SENG321: Requirements Engineering

CHANGE MANAGEMENT AND PROJECT MANAGEMENT

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Stakeholders and an interesting relationship

Many classes of stakeholders

Different requirements

Diverse market/political issues

--> RE = continuous negotiation process

Software evolution and change management

Change in software development: as inevitable as difficult to control

- Reasons for change:
  - New requirements become apparent
  - Business and strategic goals change
  - Changes in customer market

- Possible responses to change:
  - Add new requirements
  - Modify existing requirements
  - Remove existing requirements

Change management: largely a project management activity

Change management techniques

1. Formal change management process

2. Requirements traceability

3. Release planning and Requirements prioritization

1. Formal change management

(traditional) Configuration management

Versioning of the Requirements Document (RD)

Baselining the RD after the requirements analysis was complete

The latest RD should include the current understanding and agreement wrt requirements

Change control board in charge of reviewing and approving change requests

Changes between versions should be documented

2. Requirements traceability

Backward traceability

To previous stages in development

Most important: traceability to requirement rationale (pre-RS traceability)

Forward traceability

To all documents/artifacts that follow RD (post-RD traceability)

Important for:

Assessing change requests

Project management: progress visibility, risk management

2. Requirements traceability

Easier in theory than in practice

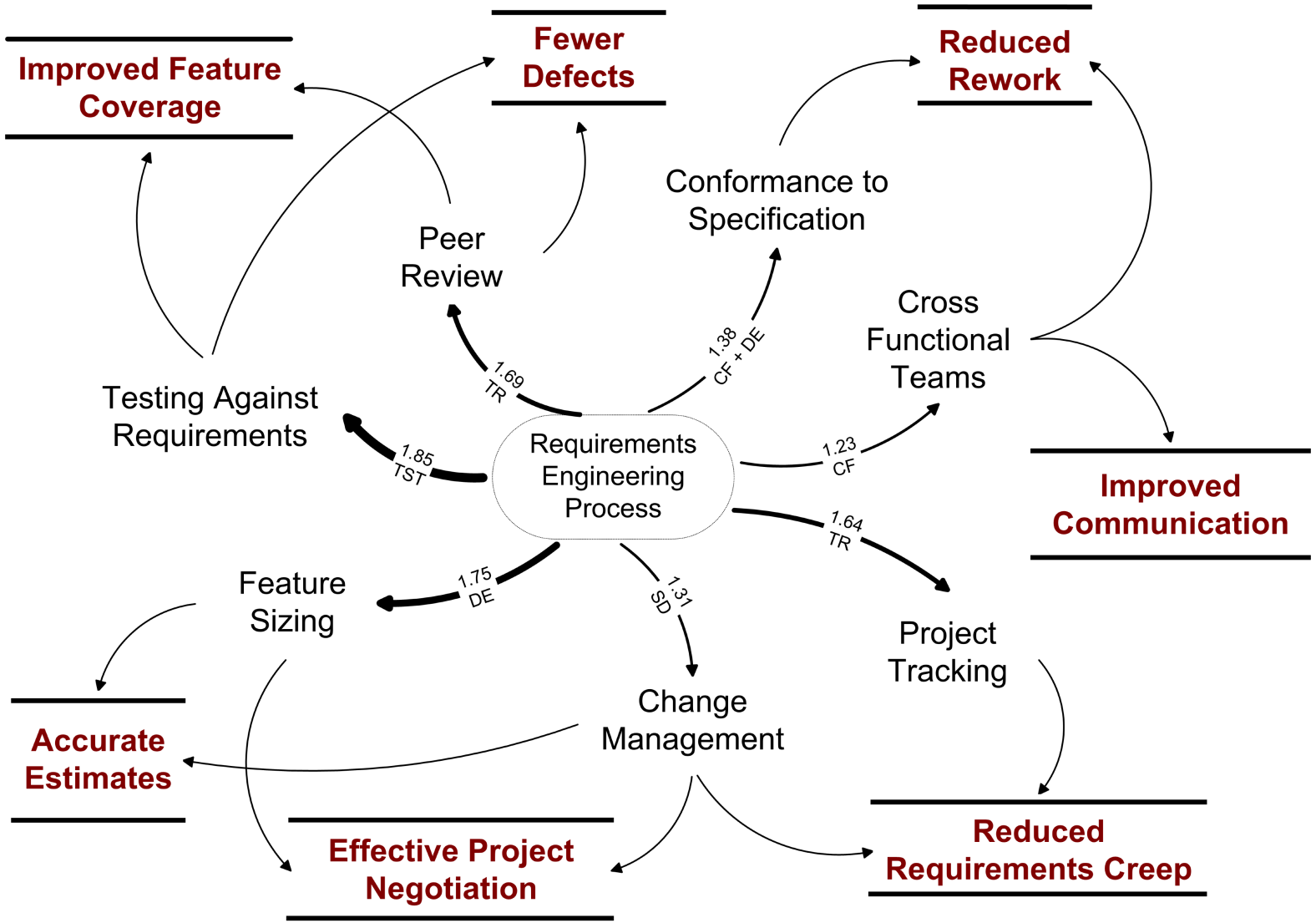
Costs may not even out for those who get the benefits

Weak current tool support in:

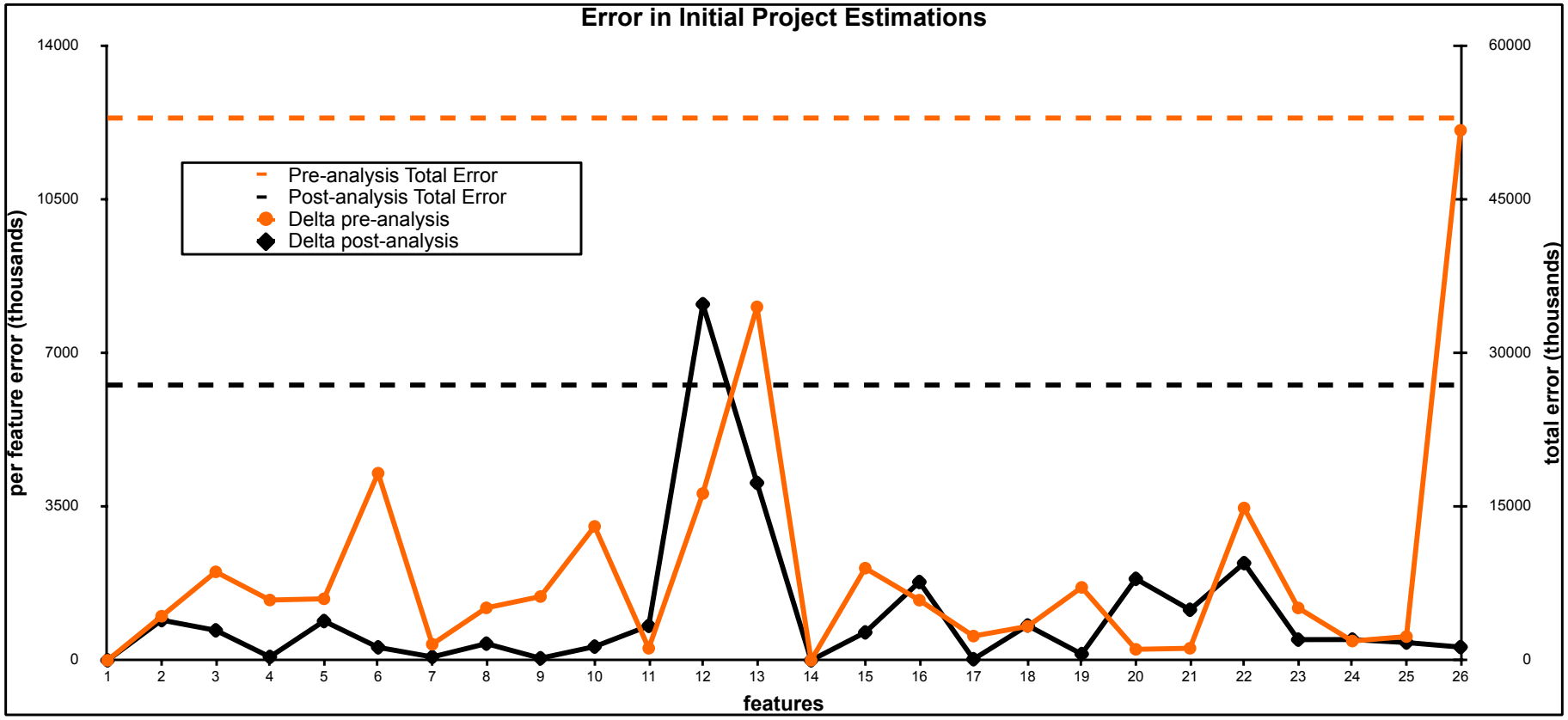
- Tracing between different tools
- Capturing informal communication

An example: Requirements traceability at Unisys

Rich interaction between the RE Process and other development processes contributed to gains in **productivity** (communication, rework), **quality** (defects) and **risk management** (estimations, feature coverage, negotiation, requirements creep).



Success stories: Significant improvements in estimation ability due to good RE processes



An example: Requirements traceability at Unisys

Sample Requirement:

Initial Feature: Scriptable Interface
Derived Technical Requirement: EA Developer shall provide a version of the D2L utility that allows the exchange of affected screen definitions from Graphical Interface Workbench to EA Developer.
Rationale: Customers may already have painted versions of the affected screens in GIW. They will likely wish to keep those existing painted screens, and be able to enhance them in the future.
Test Scenario: Enhance screens in a GIW environment. Load the provided model into EA Developer. Use D2L to transfer the enhanced screens from the GIW environment to EA Developer, into the installed model. Verify that the enhanced screens are available in EA Developer and can be further enhanced in EA Developer Painter.

