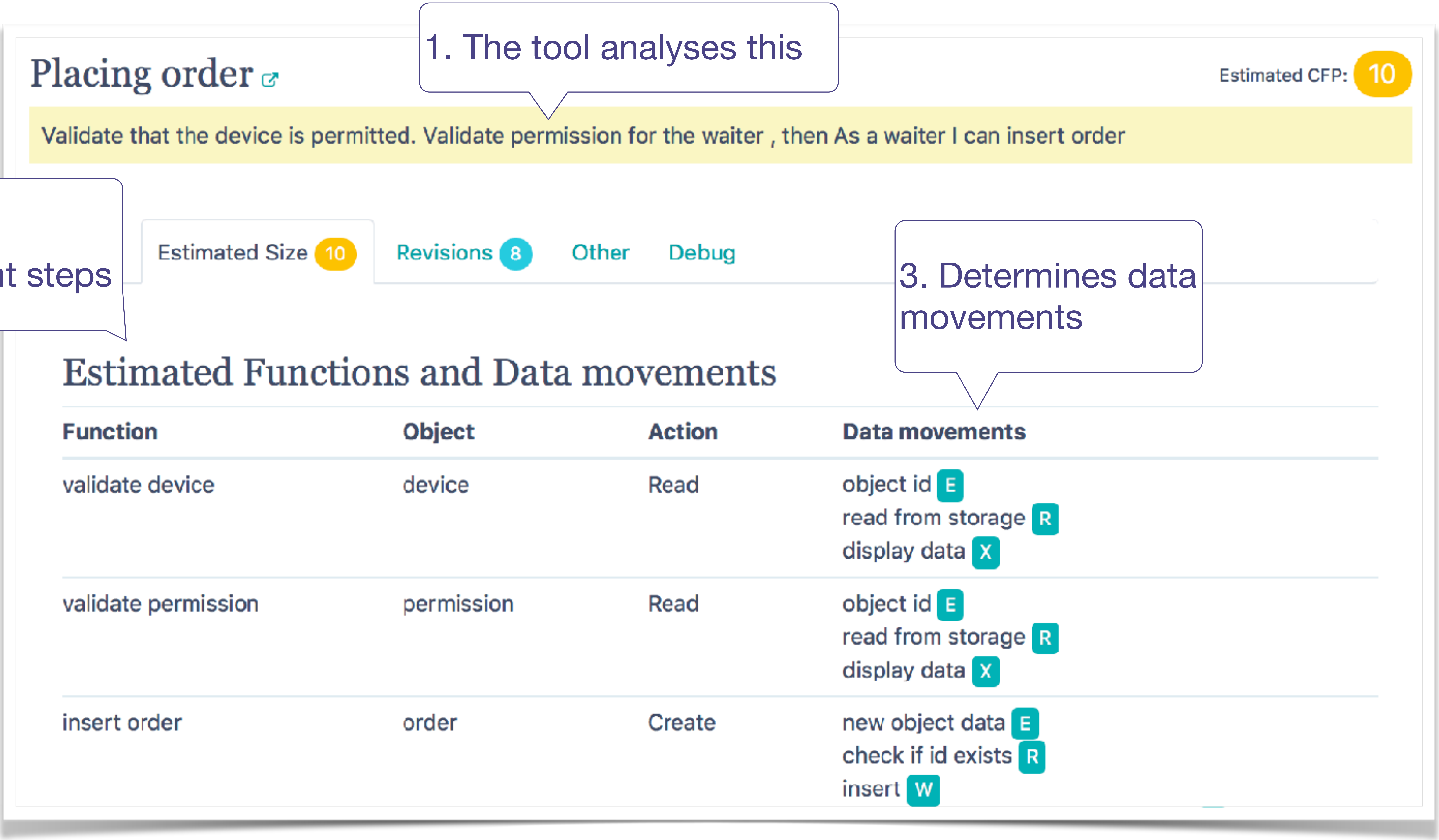
Intelligent Interpretation of intended data movements

1. The tool analyses this

2. Detects independent steps

3. Determines data movements

4. Estimates size in COSMIC FP



Placing order

Estimated CFP: 10

Validate that the device is permitted. Validate permission for the waiter , then As a waiter I can insert order

Estimated Functions and Data movements

Function	Object	Action	Data movements
validate device	device	Read	object id E read from storage R display data X
validate permission	permission	Read	object id E read from storage R display data X
insert order	order	Create	new object data E check if id exists R insert W

Automated Requirements Quality

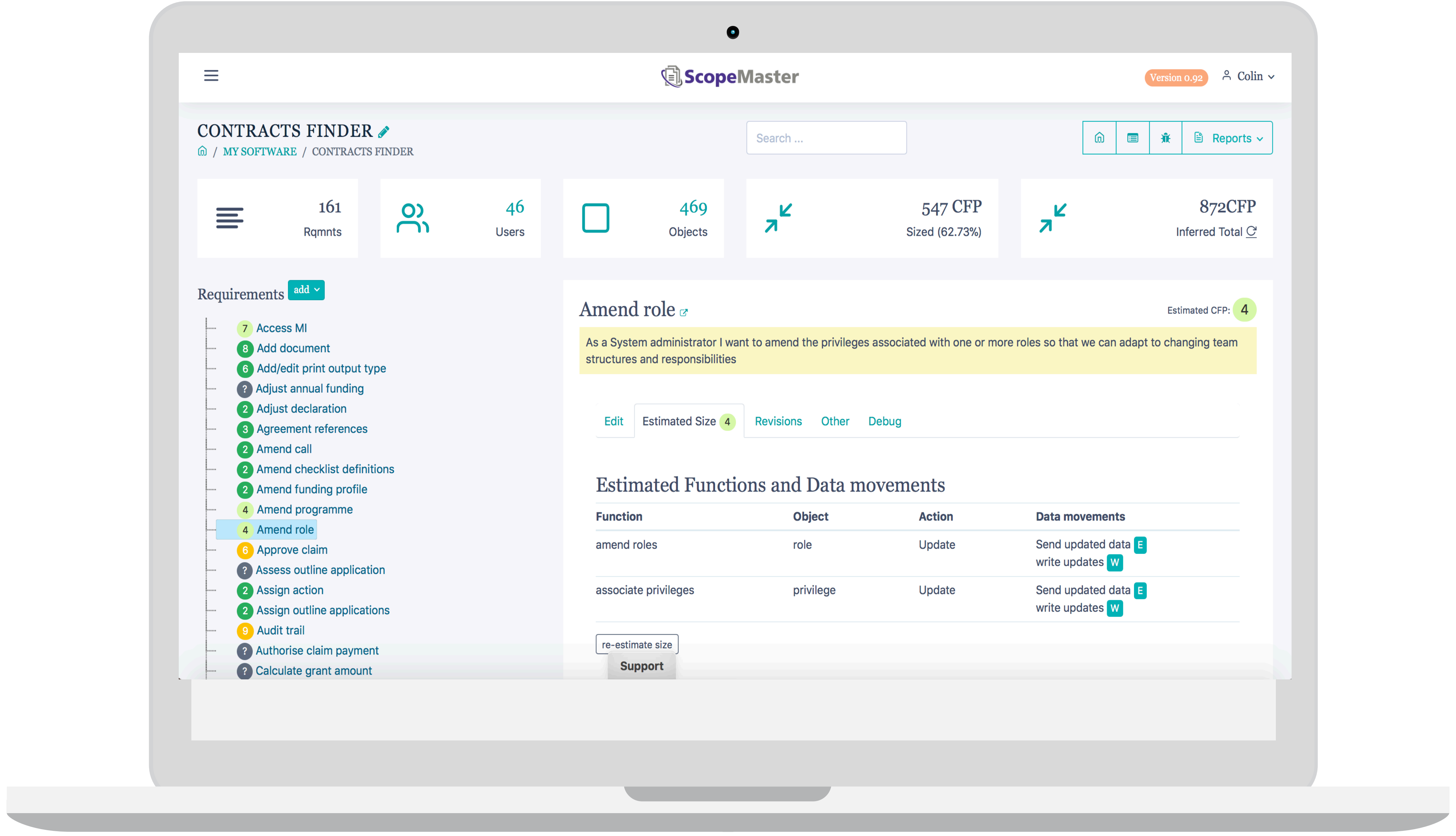
Finds approx 50% of all requirements defects

