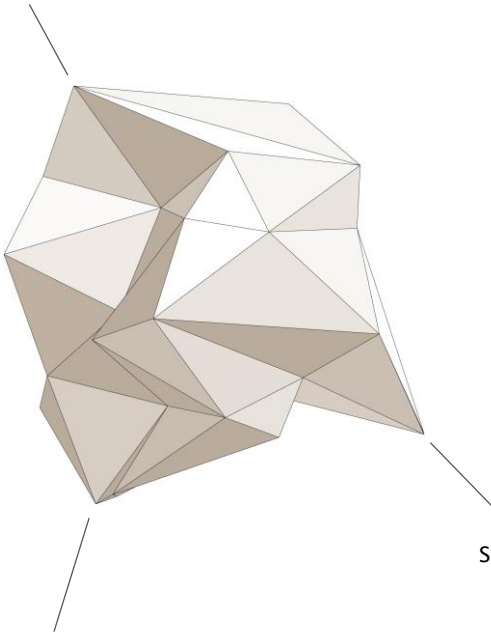


A Proven Approach to Requirements Engineering

The Why, What and How of REVEAL™

November 2013

Requirements



Architectures

System Assurance

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ALTRAn

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

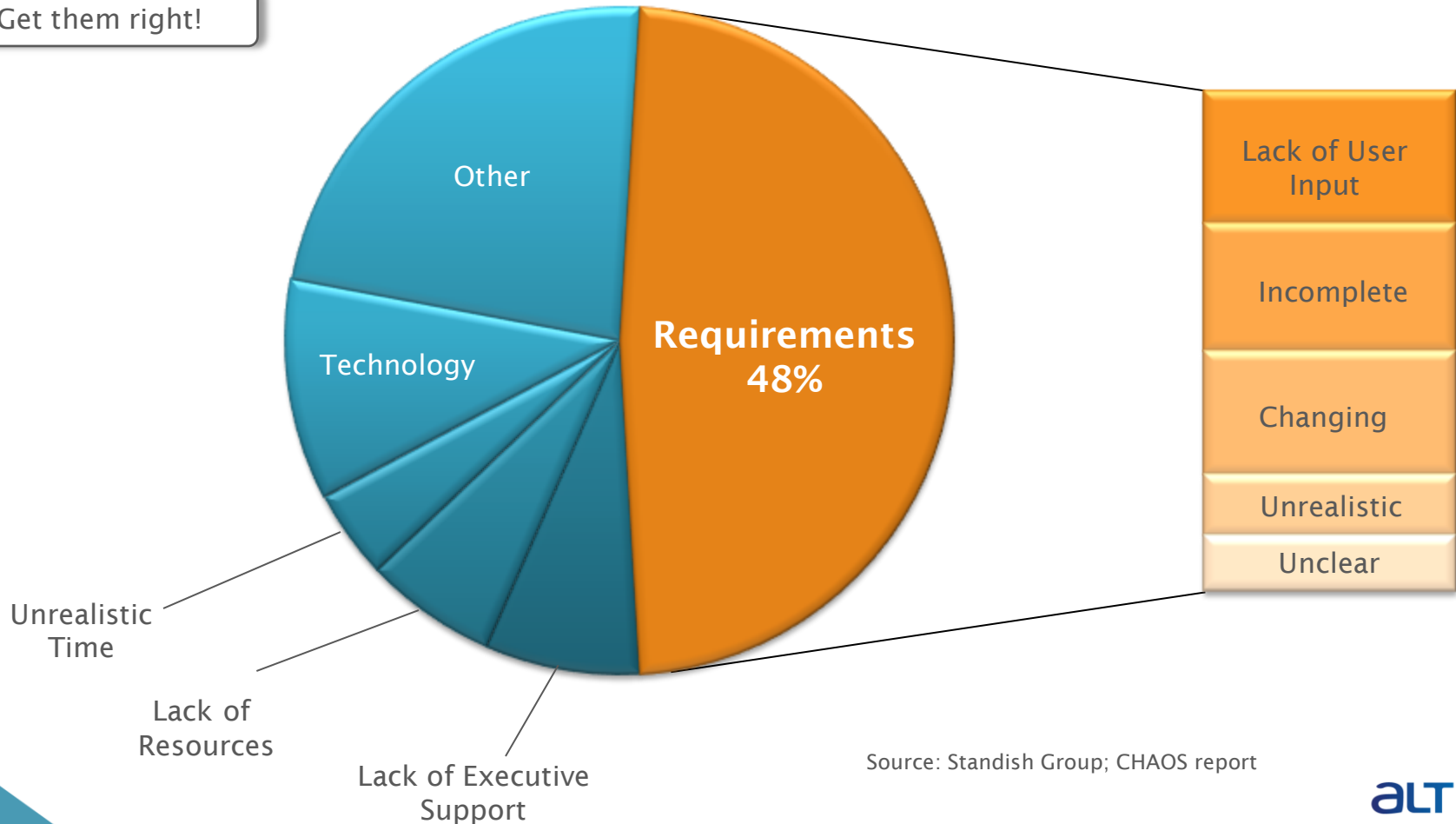
A // WHY DO WE NEED REQUIREMENTS ENGINEERING?