Requirements Traceability Matrix, examples

REQUIREMENTS TRACEABILITY MATRIX					
Project Name: Online Flight Booking Application					
Business Requirements Document BRD		Functional Requirements Document FSD			Test Case Document
Business Requirement ID#	Business Requirement / Business Use case	Functional Requirement ID#	Functional Requirement / Use Case	Priority	Test Case ID#
BR_1	Reservation Module	FR_1	One Way Ticket booking	High	TC#001 TC#002
		FR_2	Round Way Ticket		TC#003 TC#004
		FR_3	Multicity Ticket booking	High	TC#005 TC#006
BR_2	Payment Module	FR_4	By Credit Card	High	TC#007 TC#008
		FR_5	By Debit Card	High	TC#009
		FR_6	By Reward Points	Medium	TC#010 TC#011

Requirements Traceability Matrix, examples

Test Case ID#	Test Case Description
TC#001	Verify if user is able to book one way ticket
TC#002	Verify if user is able to book multiple one way tickets
TC#003	Verify if user is able to book round way ticket
TC#004	Verify if user is able to book multiple round way tickets
TC#005	Verify if user is able to book one way ticket for multiple cities
TC#006	Verify if user is able to book round way ticket for multiple cities
TC#007	Verify if usre is able to pay by Master Card
TC#008	Verify if usre is able to pay by Visa Card
TC#009	Verify if usre is able to pay by Debit Cards
TC#010	Verify if usre is able to pay Fully by Reward Points
TC#011	Verify if usre is able to pay partially by Reward Points

(An example) How to build a Requirements Traceability Matrix

Business Requirements (BR)

BR1: The system should allow the user to book one or more tickets, one way or around way for future dates

BR2: The user should be able to make payment for booked tickets via Credit/Debit Card or through Reward Points

(An example) How to build a Requirements Traceability Matrix

BR1: The system should allow the user to book one or more tickets, one way or around way for future dates

FR1: One way Ticket booking
The system should allow the user to book one way ticket

FR2: Round way Ticket booking
The system should allow the user to book round way ticket

FR3: Multiplicity Ticket booking
The system should allow the user to book one way or round way ticket for multiple cities

(similar for BR2..)

Requirements Traceability Matrix, examples

Test Case ID#	Test Case Description
TC#001	Verify if user is able to book one way ticket
TC#002	Verify if user is able to book multiple one way tickets
TC#003	Verify if user is able to book round way ticket
TC#004	Verify if user is able to book multiple round way tickets
TC#005	Verify if user is able to book one way ticket for multiple cities
TC#006	Verify if user is able to book round way ticket for multiple cities
TC#007	Verify if usre is able to pay by Master Card
TC#008	Verify if usre is able to pay by Visa Card
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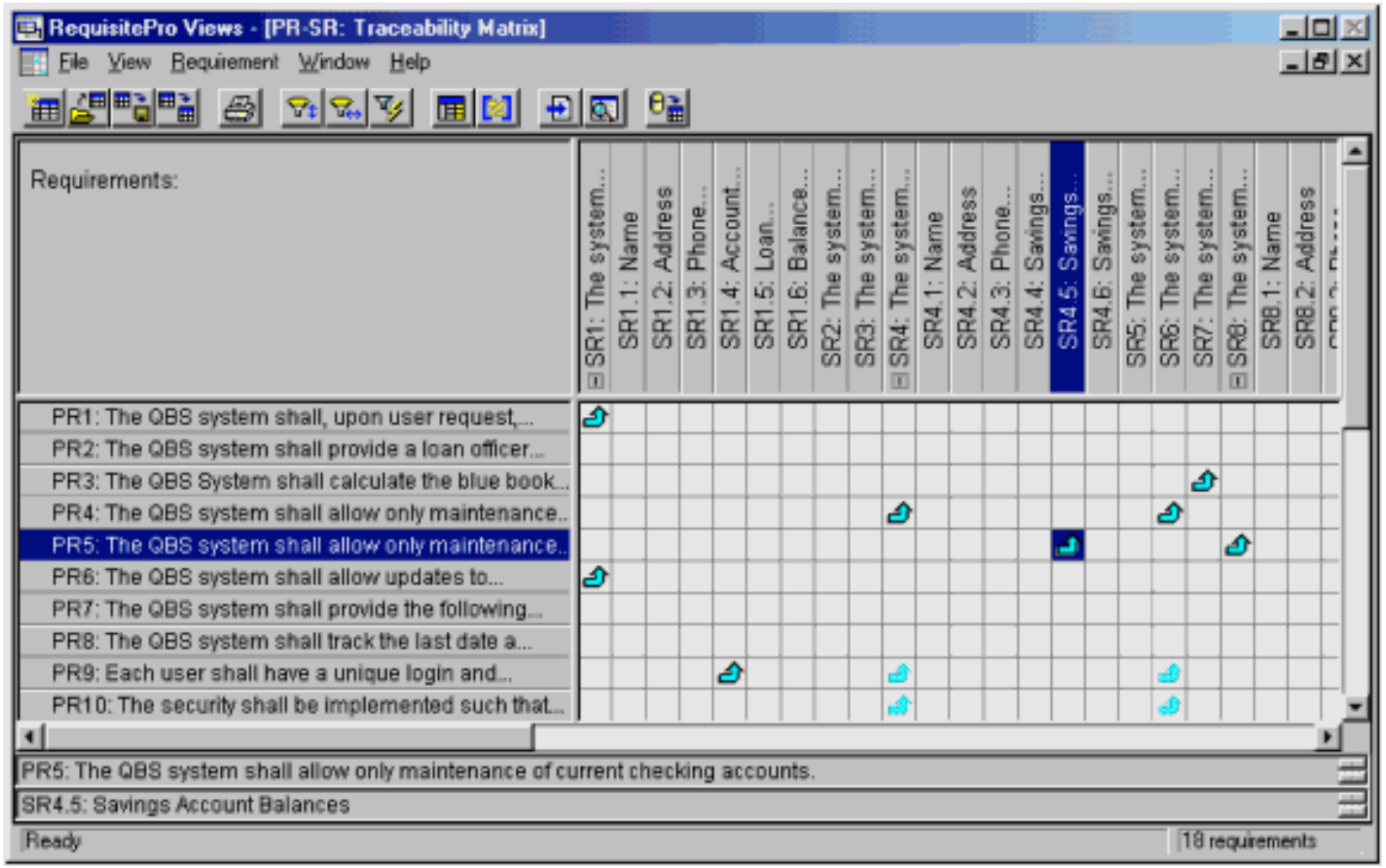
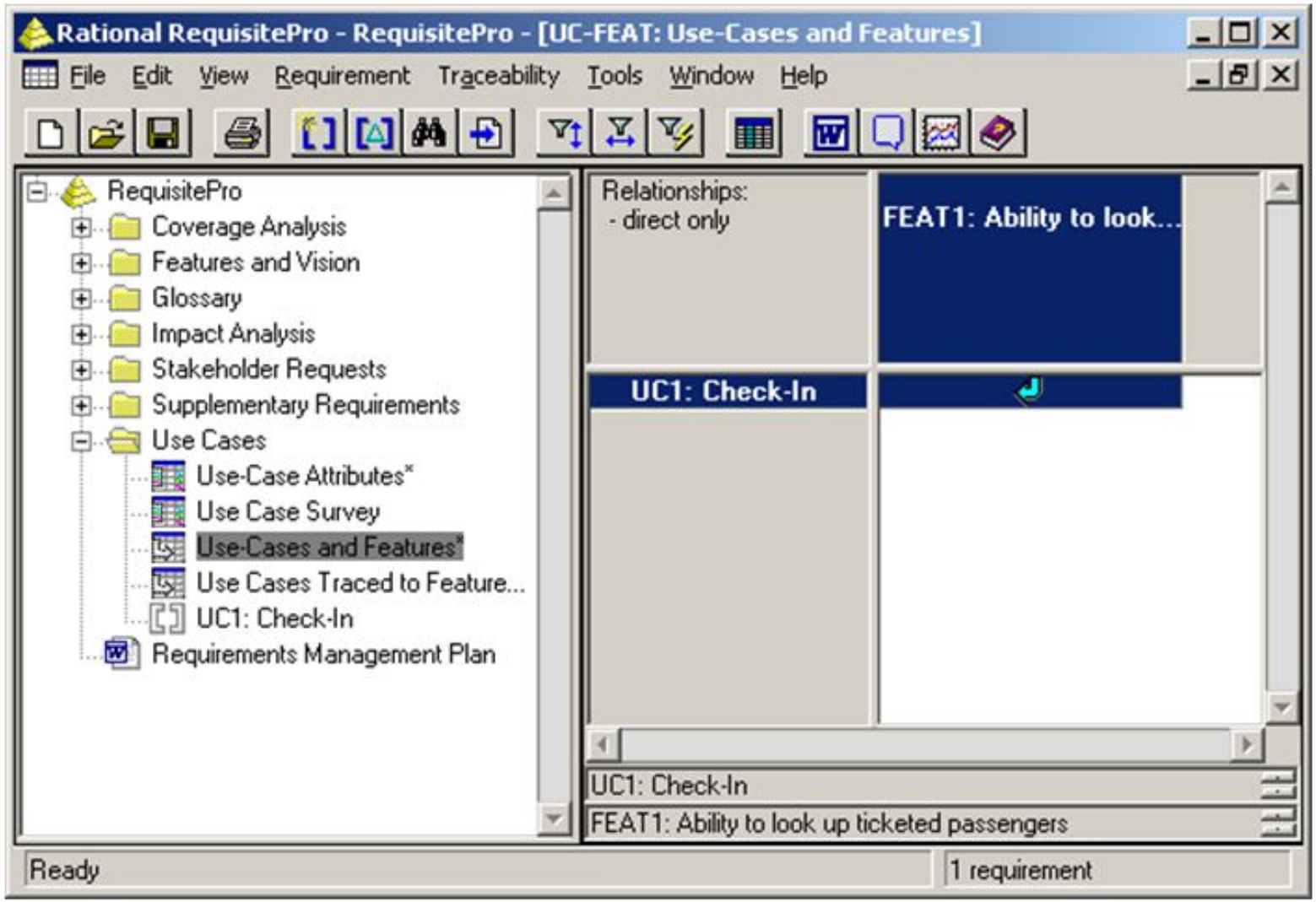
		FR_2	Round Way Ticket		TC#003 TC#004
		FR_3	Multicity Ticket booking	High	TC#005 TC#006
BR_2	Payment Module	FR_4	By Credit Card	High	TC#007 TC#008
		FR_5	By Debit Card	High	TC#009
		FR_6	By Reward Points	Medium	TC#010 TC#011