- Independent
- Negotiable (Concise)
- Valuable
- Estimable
- Sized
- Testable (partly)

- Clear(unambiguous)
- Complete
- Concise
- Consistent
- Correct
- Current

Does not replace any agile ceremonies, it just makes them more efficient

Case Study - Gaming Application



CONTRACTS FINDER

MY SOFTWARE / CONTRACTS FINDER

161 Rqmnts	46 Users	469 Objects	547 CFP Sized (62.73%)	872CFP Inferred Total

Requirements

- 7 Access MI
- 8 Add document
- 6 Add/edit print output type
- ? Adjust annual funding
- 2 Adjust declaration
- 3 Agreement references
- 2 Amend call
- 2 Amend checklist definitions
- 2 Amend funding profile
- 4 Amend programme
- 4 Amend role
- 6 Approve claim
- ? Assess outline application
- 2 Assign action
- 2 Assign outline applications
- 9 Audit trail
- ? Authorise claim payment
- ? Calculate grant amount

Amend role

Estimated CFP: 4

As a System administrator I want to amend the privileges associated with one or more roles so that we can adapt to changing team structures and responsibilities

Edit | Estimated Size 4 | Revisions | Other | Debug

Estimated Functions and Data movements

Function	Object	Action	Data movements
amend roles	role	Update	Send updated data E write updates W
associate privileges	privilege	Update	Send updated data E write updates W

1 Person

16 hours

No training

90 Stories

150 defects found & fixed

before coding even started!

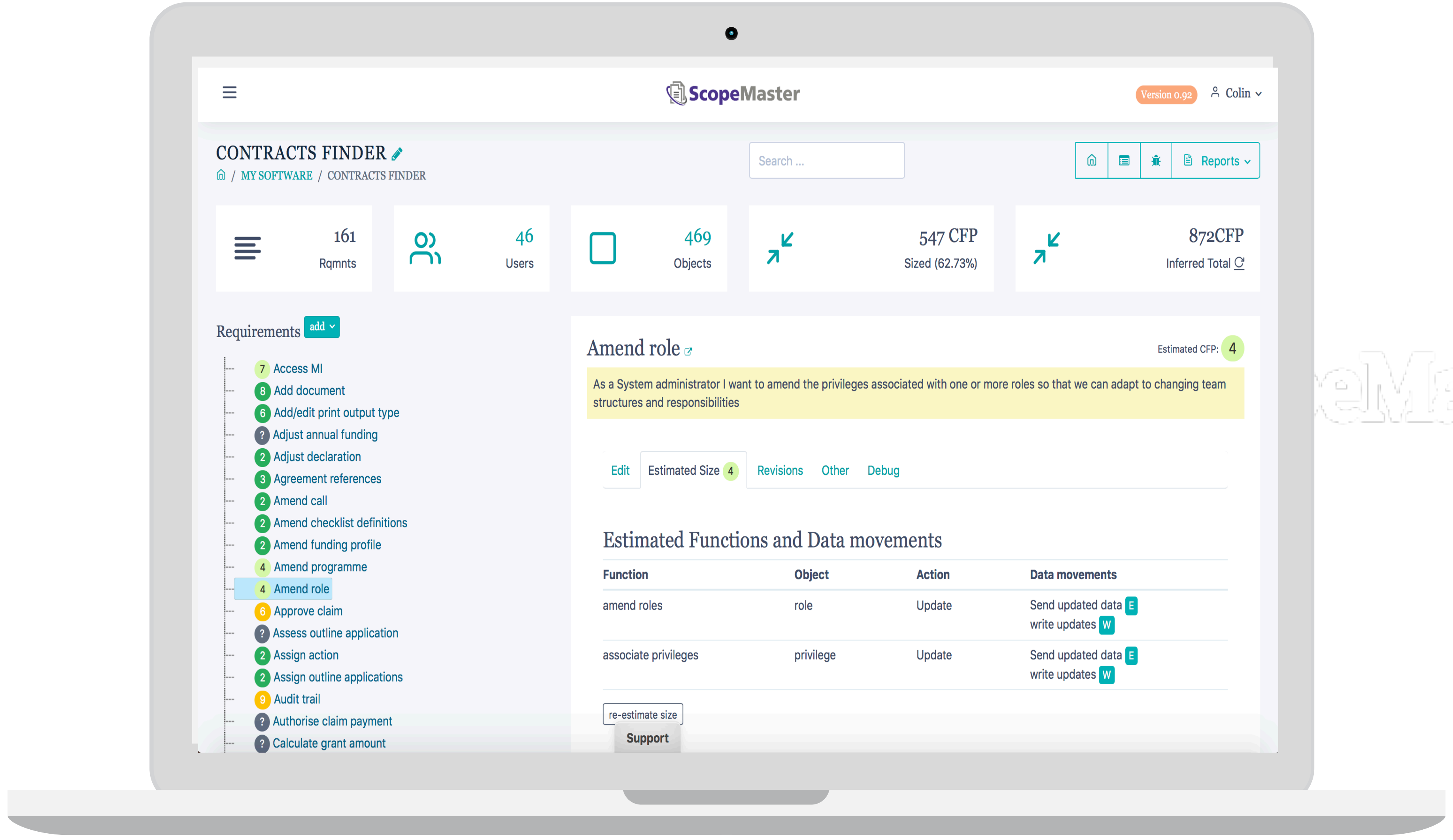
Value $35k - $100k, in 2 days

https://www.scopemaster.com/case-study/scopemaster-gaming-application/

Find and fix a requirements problems

User Story Refinement Meeting

2- 5 hours effort



CONTRACTS FINDER

MY SOFTWARE / CONTRACTS FINDER

161 Rqmnts | 46 Users | 469 Objects | 547 CFP Sized (62.73%) | 872CFP Inferred Total

Requirements

- 7 Access MI
- 8 Add document
- 6 Add/edit print output type
- ? Adjust annual funding
- 2 Adjust declaration
- 3 Agreement references
- 2 Amend call
- 2 Amend checklist definitions
- 2 Amend funding profile
- 4 Amend programme
- 4 Amend role
- 6 Approve claim
- ? Assess outline application
- 2 Assign action
- 2 Assign outline applications
- 9 Audit trail
- ? Authorise claim payment
- ? Calculate grant amount

Amend role

Estimated CFP: 4

As a System administrator I want to amend the privileges associated with one or more roles so that we can adapt to changing team structures and responsibilities

Estimated Functions and Data movements

Function	Object	Action	Data movements
amend roles	role	Update	Send updated data E write updates W
associate privileges	privilege	Update	Send updated data E write updates W