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!

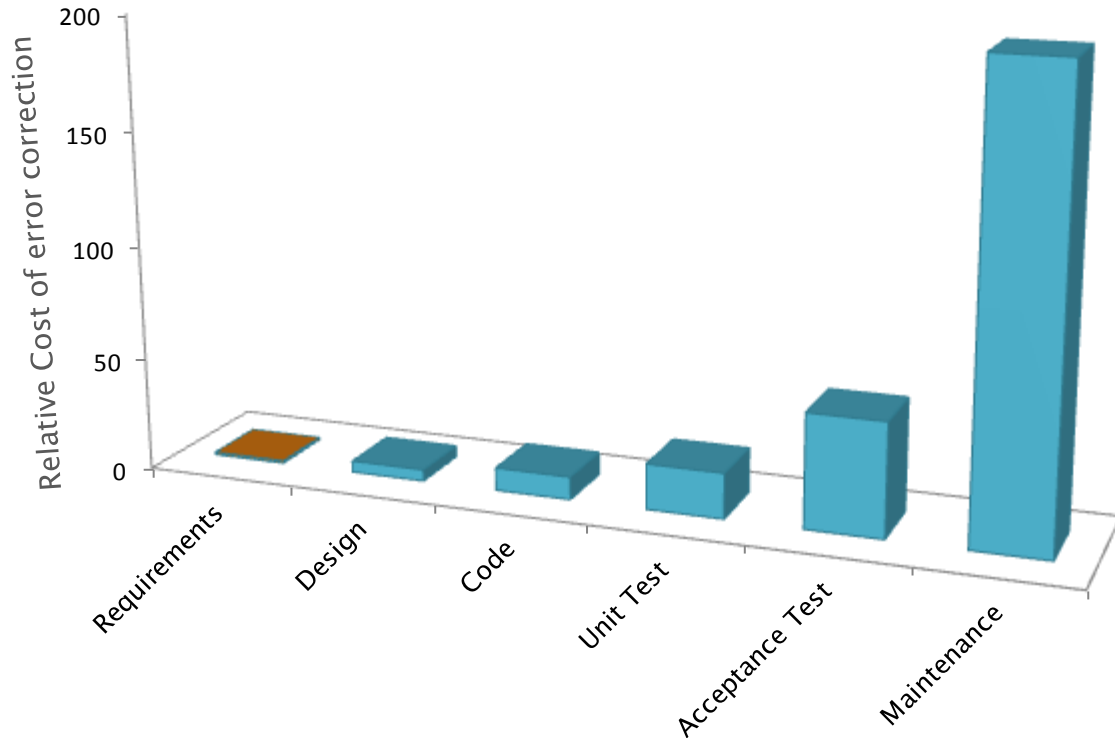


Source: Standish Group; CHAOS report

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The Cost of Not Finding Errors