Requirements Traceability Matrix, ReqPro tool



RequisitePro – Traceability Matrix



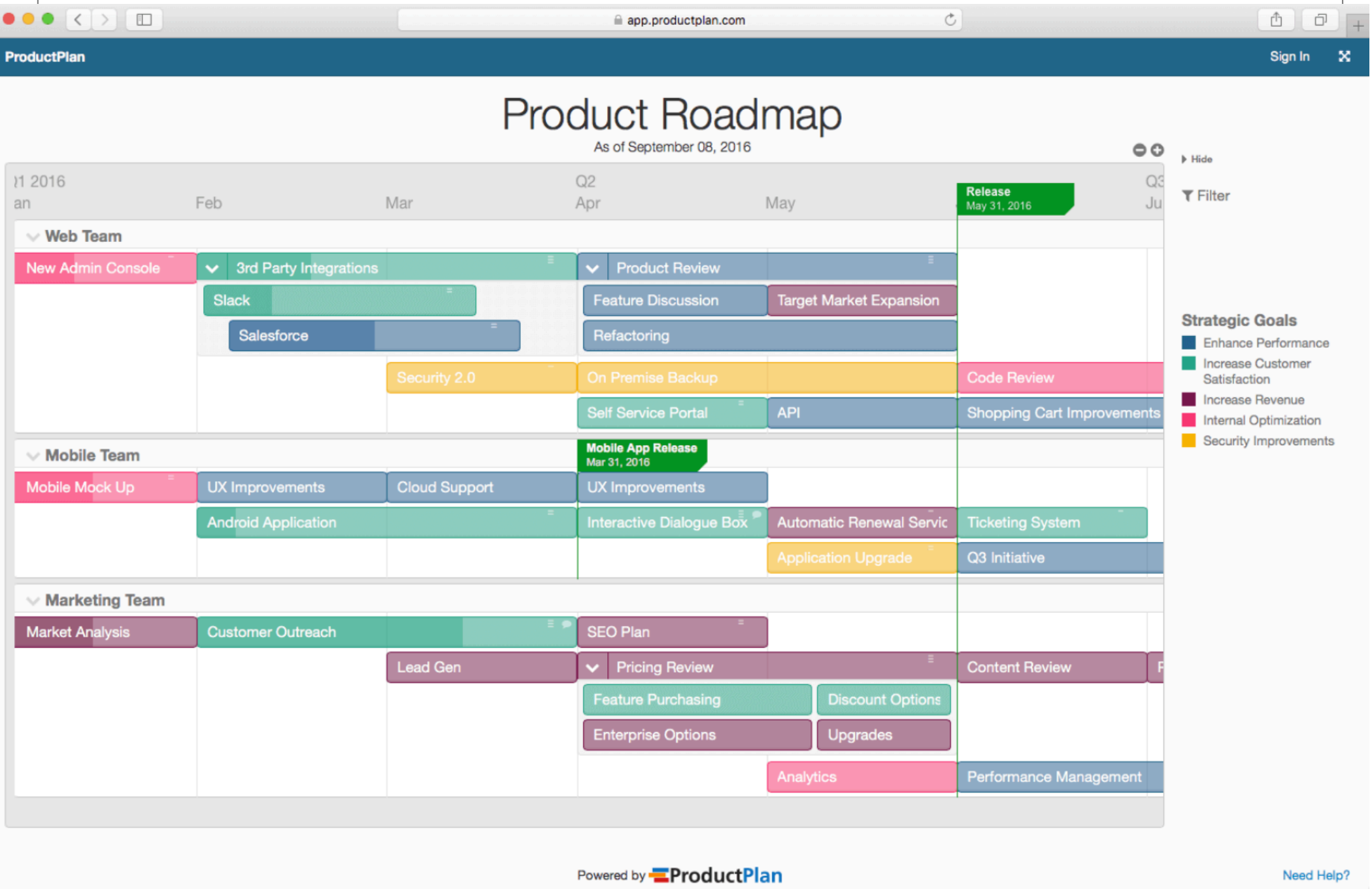
3. Release Planning

Create **iterations** and **iteration Plans** and **Product Roadmap**

To manage clients' needs

To align with Company Business Roadmap

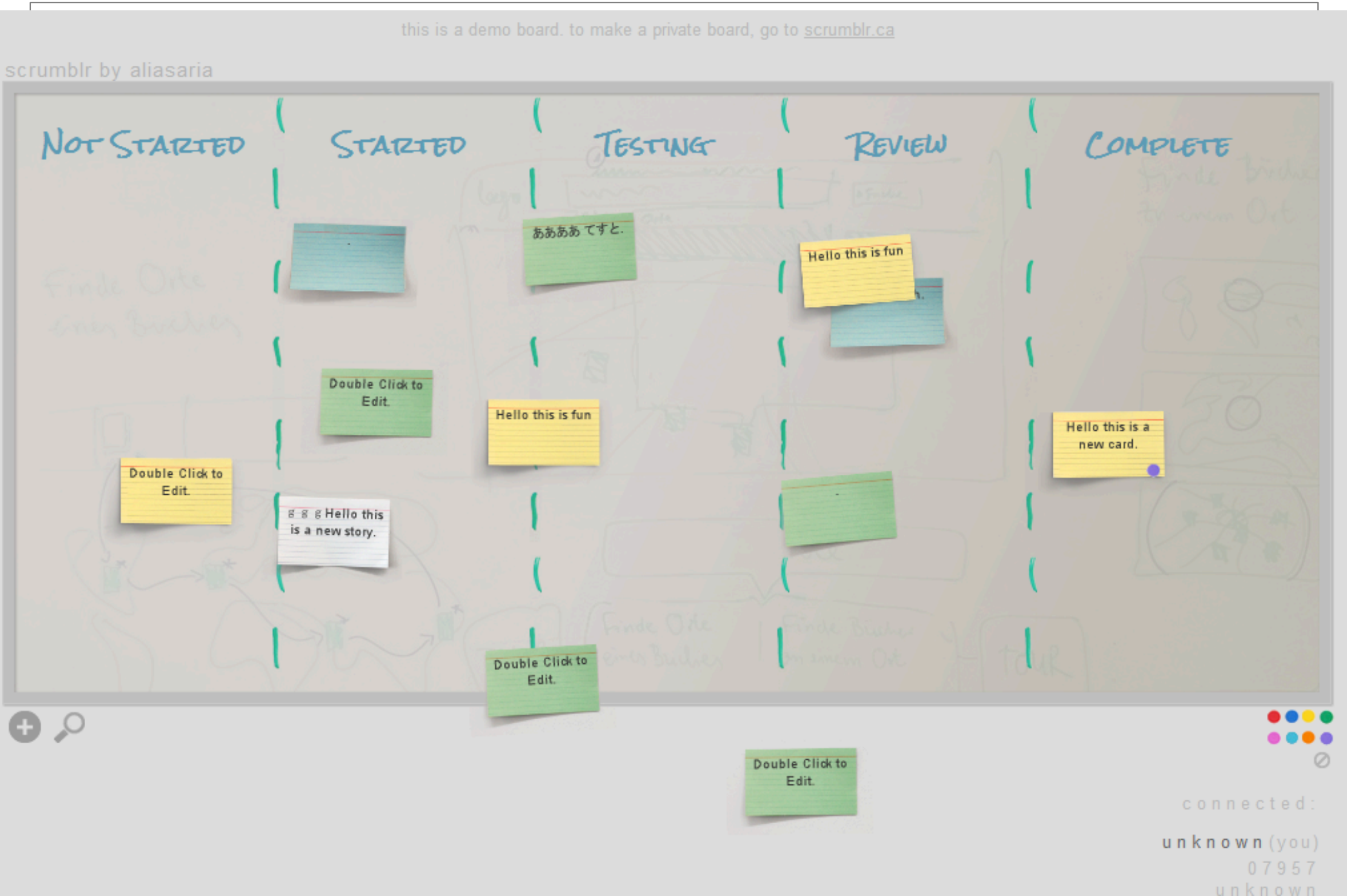
Typical to *Incremental Development*

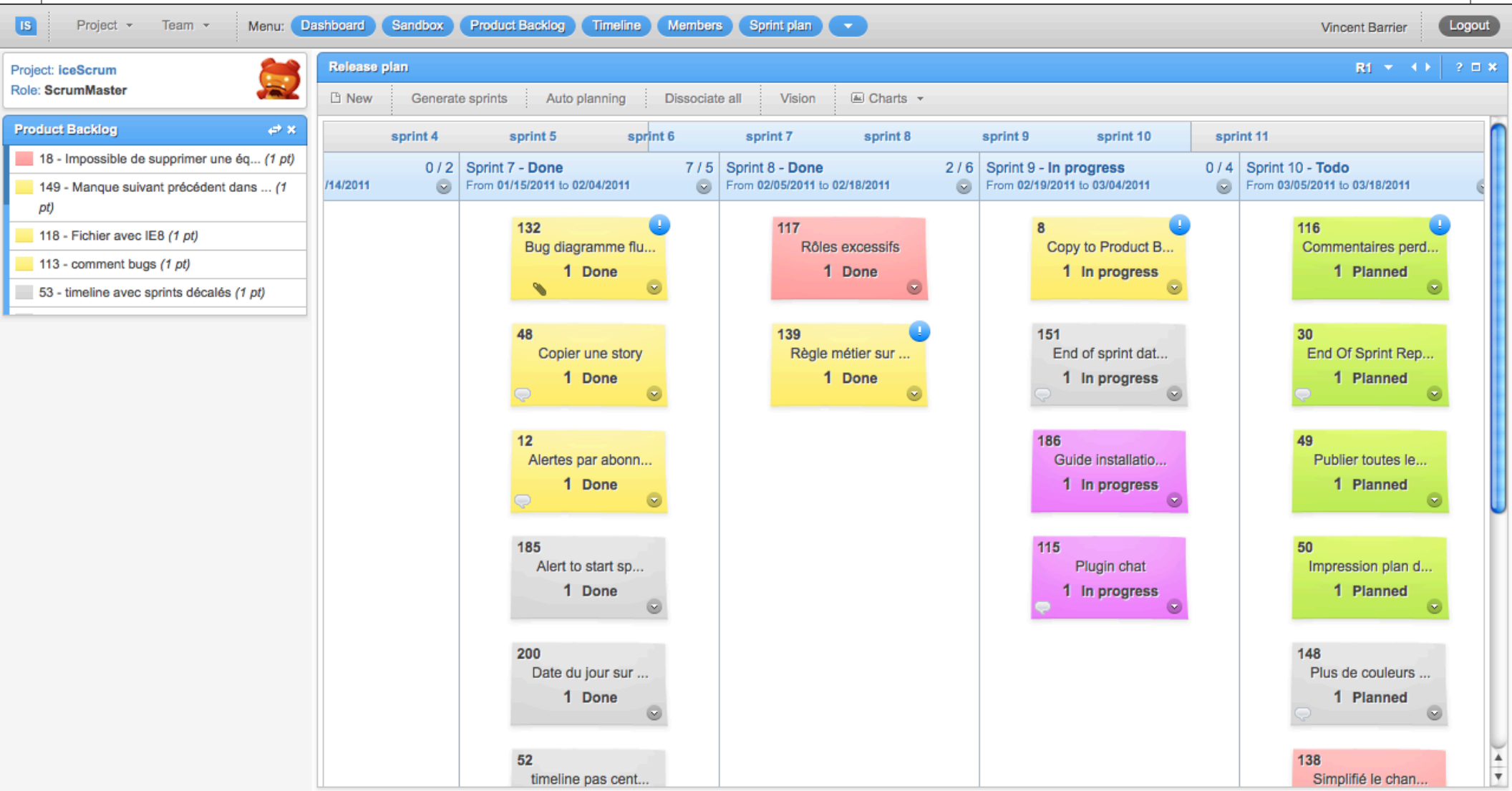

app.productplan.com
ProductPlan
Sign In
Product Roadmap
As of September 08, 2016
Hide
Filter
Q1 2016
Jan
Feb
Mar
Q2
Apr
May
Release
May 31, 2016
Q3
Jul
Web Team
New Admin Console
3rd Party Integrations
Slack
Salesforce
Product Review
Feature Discussion
Target Market Expansion
Refactoring
Security 2.0
On Premise Backup
Code Review
Self Service Portal
API