15 minutes effort

8 -20X Faster ✓

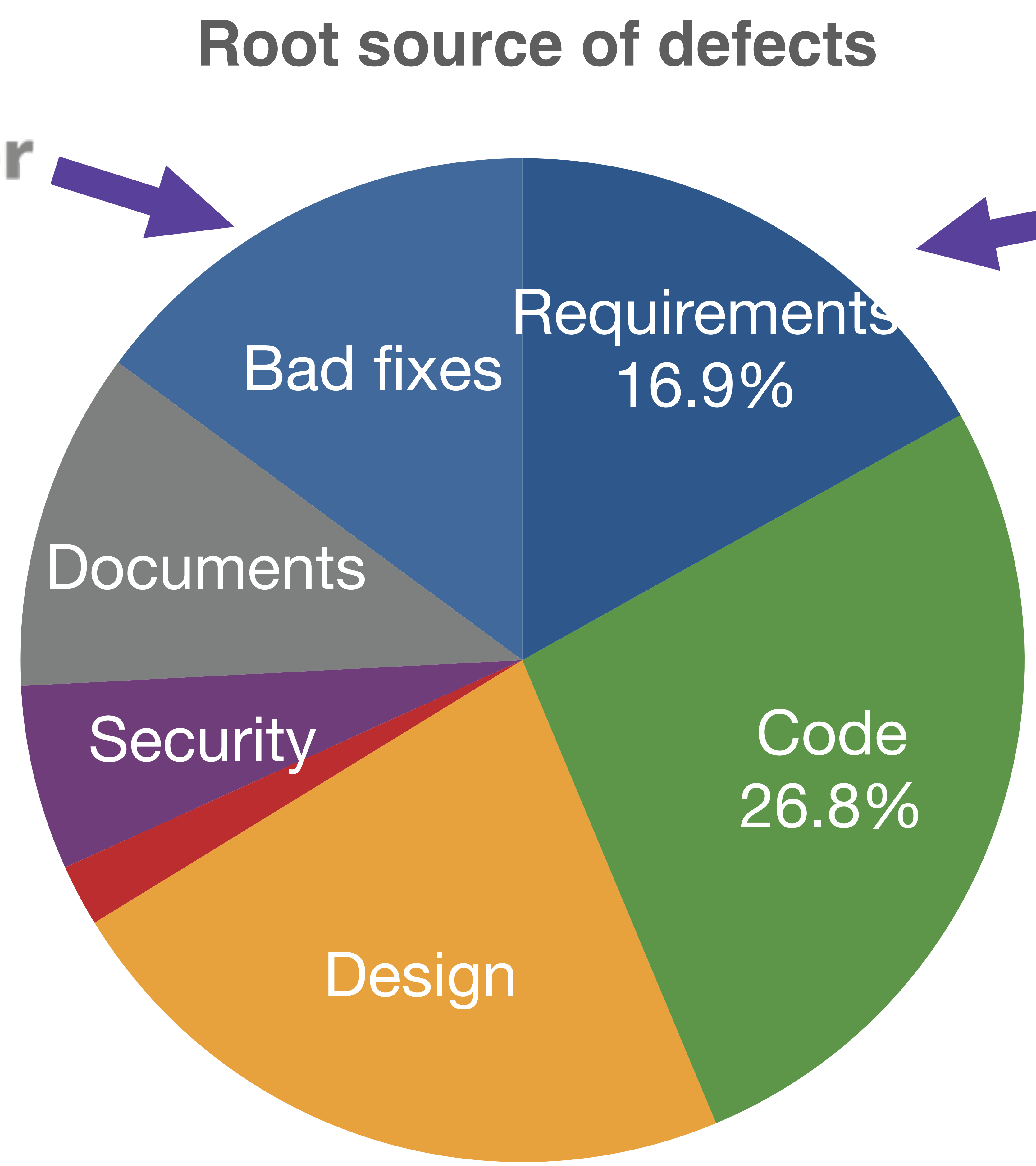
Value of finding requirement defects early

Find		Fix		Rework avoided
$100 - $150	+	$25 - $200	+	$1000’s
2- 5 hours		0.5 - 4 hours		Impacts timelines

Minumum typical effort cost to find and fix is $125, with ScopeMaster you can do that in less than 15 minutes.

But this is often QA work that is so boring it doesn’t happen, so you end up carrying the defect into coding then causing $1000’s of rework.

Poor quality is the cause of most delays

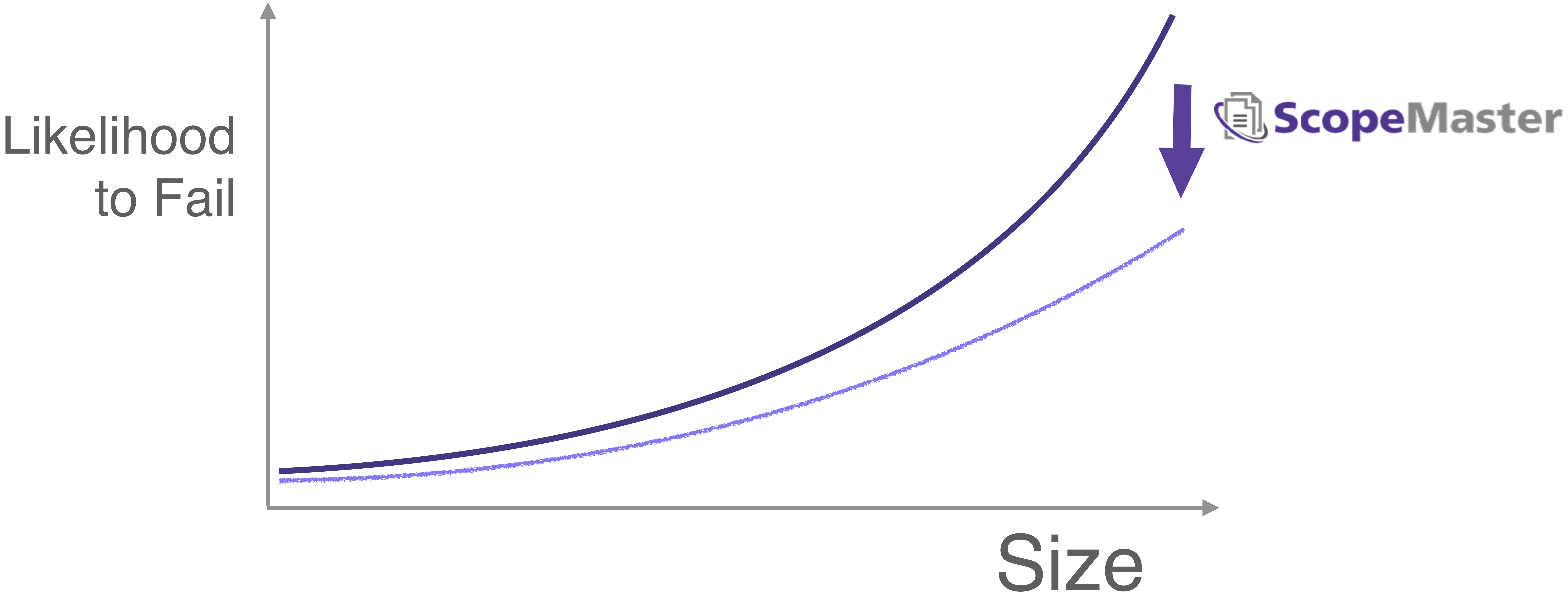


Most Activity
Unit testing
Systems testing
Functional testing
End to end testing
Acceptance testing

