A Proven Approach to Requirements Engineering
The Why, What and How of REVEAL™
November 2013
CONTENT

A. Why do we need Requirements Engineering?
B. What makes Requirements Engineering difficult?
C. REVEAL™ Overview
D. Case Studies
E. Support and Next Steps
A // WHY DO WE NEED REQUIREMENTS ENGINEERING?

1. Sources of Project Failure
2. The Cost of Not Finding Errors
3. Correlation Between Success and Capability
4. Summary
Sources of Project Failure

Different research: consistent results

Get them right!

Requirements 48%

Source: Standish Group; CHAOS report
The Cost of Not Finding Errors

Find errors early!

Source: Leffingwell
Correlation Between Success and Capability

Recent INCOSE research

Project success is strongly correlated to capability in requirements processes

Source: Carnegie Mellon University, 2012
http://www.sei.cmu.edu/library/abstracts/reports/12sr009.cfm
Summary: If you don’t manage requirements...

- You have rework
  - Time overrun
  - Budget overrun
- You solve the wrong problem
  - Not what the customer wants
  - Acceptance or certification fail
- You have unknown risk
  - When?
  - What?
  - How much?
B // WHAT MAKES REQUIREMENTS ENGINEERING DIFFICULT?

1. Key Challenges
2. Real Example of Failure
Key Challenges

- **Expression**
  - Stakeholders find it difficult to express requirements
  - They don’t even know what they want

- **Conflict**
  - Different stakeholder have different needs
  - These needs often conflict with each other
  - We don’t know which ones to try and satisfy

- **Change**
  - Requirements change
  - The domain changes
  - The system ends up being wrong before it is started

- **Information Management**
  - Vast amount of information involved in Requirements Engineering
  - Multi-disciplined teams interacting, often globally
  - Tools help, but do not manage themselves – an effective process is essential
  - *Be selective: focus the rigour where it is needed*
Real Example of Failure

- **Original System Requirement**
  - The rear window of the car shall withstand windspeeds of 160 kph;

- **Project Edict during development**
  - Use Value Management to halve the cost and weight of your window

- **Designer’s viewpoint**
  - 160 kph is excessive…
  - Let’s relax it to 100 kph (max reverse speed 30 kph, adverse wind 60 kph, 10 kph margin)

- **Result…?**
  - Many of the first batch of cars delivered had their rear windows broken
Conflicting requirements of Logistics stakeholder (rear windscreen subjected to high speeds on transportation) and Management (keep costs and weight down)

Was Logistics stakeholder even consulted?

Had conflict been identified & resolved damage may have been avoided

- Make windscreen stronger
- Transport by other means
C // REVEAL™ OVERVIEW

1. What is REVEAL?
2. The REVEAL Process
3. REVEAL Techniques
4. REVEAL Concepts
5. Why is Domain Knowledge so Important?
6. REVEAL Satisfaction Arguments
7. REVEAL Manages Information
8. REVEAL Addresses Key Challenges
What is REVEAL?

Altran’s REVEAL is a requirements process, consisting of requirements techniques, built on rigorous requirements concepts, that can be used by requirements tools.
The REVEAL Process

REVEAL has no prescribed lifecycle – it can blend top down, bottom up, and revalidation of existing infrastructure.
REVEAL Techniques

Conflict Management
- Separation of Concerns
- Requirement Classification
- Tool Evaluation
- Glossary

Extended Context Diagram
- Define the Problem
- Stakeholder Analysis
- Validation and Verification

Change Management
- Configuration Management
- Database Design
- Document Structure

Stakeholder Elicitation
- Testable Requirements
- Describe the Application Domain
- Writing Good Requirements

Extended Context Diagram
- Justification of Requirements
- Scenarios
- Metrics

Entity-Relationship Diagram
- Validation and Verification
- Stakeholder Analysis
- Testable Requirements
- Describe the Application Domain
- Writing Good Requirements

Support and Next Steps

Why do we need Requirements Engineering?

What makes Requirements Engineering difficult?

REVEAL™ Overview

Case Studies

Stakeholder Analysis

Writing Good Requirements

REVEAL Techniques

Stakeholder Elicitation

Testable Requirements

Glossary

Describe the Application Domain

Configuration Management

Database Design

Justification of Requirements

Change Management

Requirement Classification

Tool Evaluation

Define the Problem

Validation and Verification

Entity-Relationship Diagram

Commercial in confidence
REVEAL Concepts

Requirements (_requirements): a statement about things in the World that we want the Machine (System) to help make true
  - *Pedestrians shall be allowed to cross the road while traffic is stopped*

Specifications (Specifications): what the Machine must do or what attributes it must have
  - Describes the Machine’s external behaviour
  - *Must* be achievable by the Machine on its own
  - *The pedestrian light shall show green within 1 minute of the button being pressed*

Domain Knowledge (Domain Knowledge): a property of the Environment that is true (or assumed to be so)
  - *Drivers stop at red lights*
Why is Domain Knowledge so important?