Shopping Cart Improvements
Mobile Team
Mobile App Release
Mar 31, 2016
Mobile Mock Up
UX Improvements
Cloud Support
UX Improvements
Android Application
Interactive Dialogue Box
Automatic Renewal Servic
Ticketing System
Application Upgrade
Q3 Initiative
Marketing Team
Market Analysis
Customer Outreach
SEO Plan
Lead Gen
Pricing Review
Content Review
Feature Purchasing
Discount Options
Enterprise Options
Upgrades
Analytics
Performance Management
Strategic Goals
Enhance Performance
Increase Customer Satisfaction
Increase Revenue
Internal Optimization
Security Improvements
Powered by ProductPlan
Need Help?

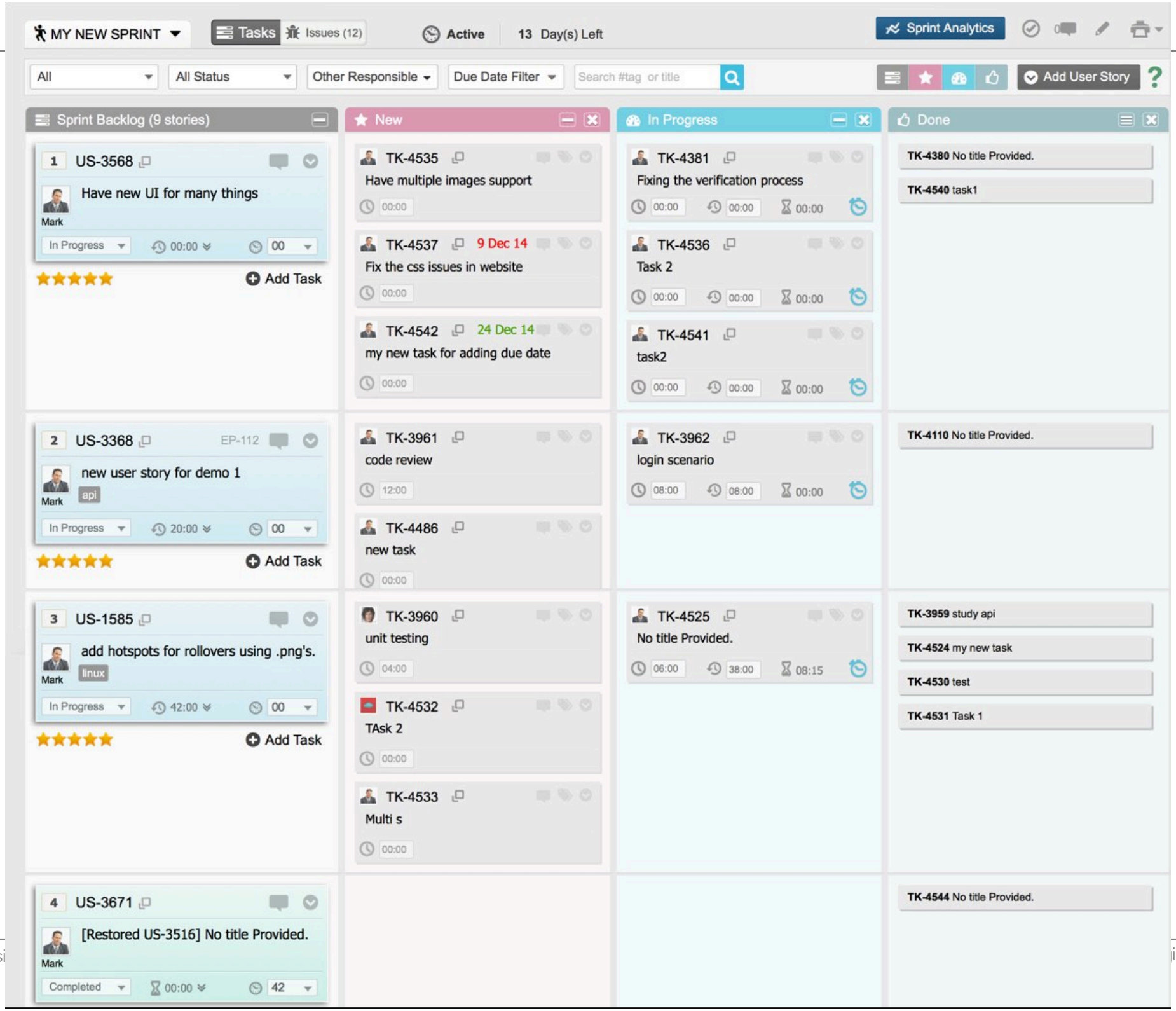
Agile Development has changed that

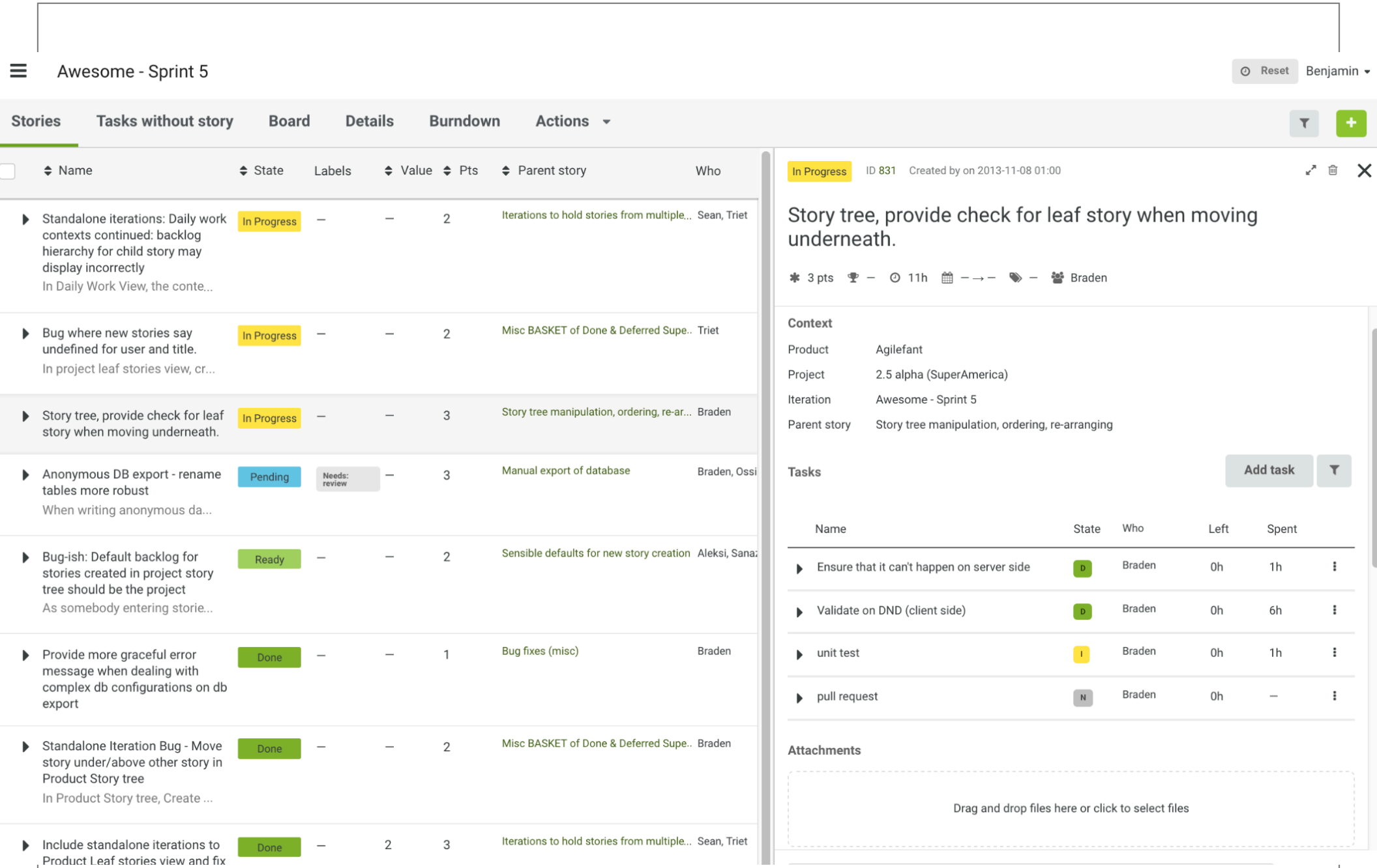
Iteration –> Sprints

Iteration Plan –> simply the Backlog!