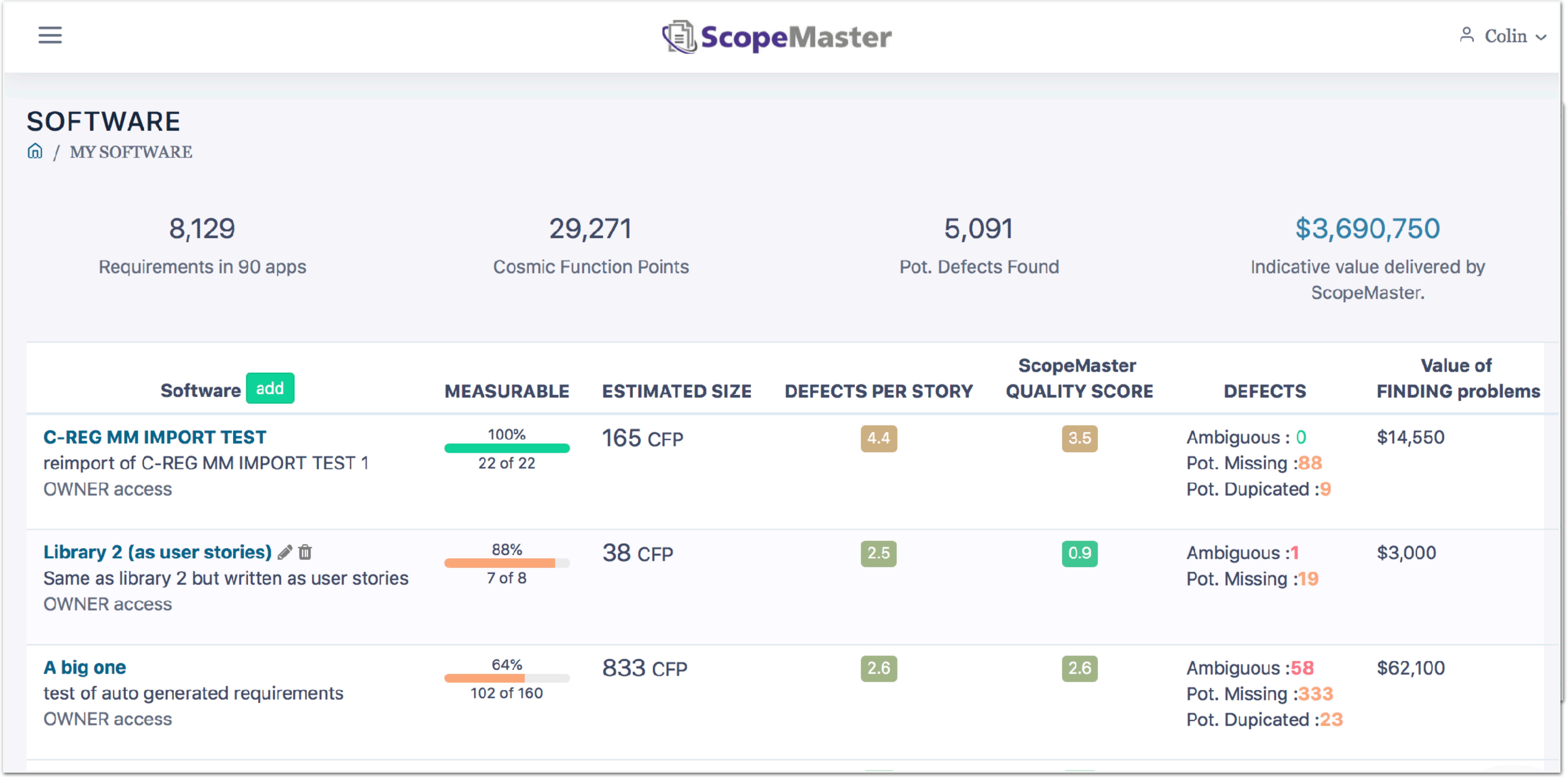
1,000 FP Application
Source Capers Jones

Size and failure

Our vision



Portfolio Overview



SOFTWARE

MY SOFTWARE

8,129
Requirements in 90 apps

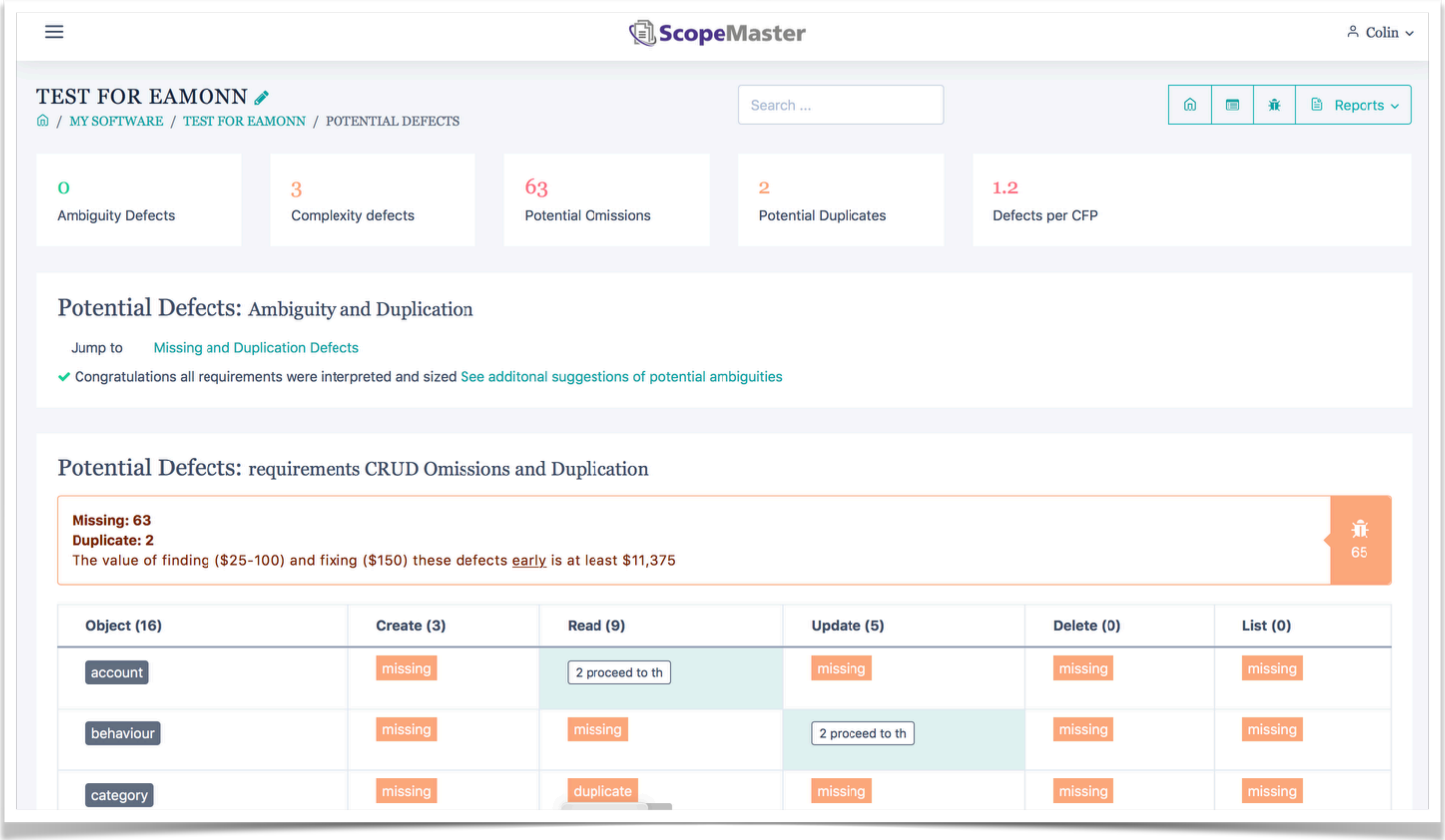
29,271
Cosmic Function Points

5,091
Pot. Defects Found

$3,690,750
Indicative value delivered by ScopeMaster.

Software add	MEASURABLE	ESTIMATED SIZE	DEFECTS PER STORY	ScopeMaster QUALITY SCORE	DEFECTS	Value of FINDING problems
C-REG MM IMPORT TEST reimport of C-REG MM IMPORT TEST 1 OWNER access	100% 22 of 22	165 CFP	4.4	3.5	Ambiguous : 0 Pot. Missing :88 Pot. Dupicated :9	$14,550
Library 2 (as user stories) Same as library 2 but written as user stories OWNER access	88% 7 of 8	38 CFP	2.5	0.9	Ambiguous :1 Pot. Missing :19	$3,000
A big one test of auto generated requirements OWNER access	64% 102 of 160	833 CFP	2.6	2.6	Ambiguous :58 Pot. Missing :333 Pot. Dupicated :23	$62,100

Detailed Quality Report



ScopeMaster

Colin

TEST FOR EAMONN

/ MY SOFTWARE / TEST FOR EAMONN / POTENTIAL DEFECTS

Search ...