Find errors **early!**



Source: Leffingwell

Correlation Between Success and Capability

Recent INCOSE research

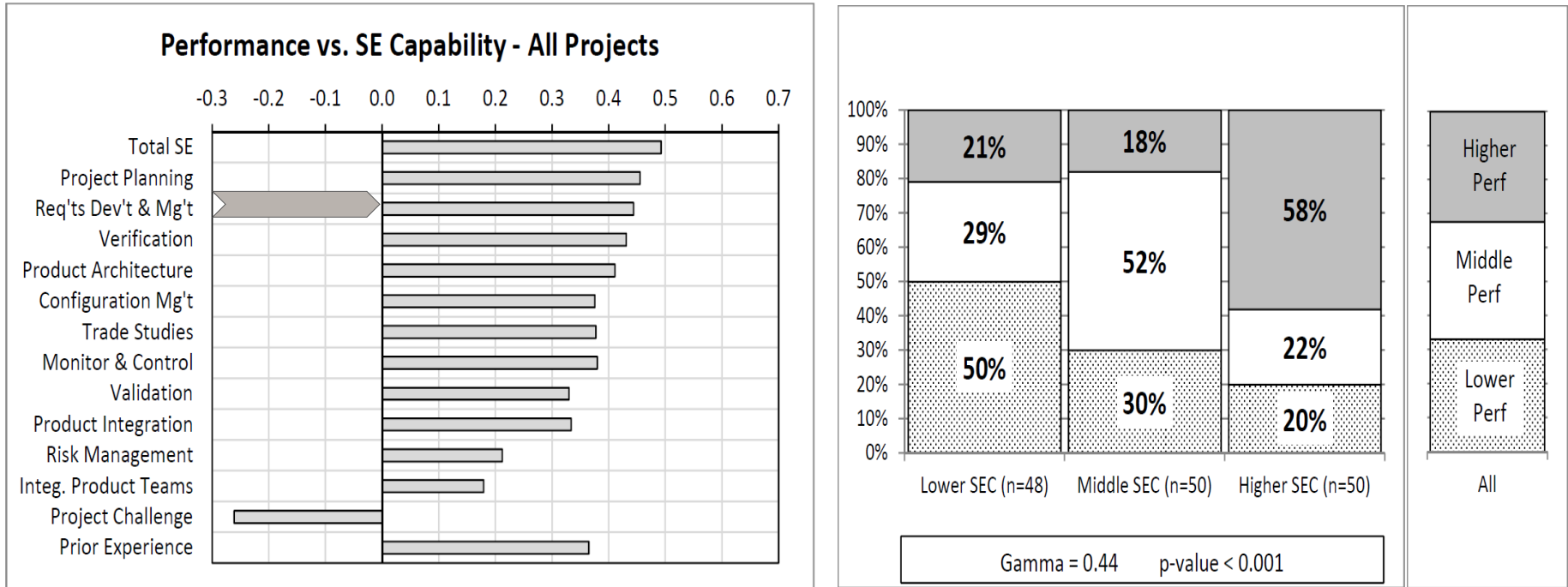


Figure 2: Project Performance vs. SE Capabilities and Drivers

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?