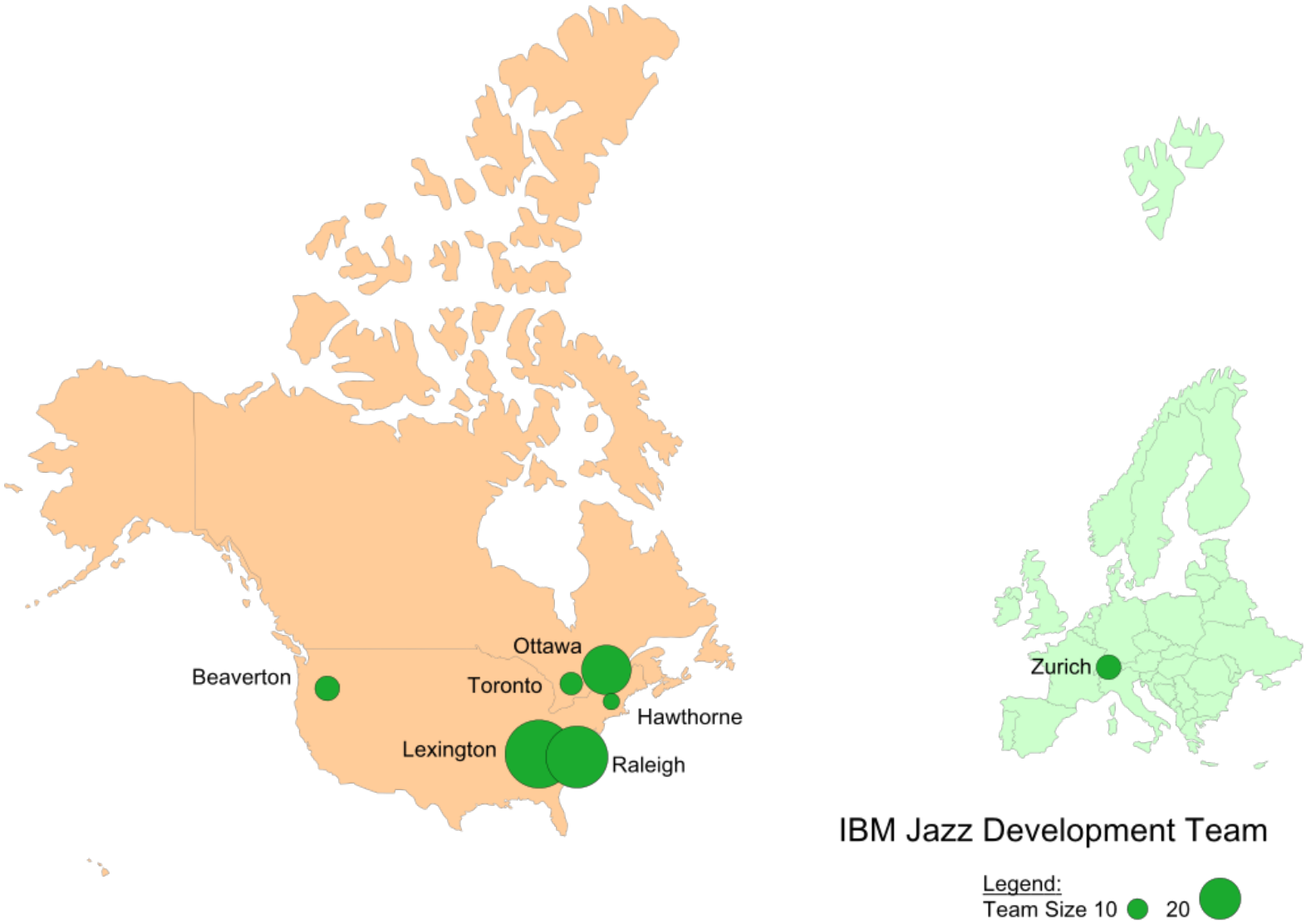

this is a demo board. to make a private board, go to scrumblr.ca
scrumblr by aliasaria
Not Started
Started
Testing
Review
Complete
ああああ てすと.
Hello this is fun
Double Click to Edit.
Hello this is fun
Hello this is a new card.
Double Click to Edit.
g g g Hello this is a new story.
Double Click to Edit.
Double Click to Edit.
connected:
unknown (you)
07957
unknown

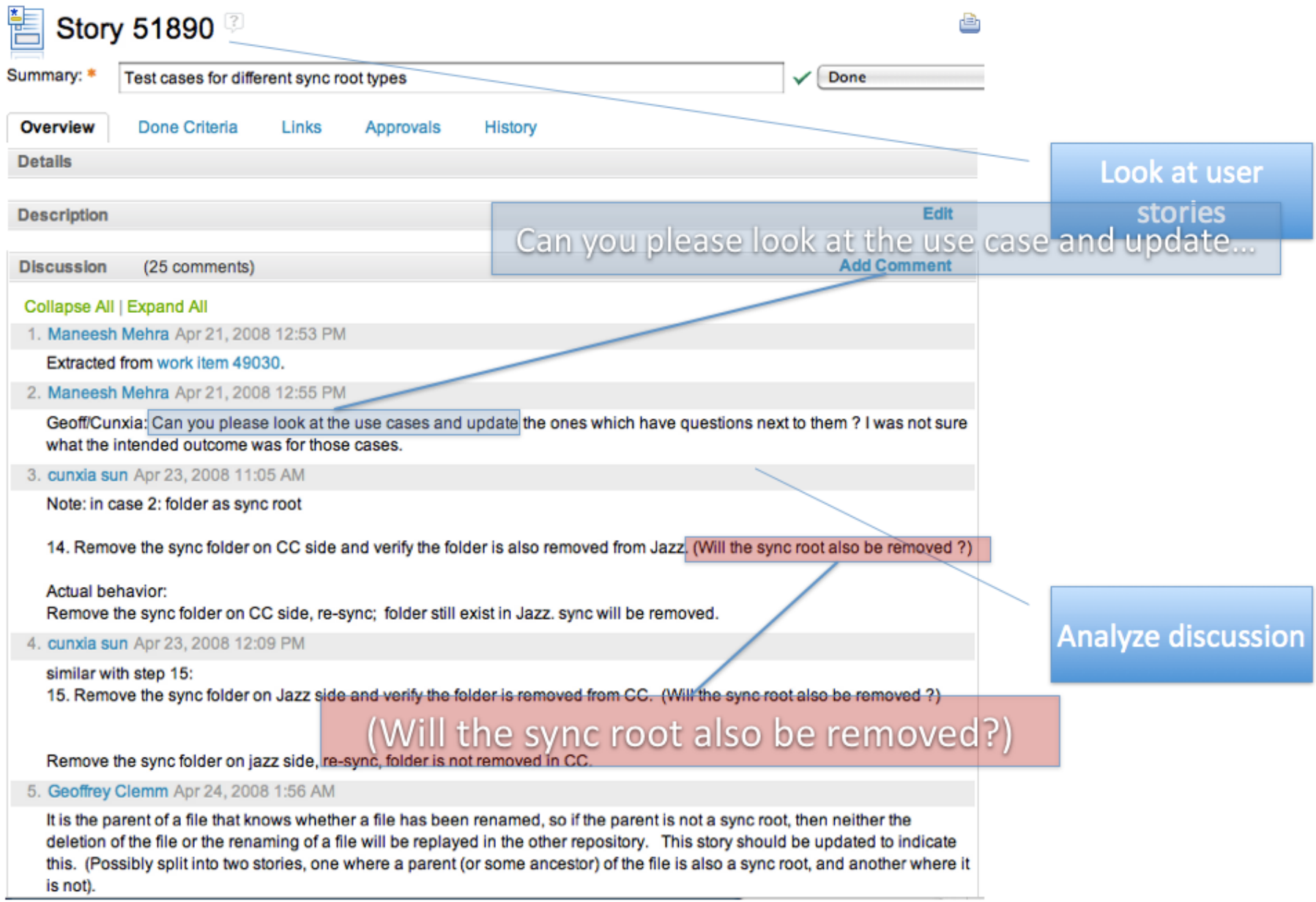

IS
Project
Team
Menu:
Dashboard
Sandbox
Product Backlog
Timeline
Members
Sprint plan
Vincent Barrier
Logout
Project: iceScrum
Role: ScrumMaster
Product Backlog
18 - Impossible de supprimer une éq... (1 pt)
149 - Manque suivant précédent dans ... (1 pt)
118 - Fichier avec IE8 (1 pt)
113 - comment bugs (1 pt)
53 - timeline avec sprints décalés (1 pt)
Release plan
R1
New
Generate sprints
Auto planning
Dissociate all
Vision
Charts
sprint 4
sprint 5
sprint 6
sprint 7
sprint 8
sprint 9
sprint 10
sprint 11
0 / 2
/14/2011
Sprint 7 - Done
From 01/15/2011 to 02/04/2011
7 / 5
Sprint 8 - Done
From 02/05/2011 to 02/18/2011
2 / 6
Sprint 9 - In progress
From 02/19/2011 to 03/04/2011
0 / 4
Sprint 10 - Todo
From 03/05/2011 to 03/18/2011
132
Bug diagramme flu...
1 Done
48
Copier une story
1 Done
12
Alertes par abonn...
1 Done
185
Alert to start sp...
1 Done
200
Date du jour sur ...
1 Done
52
timeline pas cent...
117
Rôles excessifs
1 Done
139
Règle métier sur ...
1 Done
8
Copy to Product B...
1 In progress
151
End of sprint dat...
1 In progress
186
Guide installatio...
1 In progress
115
Plugin chat
1 In progress
116
Commentaires perd...
1 Planned
30
End Of Sprint Rep...
1 Planned
49
Publier toutes le...
1 Planned
50
Impression plan d...
1 Planned
148
Plus de couleurs ...
1 Planned
138
Simplifié le chan...