Reports

0 Ambiguity Defects	3 Complexity defects	63 Potential Omissions	2 Potential Duplicates	1.2 Defects per CFP

Potential Defects: Ambiguity and Duplication

Jump to Missing and Duplication Defects

✓ Congratulations all requirements were interpreted and sized See additonal suggestions of potential ambiguities

Potential Defects: requirements CRUD Omissions and Duplication

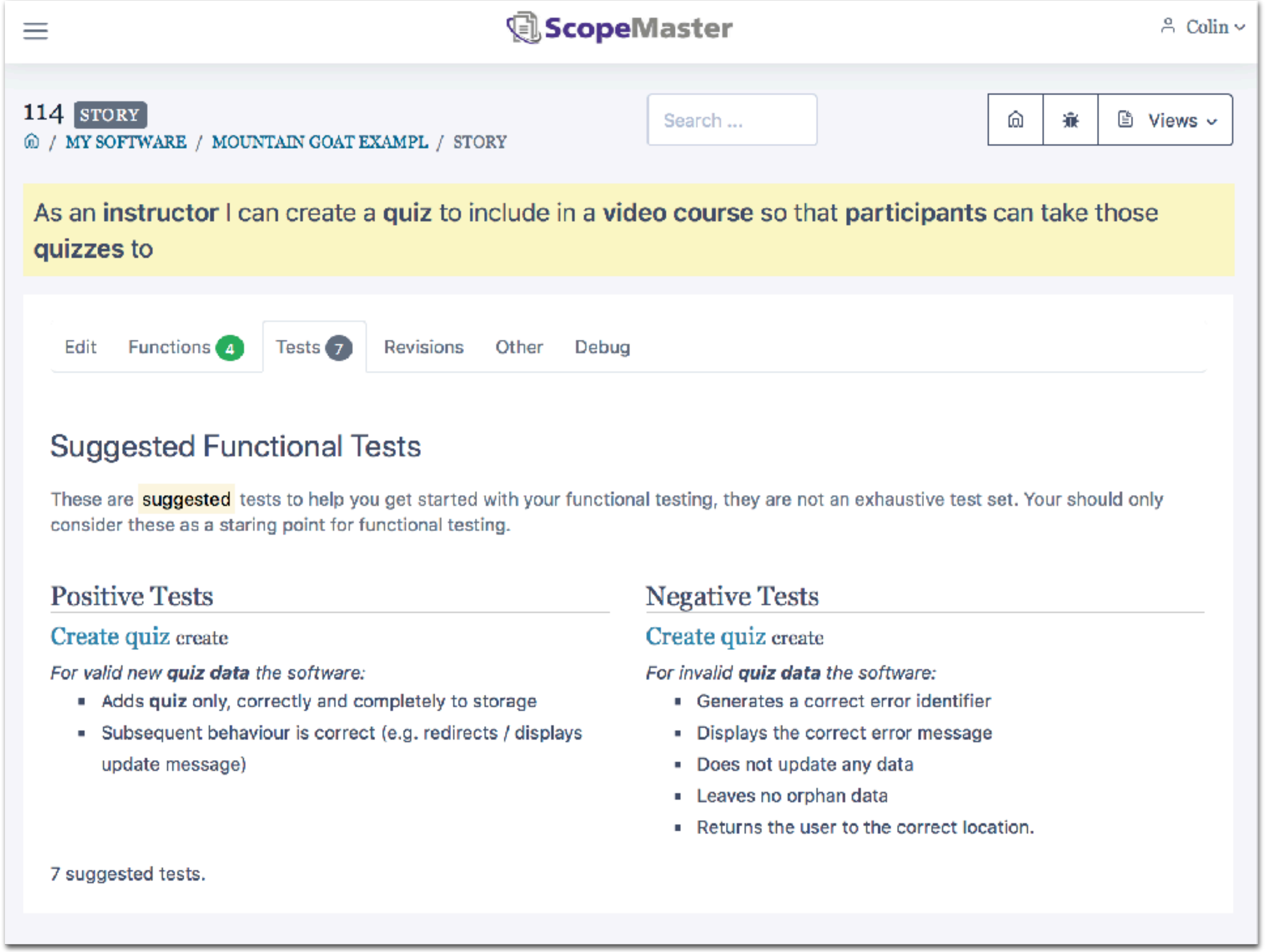
Missing: 63
Duplicate: 2
The value of finding ($25-100) and fixing ($150) these defects early is at least $11,375

65

Object (16)	Create (3)	Read (9)	Update (5)	Delete (0)	List (0)
account	missing	2 proceed to th	missing	missing	missing
behaviour	missing	missing	2 proceed to th	missing	missing
category	missing	duplicate	missing	missing	missing

Clear(unambiguous)
Complete
Concise
Consistent

Proposes Functional Tests



As an **instructor** I can create a **quiz** to include in a **video course** so that **participants** can take those **quizzes** to

Suggested Functional Tests

These are suggested tests to help you get started with your functional testing, they are not an exhaustive test set. Your should only consider these as a staring point for functional testing.

Positive Tests

Create quiz create

*For valid new **quiz data** the software:*

- Adds **quiz** only, correctly and completely to storage
- Subsequent behaviour is correct (e.g. redirects / displays update message)

Negative Tests

Create quiz create

*For invalid **quiz data** the software:*

- Generates a correct error identifier
- Displays the correct error message
- Does not update any data
- Leaves no orphan data
- Returns the user to the correct location.

7 suggested tests.

Suggested positive and negative functional tests

Software Analysis Tools *that help you write better software*

Code the Right Thing

ScopeMaster

Work as a team

Jira Software

Trello

GitHub

MICRO FOCUS

ATLASSIAN Bitbucket

Visual Studio Team Foundation Server

Code it Well

CAST

CODE CLIMATE

CHECKMARX

SYNOPSYS

CODEBEAT

CODACY

JET BRAINS

SMARTBEAR

sonarqube

MICRO FOCUS

eggplant

Semmle™

Some testimonials

“..to me it’s a no brainer…”

“……it’s the only static analysis tool for requirements that I have ever seen”

“…would have saved 3 – 6 months in the requirement’s gathering process”

…(should) improve development team productivity by at least 10%

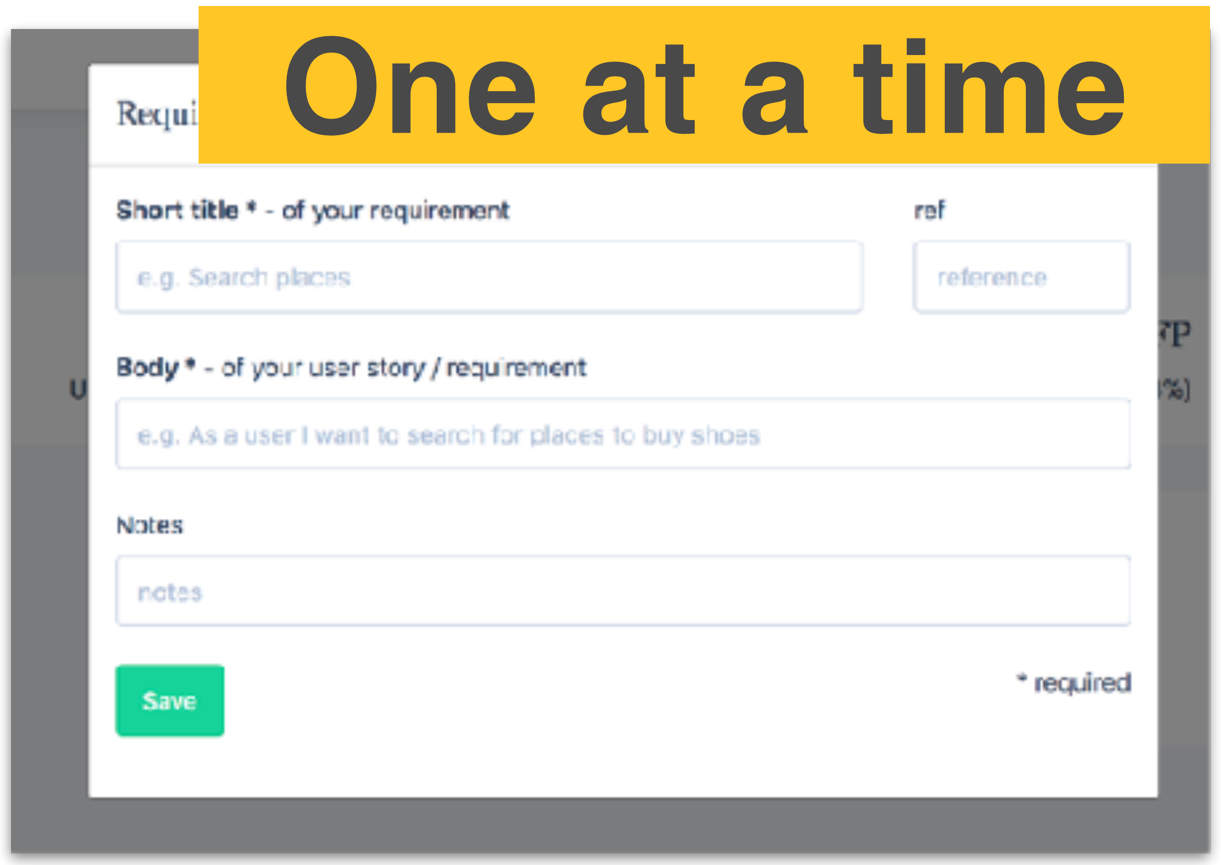
….doesn’t just help find the requirements defects but helps educate authors to prevent them in future!”