- Many system failures are not failures to understand (R), they are mistakes in (D).

- For example:
  
  › A NYC subway train crashed into the rear end of another train on 5th June 1995. The motorman ran through a red light. The safety system did apply the emergency brakes.

  › However; the signal spacing was set in 1918, when trains were shorter, lighter and slower, and the emergency brake system could not stop the train in time.
REVEAL Satisfaction Arguments

- **R**: Pedestrians shall be allowed across the road while traffic is stopped

- **D**: Drivers stop at red lights

- **D**: Pedestrians push the button when they want to cross

- **S**: The pedestrian light shall show green within 1 minute of the button being pressed

- **S**: The traffic lights shall show red at least 3 seconds before the pedestrian light shows green

- **D**: A driver can stop within 2 seconds

- **D**: Pedestrians cross when they have a green light

Why do we need Requirements Engineering?

What makes Requirements Engineering difficult?

REVEAL Overview

Case Studies

Support and Next Steps
REVEAL Manages Information

- REVEAL defines your information tree (traceability structure):

  - Each link has a defined purpose and direction
  - Project dictionary defines allowed types of artefact and links
  - Can be built from a previous good example
  - Spend time validating this before rushing to a requirements database
  - The maturity of all these artefacts can be measured, and used to feed a project dashboard
REVEAL Addresses Key Challenges

- Customers don’t know what they want
- They can’t express it
- They ask for conflicting things
- The requirements and domain change
- Information is hard to structure and relate

✓ REVEAL stakeholders elicitation
✓ REVEAL rigorous concepts
✓ REVEAL conflict management
✓ REVEAL change management
✓ REVEAL information management
D // CASE STUDIES
Railway Route Modernization

CONTEXT & OBJECTIVES

» The SE group of West Coast Route Modernization railway program (UK) needed a major change in their requirements management process to account for significant changes in program scope.

» Existing design justifications traceability had been developed & maintained over more than 5 years; a new approach was required to support the delivery & acceptance case with very short timescale.

APPROACH & SOLUTION

» Altran worked alongside client’s functional and domain experts to define and populate a requirements model in DOORS™, and provide long-term support.

» Altran provided input into the new traceability model & produced design justification.

» Altran worked with the SE Group to develop the Concept of Operation, providing the SE approach necessary to demonstrate that the resulting design solutions and operating procedures were appropriate to meet and support the business requirements.

RESULTS & ADDED VALUE

» 58 per cent of new traceability and design justification was established in just two months.

» The proposed approach facilitated future application and update to other rail projects.
REVEAL™ Capability Enhancement

Railways (Rolling Stock Manufacturer)

CONTEXT & OBJECTIVES

» Problem ......
» Altran were asked to provide a solution to deliver significant reduction in downstream costs from requirements changes.

APPROACH & SOLUTION

» The implementation of a formal requirements engineering and management approach for use by the client’s team of 100 engineers.
» An intensive initial stage provided formal training, supported by embedding of Altran staff.
» The design of a long term capability enhancement programme for the client’s organization.

RESULTS & ADDED VALUE

» A rapid initial return ......
» Requirements capability enhanced to client satisfaction.
» Client organization left with a self-sustaining requirements engineering capability.
REVEAL™ Support to Proposal Generation

**CONTEXT & OBJECTIVES**

» Client had to produce rapid response to a large Invitation to Tender for the supply of marine propulsion plant
» Altran were asked to investigate the use of REVEAL™ to support the bid team.
» Objective to ensure full understanding of client requirements and produce a fully compliant proposal.

**APPROACH & SOLUTION**

» Started by applying REVEAL™ problem context, stakeholder and requirement analysis techniques in parallel to bid team.
» Rapid findings of analysis, within 2 days, led to full integration of the Altran consultant within the bid team.
» Produced requirement traceability and satisfaction argument diagrams to support better understanding of the client requirements in the Invitation to Tender by the bid team.

**RESULTS & ADDED VALUE**

» Altran consultant became an integral and valued member of the client bid team.
» Rapid improvement in the bid team understanding of the client requirement.
» Client produced the winning proposal.
E // SUPPORT AND NEXT STEPS
How we can support you

- Process benchmarking
- Business change management
- Definition, pilot and roll-out of process enhancement
- Tailoring of tools
- Training and mentoring
- Creation of project assets
- Objective review of project assets
Next Steps

- Please give us your feedback
  - Now or later

- Which of the topics covered are of interest to you?
Altran UK Limited
22 St Lawrence Street
SouthGate
BATH BA1 1AN

Tel: +44 1225 466991
Fax: +44 1225 469006
Website: www.altran.com

Email: jonathan.hammond@altran.com
INNOVATION MAKERS