MY NEW SPRINT
Tasks
Issues (12)
Active
13 Day(s) Left
Sprint Analytics
All
All Status
Other Responsible
Due Date Filter
Search #tag or title
Add User Story
Sprint Backlog (9 stories)
New
In Progress
Done
1 US-3568
Have new UI for many things
Mark
In Progress
00:00
00
Add Task
TK-4535
Have multiple images support
TK-4537
9 Dec 14
Fix the css issues in website
TK-4542
24 Dec 14
my new task for adding due date
TK-4381
Fixing the verification process
TK-4536
Task 2
TK-4541
task2
TK-4380 No title Provided.
TK-4540 task1
2 US-3368
EP-112
new user story for demo 1
api
In Progress
20:00
TK-3961
code review
TK-4486
new task
TK-3962
login scenario
TK-4110 No title Provided.
3 US-1585
add hotspots for rollovers using .png's.
linux
In Progress
42:00
TK-3960
unit testing
TK-4532
TAsk 2
TK-4533
Multi s
TK-4525
No title Provided.
06:00
38:00
08:15
TK-3959 study api
TK-4524 my new task
TK-4530 test
TK-4531 Task 1
4 US-3671
[Restored US-3516] No title Provided.
Completed
42
TK-4544 No title Provided.

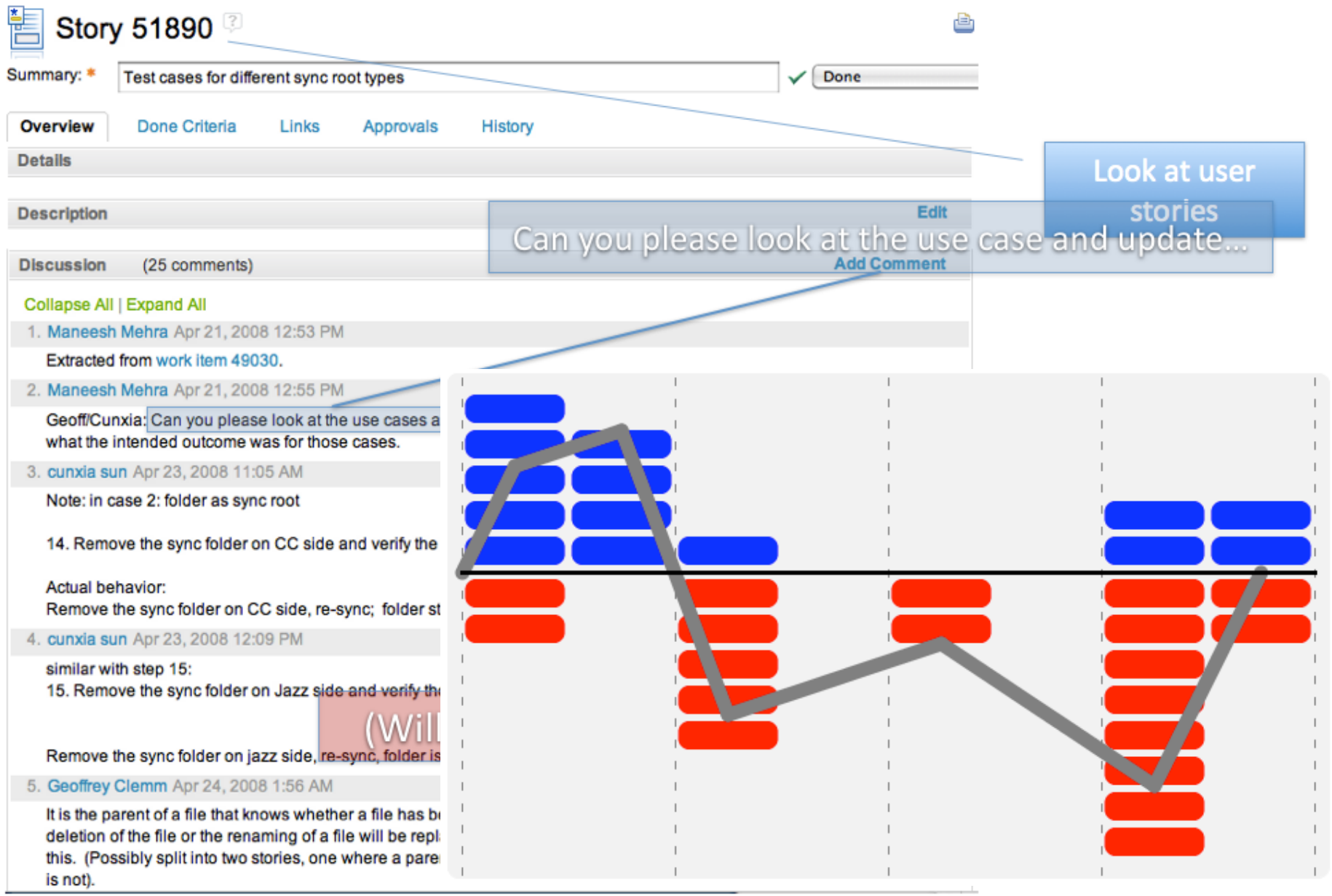

Awesome - Sprint 5
Reset
Benjamin
Stories
Tasks without story
Board
Details
Burndown
Actions
Name
State
Labels
Value
Pts
Parent story
Who
Standalone iterations: Daily work contexts continued: backlog hierarchy for child story may display incorrectly
In Daily Work View, the conte...
In Progress
2
Iterations to hold stories from multiple...
Sean, Triet
Bug where new stories say undefined for user and title.
In project leaf stories view, cr...
In Progress
2
Misc BASKET of Done & Deferred Supe..
Triet
Story tree, provide check for leaf story when moving underneath.
In Progress
3
Story tree manipulation, ordering, re-ar...
Braden
Anonymous DB export - rename tables more robust
When writing anonymous da...
Pending
Needs: review
3
Manual export of database
Braden, Ossi
Bug-ish: Default backlog for stories created in project story tree should be the project
As somebody entering storie...
Ready
2
Sensible defaults for new story creation
Aleksi, Sana
Provide more graceful error message when dealing with complex db configurations on db export
Done
1
Bug fixes (misc)
Braden
Standalone Iteration Bug - Move story under/above other story in Product Story tree
In Product Story tree, Create ...
Done
2
Misc BASKET of Done & Deferred Supe..
Braden
Include standalone iterations to Product Leaf stories view and fix
Done
2
3
Iterations to hold stories from multiple...
Sean, Triet
In Progress
ID 831
Created by on 2013-11-08 01:00
Story tree, provide check for leaf story when moving underneath.
3 pts
11h
Braden
Context
Product
Agilefant
Project
2.5 alpha (SuperAmerica)
Iteration
Awesome - Sprint 5
Parent story
Story tree manipulation, ordering, re-arranging
Tasks
Add task
Name
State
Who
Left
Spent
Ensure that it can't happen on server side
D
Braden
0h
1h
Validate on DND (client side)
D
Braden
0h
6h
unit test
I
Braden
0h
1h
pull request
N
Braden
0h
–
Attachments
Drag and drop files here or click to select files

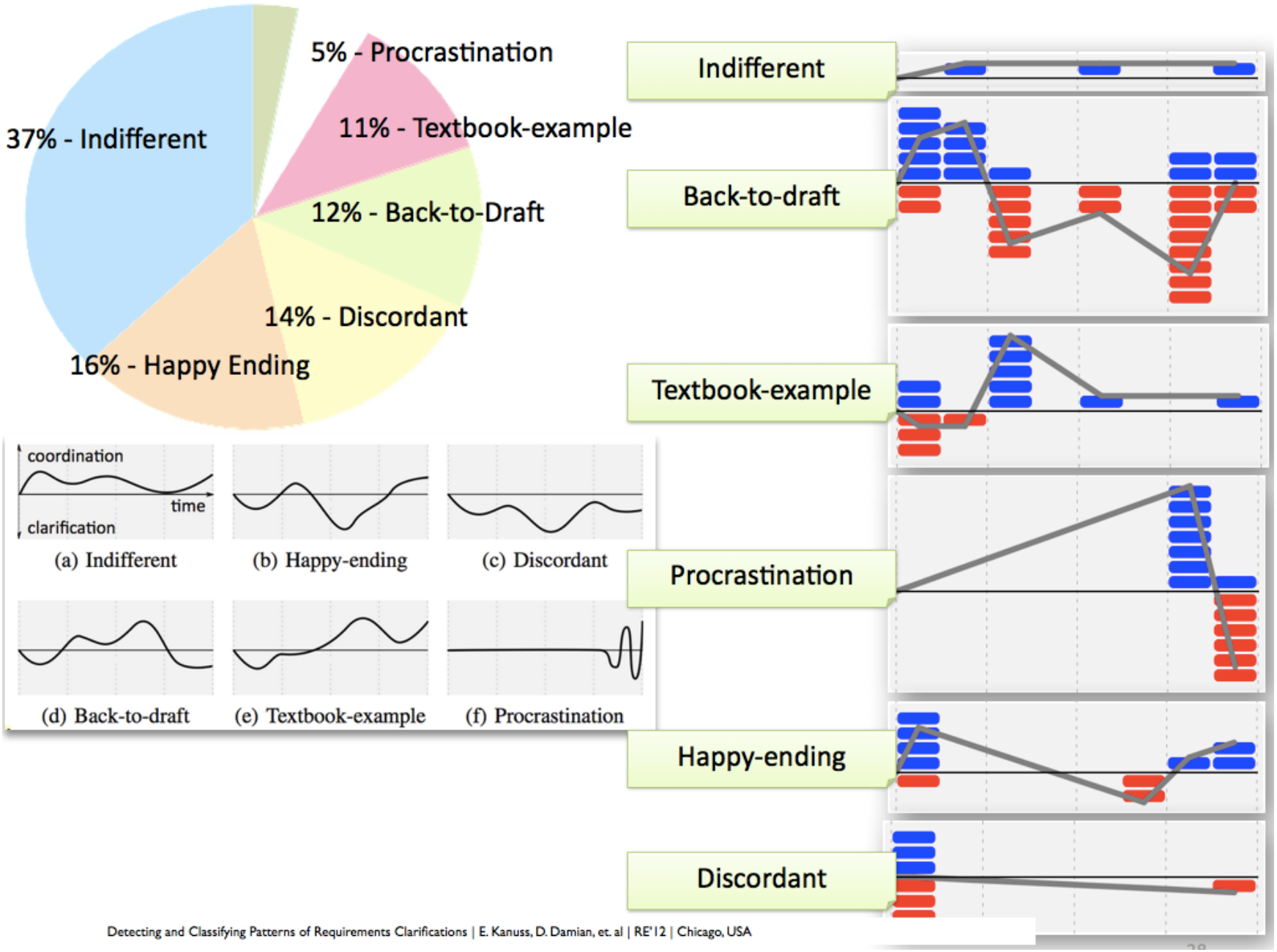
Case studies of developer communications in large projects