“…Its amazing that you have come up with the right set of functional requirements.”

“Using ScopeMaster, not only I did I find and fix 150 defects in 2 days, it was actually fun to use!”

Adding Stories

There are four ways to add requirements



One at a time

Requi

Short title * - of your requirement

e.g. Search places

ref

reference

Body * - of your user story / requirement

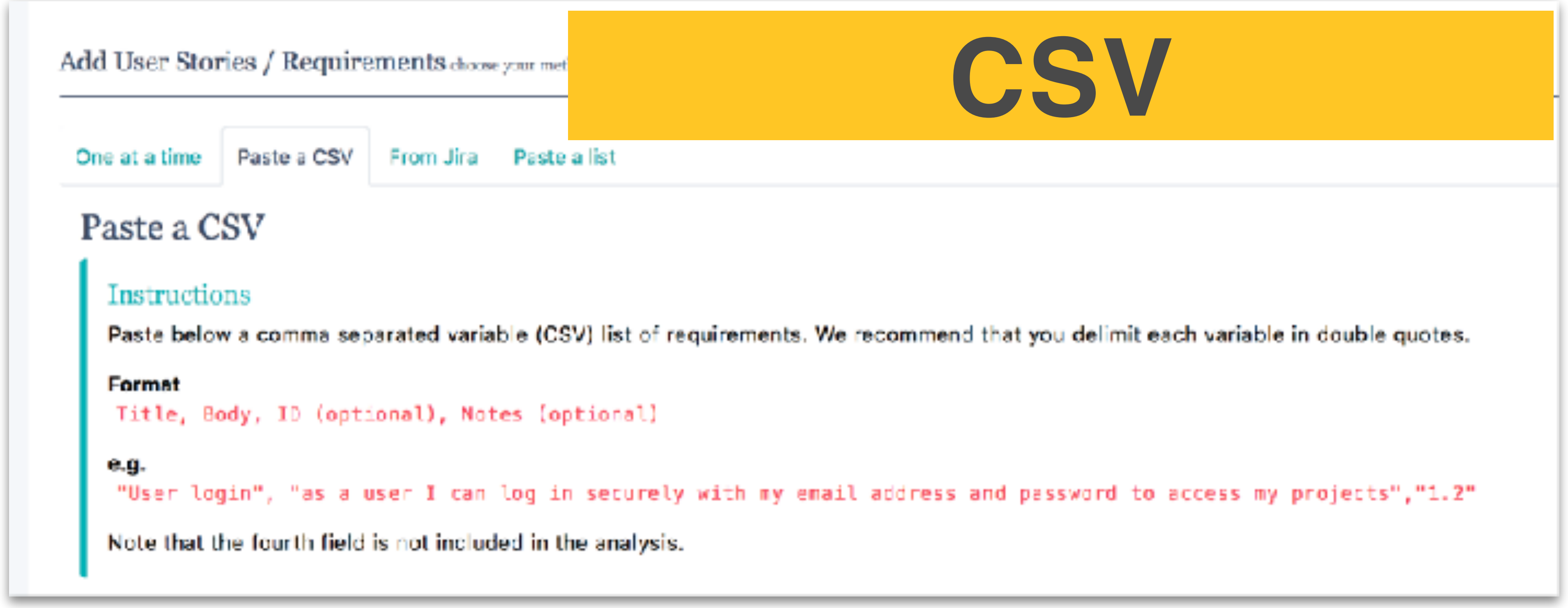
e.g. As a user I want to search for places to buy shoes

Notes

notes

Save

* required



CSV

Add User Stories / Requirements choose your met

One at a time | Paste a CSV | From Jira | Paste a list

Paste a CSV

Instructions

Paste below a comma separated variable (CSV) list of requirements. We recommend that you delimit each variable in double quotes.

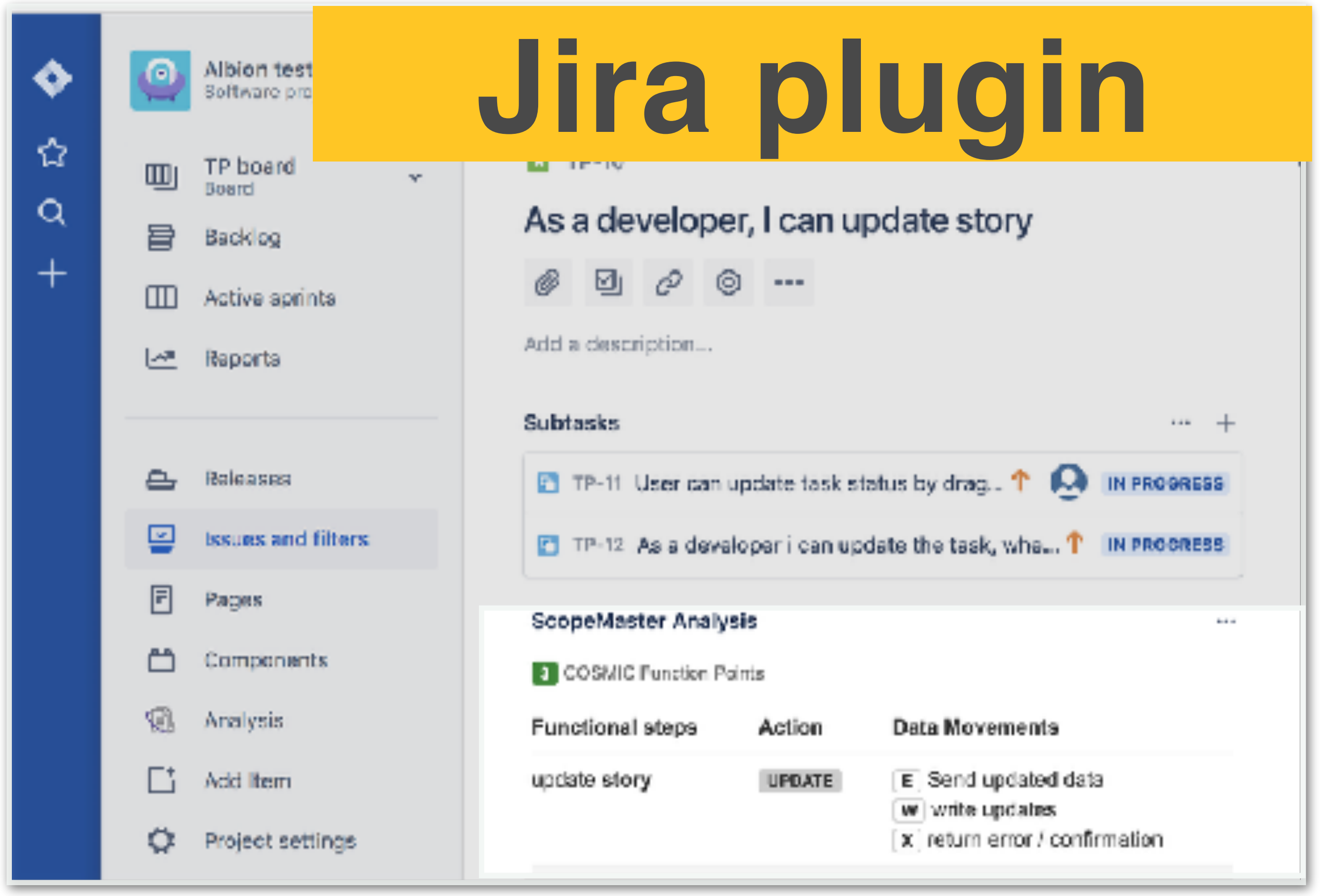
Format

```
Title, Body, ID (optional), Notes [optional]
```

e.g.

```
"User login", "as a user I can log in securely with my email address and password to access my projects","1.2"
```

Note that the fourth field is not included in the analysis.



Jira plugin

As a developer, I can update story

Add a description...

Subtasks

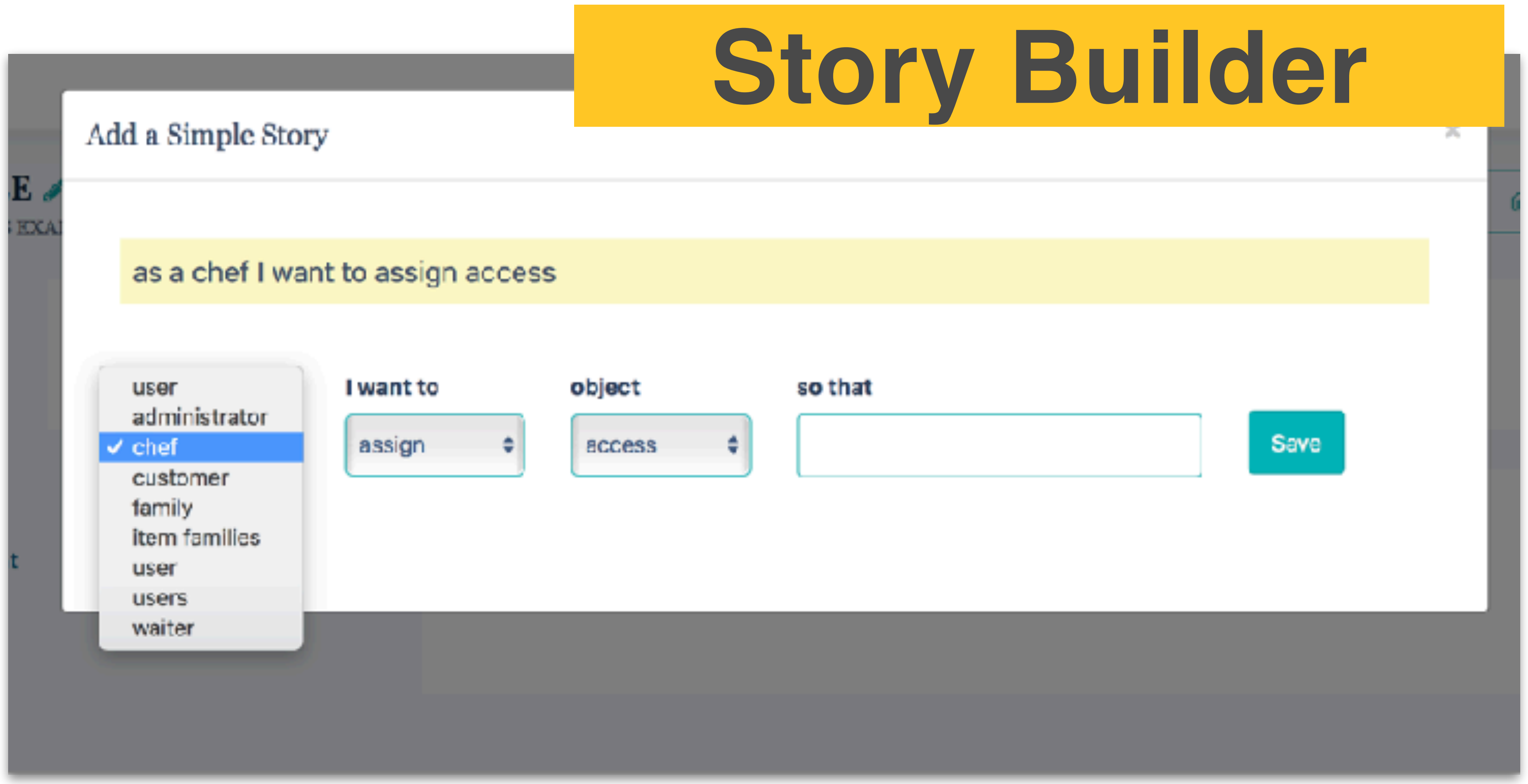
TP-11 User can update task status by drag... IN PROGRESS

TP-12 As a developer i can update the task, wha... IN PROGRESS

ScopeMaster Analysis

COSMIC Function Points

Functional steps	Action	Data Movements
update story	UPDATE	E Send updated data W write updates X return error / confirmation



Story Builder

Add a Simple Story

as a chef I want to assign access

I want to: assign

object: access

so that:

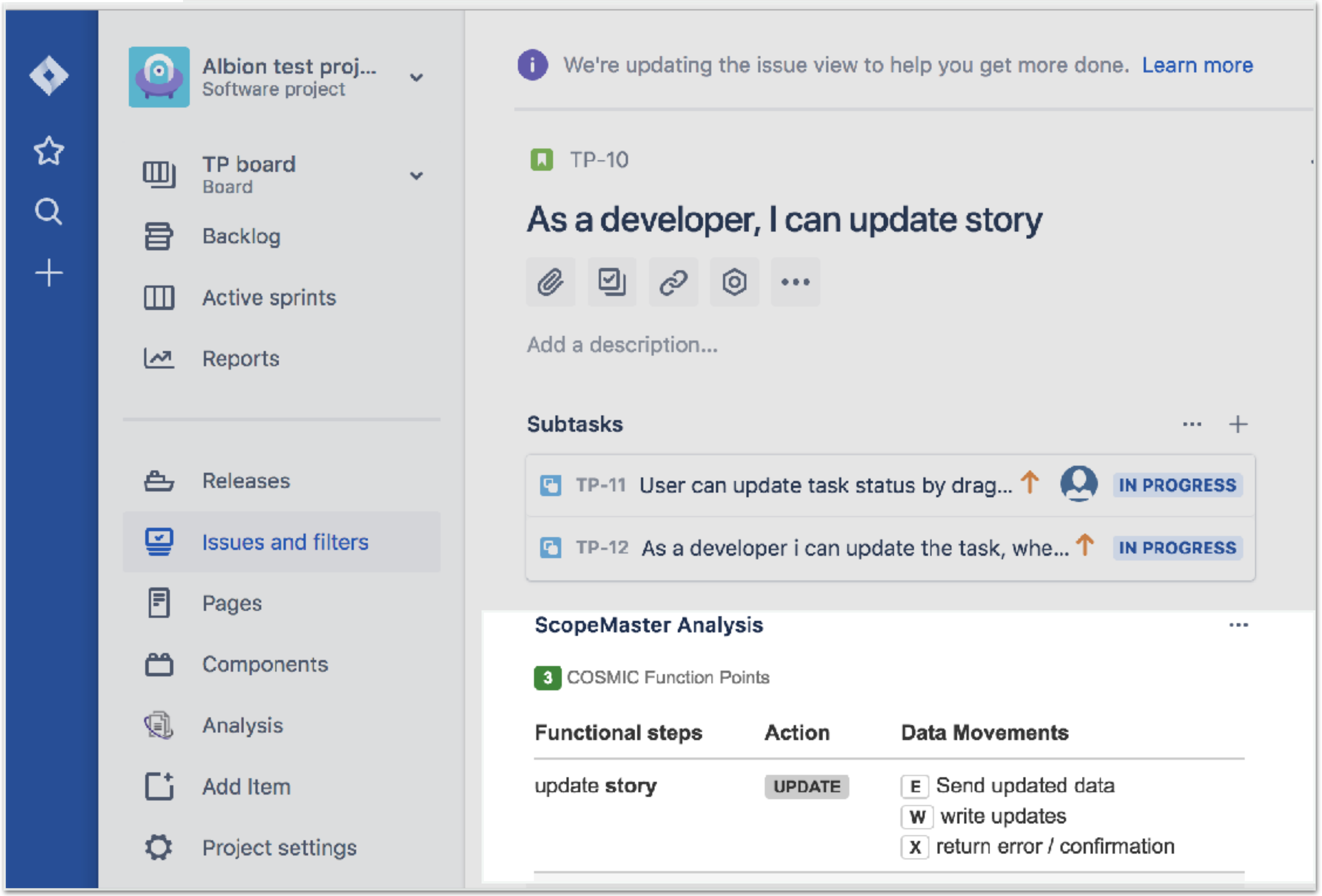
Save

Jira Cloud Plugin

Avoids double entry

ScopeMaster

Atlassian JIRA



We're updating the issue view to help you get more done. Learn more

TP-10

As a developer, I can update story

Add a description...