Detecting and Classifying Patterns of Requirements Clarifications | E. Kanuss, D. Damian, et. al | RE'12 | Chicago, USA


Story 51890
Summary: *
Test cases for different sync root types
Done
Overview
Done Criteria
Links
Approvals
History
Details
Description
Edit
Discussion
(25 comments)
Add Comment
Collapse All | Expand All
1. Maneesh Mehra Apr 21, 2008 12:53 PM
Extracted from work item 49030.
2. Maneesh Mehra Apr 21, 2008 12:55 PM
Geoff/Cunxia: Can you please look at the use cases a
what the intended outcome was for those cases.
3. cunxia sun Apr 23, 2008 11:05 AM
Note: in case 2: folder as sync root
14. Remove the sync folder on CC side and verify the
Actual behavior:
Remove the sync folder on CC side, re-sync; folder st
4. cunxia sun Apr 23, 2008 12:09 PM
similar with step 15:
15. Remove the sync folder on Jazz side and verify th
Remove the sync folder on jazz side, re-sync, folder is
5. Geoffrey Clemm Apr 24, 2008 1:56 AM
It is the parent of a file that knows whether a file has b
deletion of the file or the renaming of a file will be repl
this. (Possibly split into two stories, one where a pare
is not).
Look at user stories
Can you please look at the use case and update...


5% - Procrastination
11% - Textbook-example
37% - Indifferent
12% - Back-to-Draft
14% - Discordant
16% - Happy Ending
coordination
time
clarification
(a) Indifferent
(b) Happy-ending
(c) Discordant
(d) Back-to-draft
(e) Textbook-example
(f) Procrastination
Indifferent
Back-to-draft
Textbook-example
Procrastination
Happy-ending
Discordant
Detecting and Classifying Patterns of Requirements Clarifications | E. Kanuss, D. Damian, et. al | RE'12 | Chicago, USA

Coordination and Communication in SE

Software Ecosystems

Software Engineering Education

Applications of SE

Welcome to SEGAL

SEGAL is a research facility in the Computer Science Department of University of Victoria, BC. We carry out research to improve the collaboration of geographically distributed software development teams. Global software development is increasingly becoming common practice in the software industry. The ability to develop software at remote sites in projects allows organizations to ignore the geographic distance and benefit from access to a qualified resource pool and reduced development costs. However, large software projects in such large organizations or IT ecosystems involve complex interactions across organizational, functional as well as national, cultural and socio-economic boundaries, making their study important but difficult. In our research projects we employ a synergy of empirical methods, data mining and social network analysis techniques to understand these complex interactions as well as develop methods, processes and tools to improve the effectiveness of communication and coordination in large, distributed software projects. Check out a 2014 report on our Research Programme and the list of our recent publications for results of our work.

How to Reach Us

Recent Research News

16 MAY

MSc and PhD positions in SEGAL!

Our lab is seeking applications for MSc and Doctoral research positions in the area of software ecosystems. The research pertains to... Read More →

13 APR

Supporting the Adaptation of Contextual Requirements at Runtime

3. Requirements prioritization

Difficult task!

Different stakeholders may have different priorities

Organizations lack systematic data, metrics or techniques to help the prioritization process

Often carried out informally

Research shows that few companies know how to establish and communicate priorities

However important

Prioritizing requirements helps:

- Making acceptable tradeoffs among goals of quality, cost and time-to-market
- Project planning in allocating resources based on requirements importance to the project as a whole

A process of prioritizing requirements

Must be simple and fast, for industry adoption

Yield accurate and trustworthy results

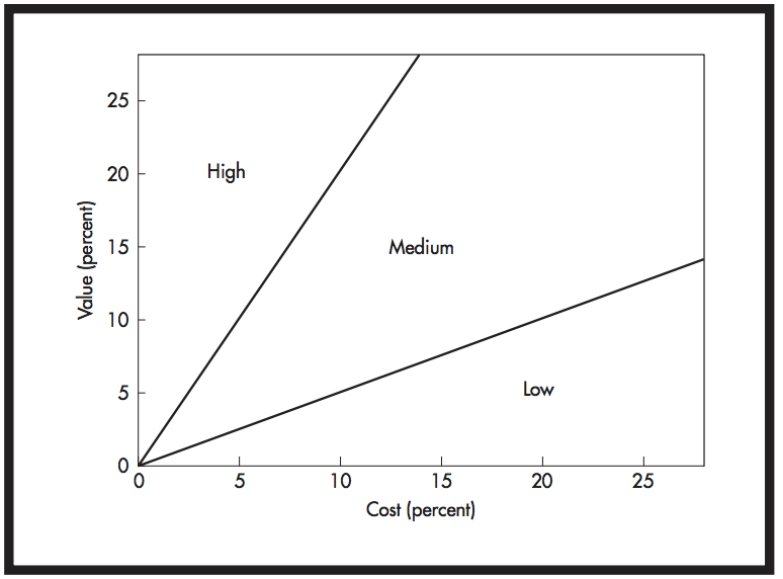
Should consider issues of:

- **Importance** of requirement to the **user/customer** (maximize)
- **Cost** of implementation (minimize)
- **Time-to-delivery** (minimize)

A cost-value approach

Calculate return on investment by:

- Assessing the **value** of each requirement
- Assessing the **cost** of each requirement
- Assess the **cost-value trade-off**



Difficulties:

- Hard to calculate absolute value/cost, relative values easier to obtain
- Interdependent requirements difficult to treat individually
- Inconsistencies or conflicts in priorities assigned by individual stakeholders

The Analytical Hierarchy Process (AHP)*

Steps (to prioritize n requirements):

1. Set up the n requirements in the rows and columns of a nxn matrix
2. Perform pairwise comparisons of all the requirements according to the criterion
3. Use averaging over normalized columns to estimate the eigenvalues of the matrix:

   Calculate sum of the column = the sum of the n elements in each column

   Divide each element in the matrix by the sum of the column the element is a member of, and calculate sums for each row

   Normalize the sum of the rows (divide each row sum with the number of requirements)

   The result == priority information for each requirement

* see example application and calculation in the PDF paper in the same connex Resource Folder

Pairwise comparison of requirements

Use a 1-9 scale with:

- $a_{ij} = 1$ if the two requirements are equal in importance
- $a_{ij} = 3$ if R_i is weakly more important than R_j
- $a_{ij} = 5$ if R_i is strongly more important than R_j
- $a_{ij} = 7$ if R_i is very strongly more important than R_j
- $a_{ij} = 9$ if R_i is absolutely more important than R_j

Example requirements prioritization techniques that leverage AHP

As developed by Karlsson and Ryan:

- Use the Analytic Hierarchy Process to assess relative values and costs of requirements
- Use cost-value diagrams to analyze and discuss candidate requirements

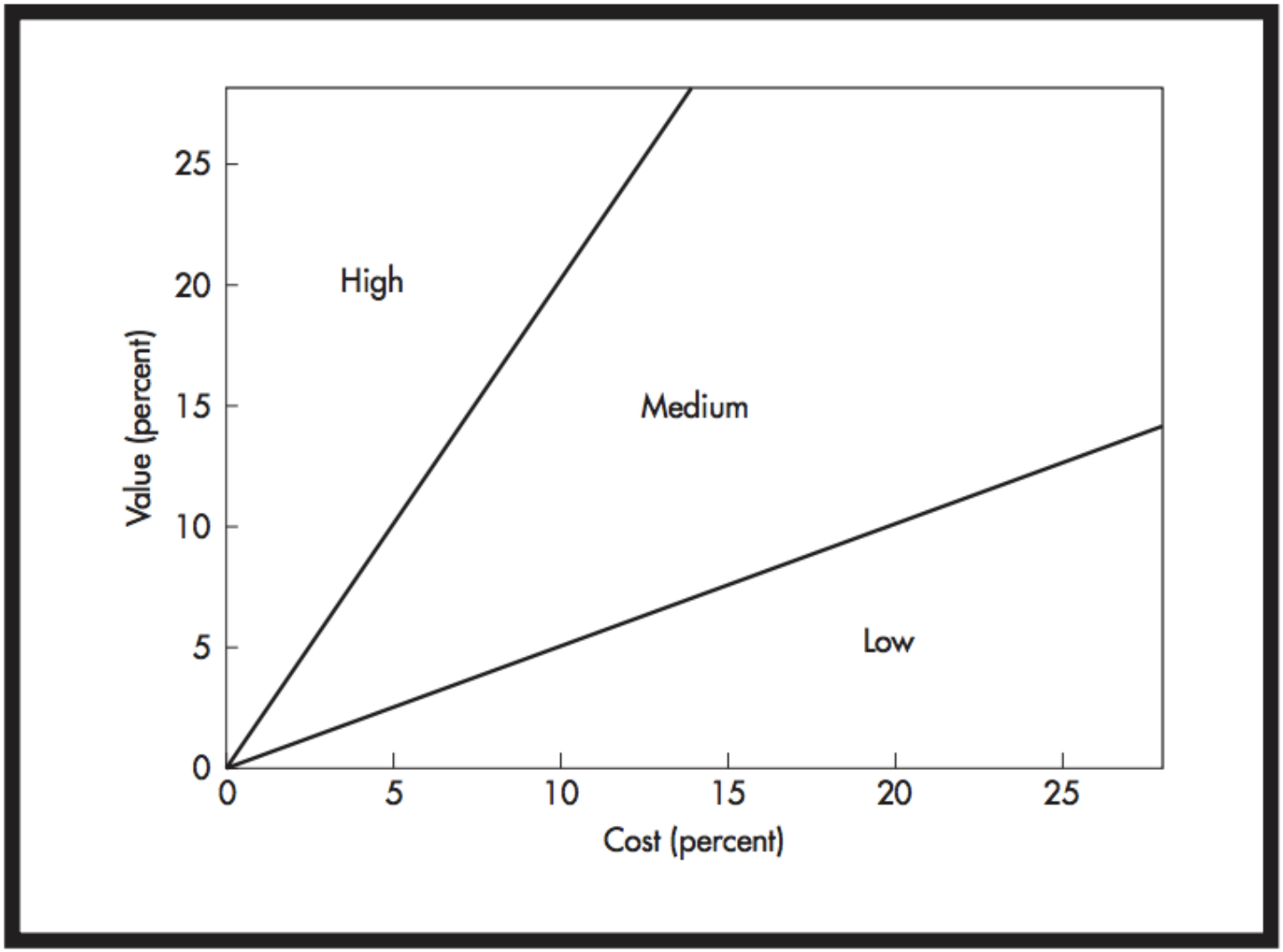
Useful to managers for requirements triage and release planning