Subtasks

TP-11	User can update task status by drag...	↑	IN PROGRESS
TP-12	As a developer i can update the task, whe...	↑	IN PROGRESS

ScopeMaster Analysis

3 COSMIC Function Points

Functional steps	Action	Data Movements
update story	UPDATE	E Send updated data W write updates X return error / confirmation

Recap

- Large Projects **Need Help** - focus on size and quality will help reduce failure.
- Finding defects **early is VERY efficient**
- The COSMIC measurement process helps improve quality and is <u>the</u> **engineering metric** of software functionality
- Natural Language Processing of user stories, Can help both quality and measurement. **Fast and highly effective.**

Thanks!

References

https://cosmic-sizing.org

Economics of Software Quality by Capers Jones

https://www.amazon.co.uk/Applied-Software-Measurement-Analysis-Productivity/dp/0071502440

Story points and CFP
https://www.scopemaster.com/blog/story-points-compared-with-cfp/

https://cosmic-sizing.org/forums/topic/superiority-cosmic-function-points-story-points-estimating-agile-projects/

colin.hammond@scopemaster.com

Appendix

Suited to:

- ☑ English text
- ☑ Agile or Waterfall
- ☑ New applications
- ☑ System changes
- ☑ Business Applications (inc ERP)
- ☑ Mobile Apps
- ☑ Embedded systems
- ☑ Before, During or After Coding
- ☑ Benchmarking development work

Not Suited to:

- Computational intense systems
- AI applications

Expect:

- ☑ Better Quality
- ☑ Faster Delivery
- ☑ Reduce rework
- ☑ Fewer Bugs
- ☑ Reduced Project Risk
- ☑ Lower Costs
- ☑ Teaches requirements authors

Ask yourself…

1. Do we have a **software project with quality problems?**

2. How many of those problems could be attributed to the **requirements quality or volatility**?

3. How much could we have saved in **time and effort** if we'd used ScopeMaster.

And for outsourced development…

1. Are we **paying the right amount** for our development? How do we know? (resources)

2. Do we have **reliable estimates** of duration and cost?

3. Has scope change been **costly**?

Why Organisations Use ScopeMaster

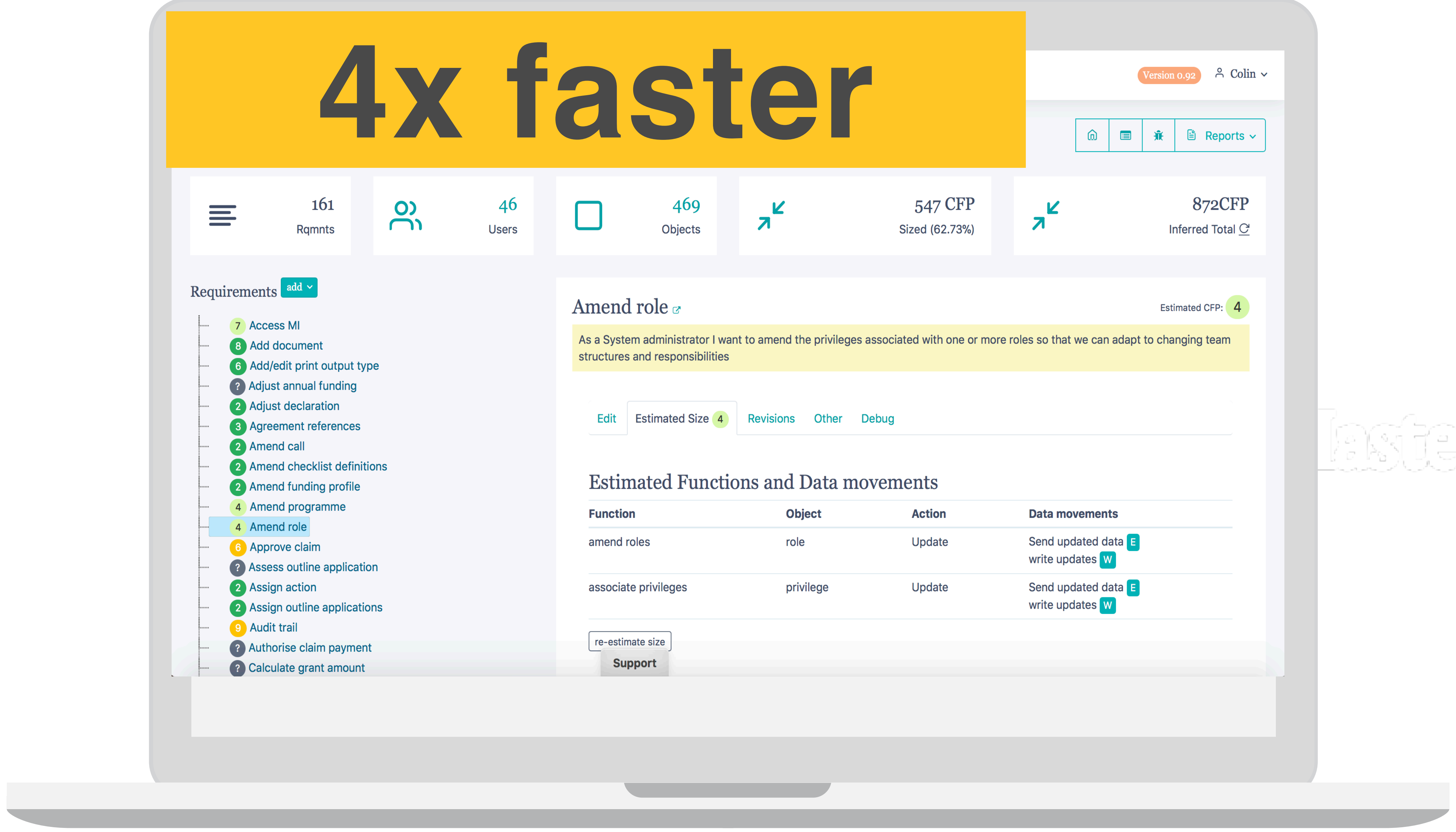
Scope and Quality	Project	Commercial	Learning
Higher quality achieved	Improve Team Productivity	Lower Outsourced dev costs	Organisational Learning
Better, faster, cheaper deliveries	Better Project Control	Vendor Management	Portfolio Mangement
More Stable	Project risk reduction	Project Assurance	Benchmarking
	Avoid project Disasters		Learn to write better stories
	Recover failing project		

Effective Functional Sizing - Speed

The International Function Point Users Group

COSMIC
www.cosmic-sizing.org

125 – 500 FP / Day



4x faster

161 Rqmnts

46 Users

469 Objects

547 CFP Sized (62.73%)

872CFP Inferred Total

Requirements add

- 7 Access MI
- 8 Add document
- 6 Add/edit print output type
- ? Adjust annual funding
- 2 Adjust declaration
- 3 Agreement references
- 2 Amend call
- 2 Amend checklist definitions
- 2 Amend funding profile
- 4 Amend programme
- 4 Amend role
- 6 Approve claim
- ? Assess outline application
- 2 Assign action
- 2 Assign outline applications
- 9 Audit trail
- ? Authorise claim payment
- ? Calculate grant amount

Amend role

Estimated CFP: 4

As a System administrator I want to amend the privileges associated with one or more roles so that we can adapt to changing team structures and responsibilities

Estimated Functions and Data movements

Function	Object	Action	Data movements
amend roles	role	Update	Send updated data E write updates W
associate privileges	privilege	Update	Send updated data E write updates W

500 –2500 FP/ day

Allows the user to review the tools’ interpretation