Detailed practical steps

1. ***Requirements engineers* check requirements** for ambiguities, completeness, etc.
2. Apply AHP's pairwise comparison to **estimate the relative *value* of candidate requirements**
3. ***Software engineers*** use AHP's pairwise comparison to **estimate the *cost* of candidate requirements**
4. Plot these values on a **cost-value diagram**
5. Stakeholders use this map to **analyze and make trade-offs**

Detailed practical steps

1. ***Re*** juities,
2. Ap ***value* of**
3. ***Sc*** **mate the**
4. Pl
5. St **s**



Applicability of method

This cost-value technique has been applied successfully to industrial projects

Has some limitations in projects with:

- Large number of requirements, pairwise comparison can be tedious
- Many interdependencies between requirements
- Distributed stakeholders

A method for distributed prioritization of requirements

When stakeholder groups geographically distributed

Each stakeholder can contribute with their particular priorities

The Product Strategy Team (PST) works with the Market operations (MO) at each customer site to iteratively prioritize features

A distributed prioritization process

Step 1. PST sends out a list of feature groups

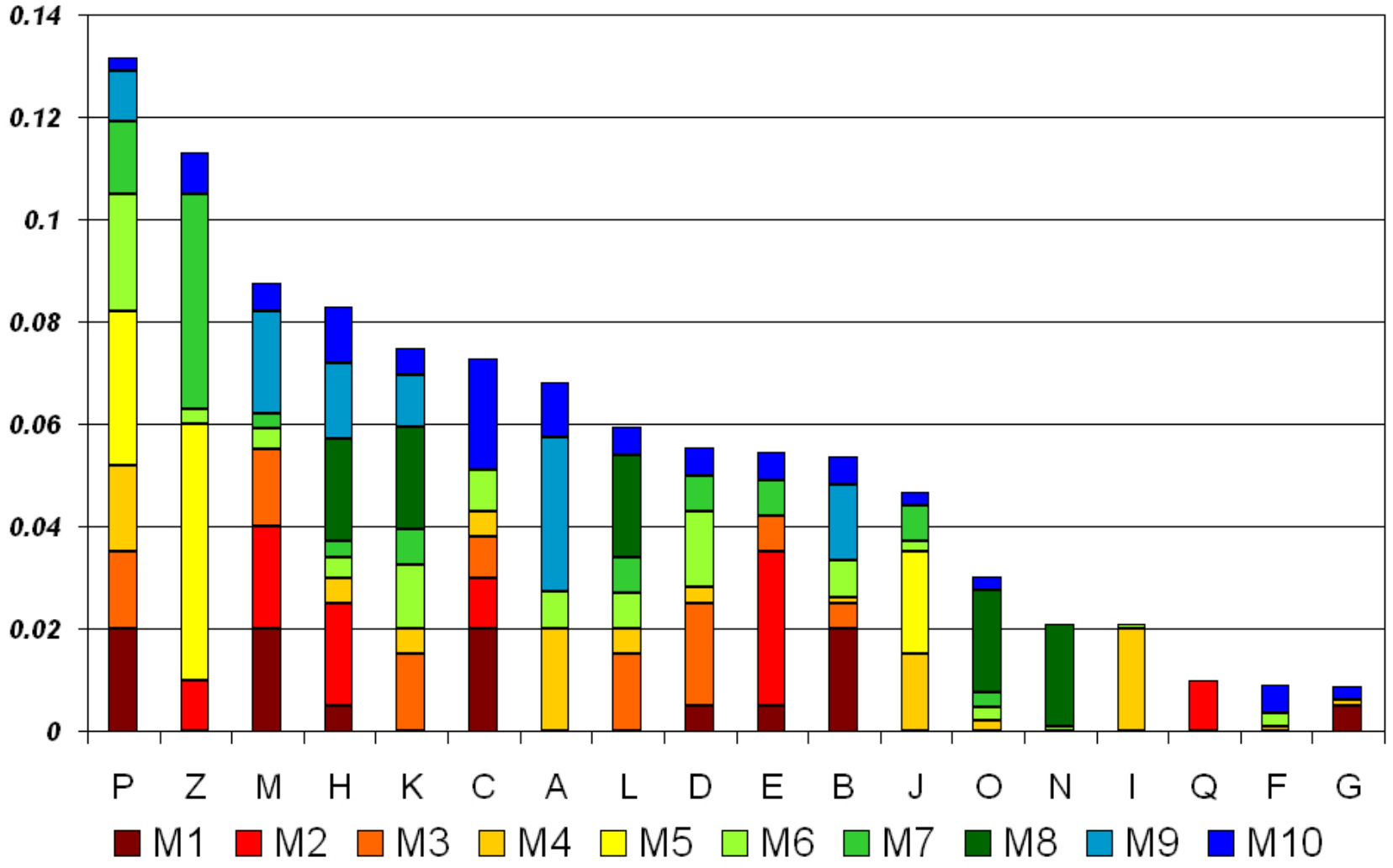
Step 2. Each MO makes a prioritization of each feature group

Step 3. based on info from step 2, PST makes a recommendation

Step 4. Stakeholder groups give feedback

Step 5. Iterate if necessary.

Visualization of prioritization data
Distribution chart with equal market influence

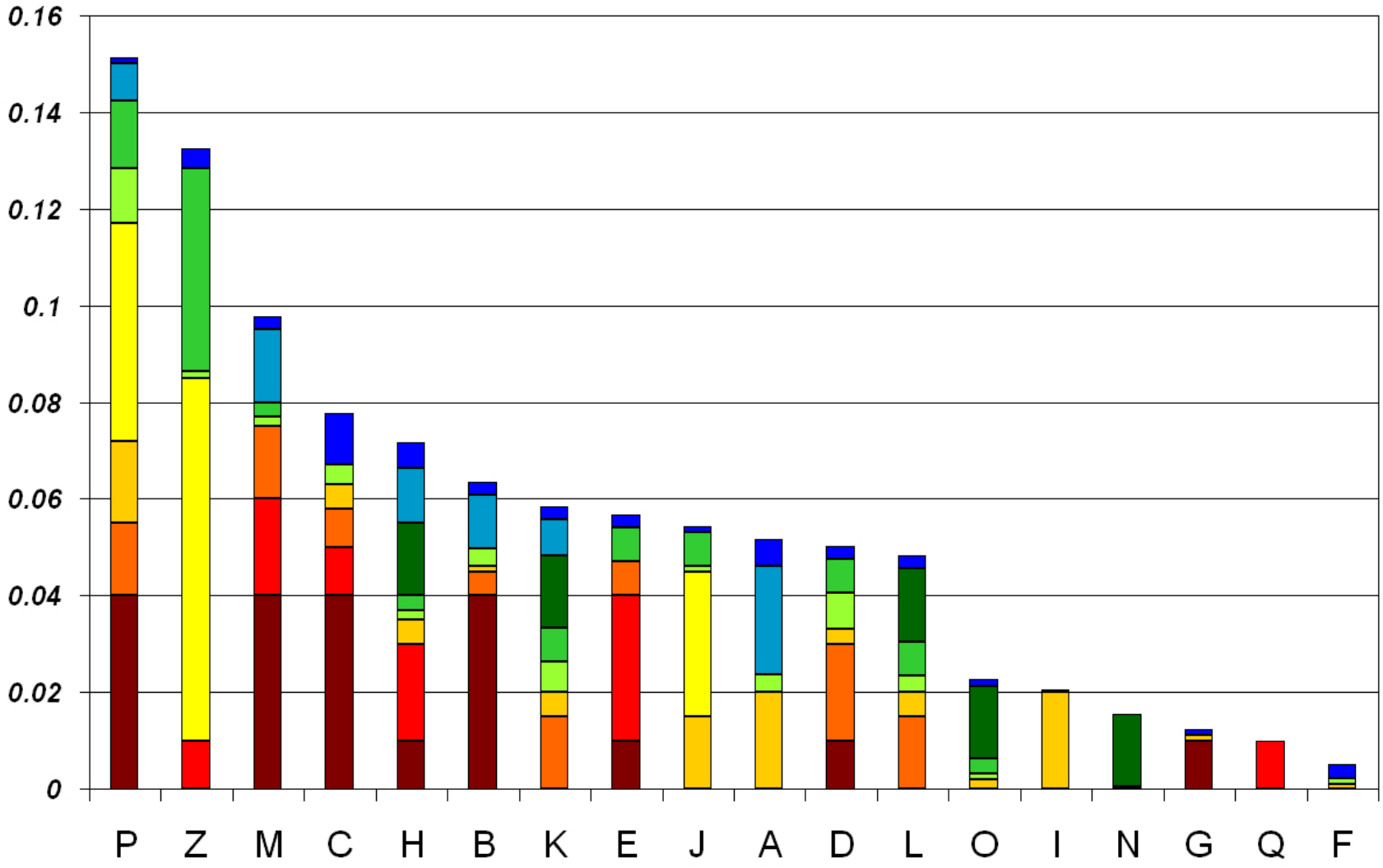


Each customer is unique

The process uses a weighting criteria to consider each individual stakeholder group by:

- Revenue last release
- Profit last release
- Number of sold licenses last release
- Predictions of the above criteria for the coming release
- Number of contracts lost to competitors
- Number of potential customer with nil licenses to date
- Size of total market segment

Visualization of prioritization data
Priority distribution chart with weighted market influence



In RD Final version

For each requirement, include Rationale for each feature, functional requirement, non functional requirement

Ensure that each has an Acceptance Test