**We understand
these issues.**

**We build
complex,
intelligent
systems for our
clients.**

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

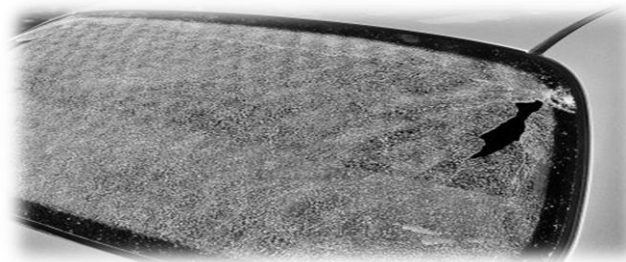
▪ Information Management

- › 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

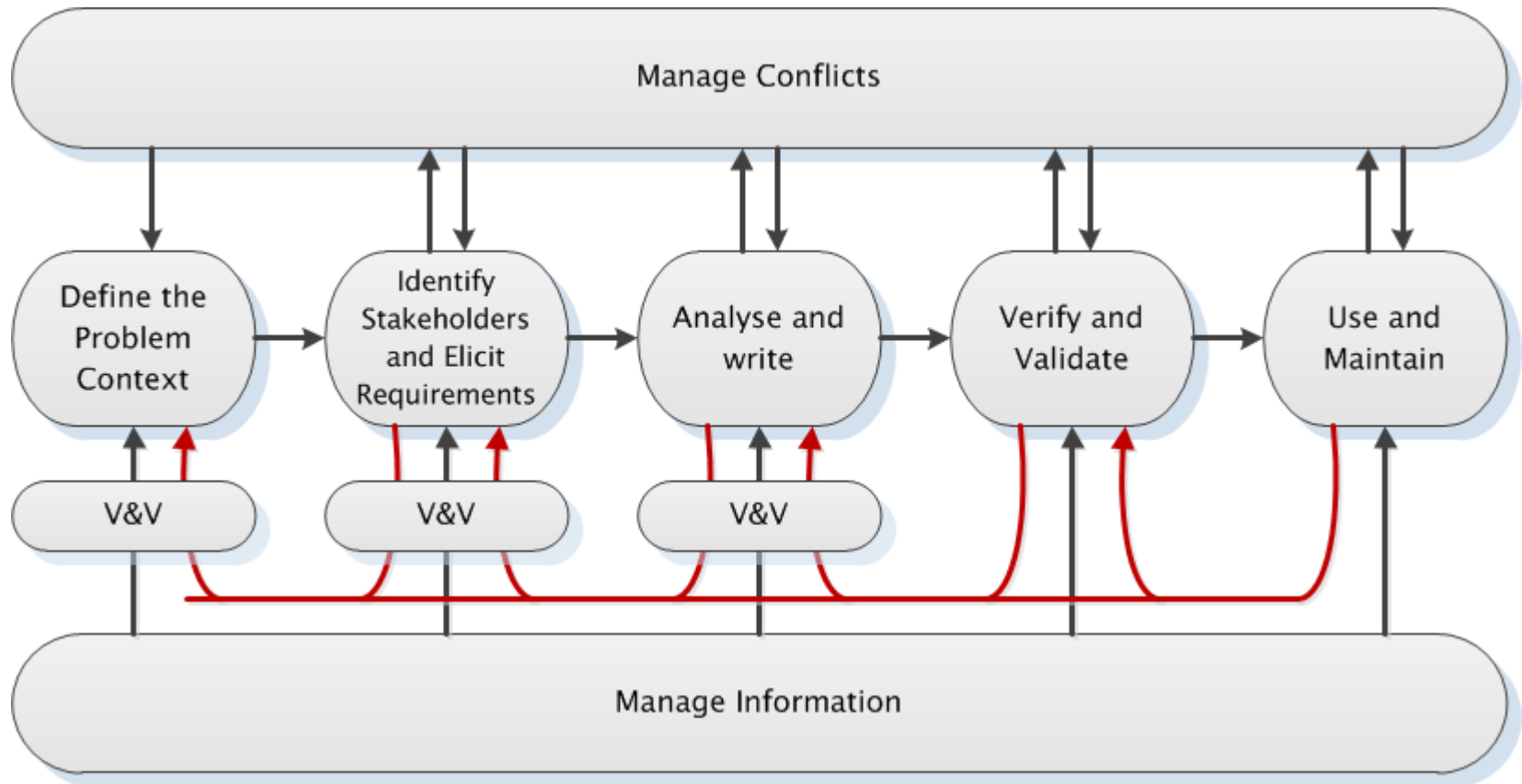
C // REVEAL™ OVERVIEW

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?

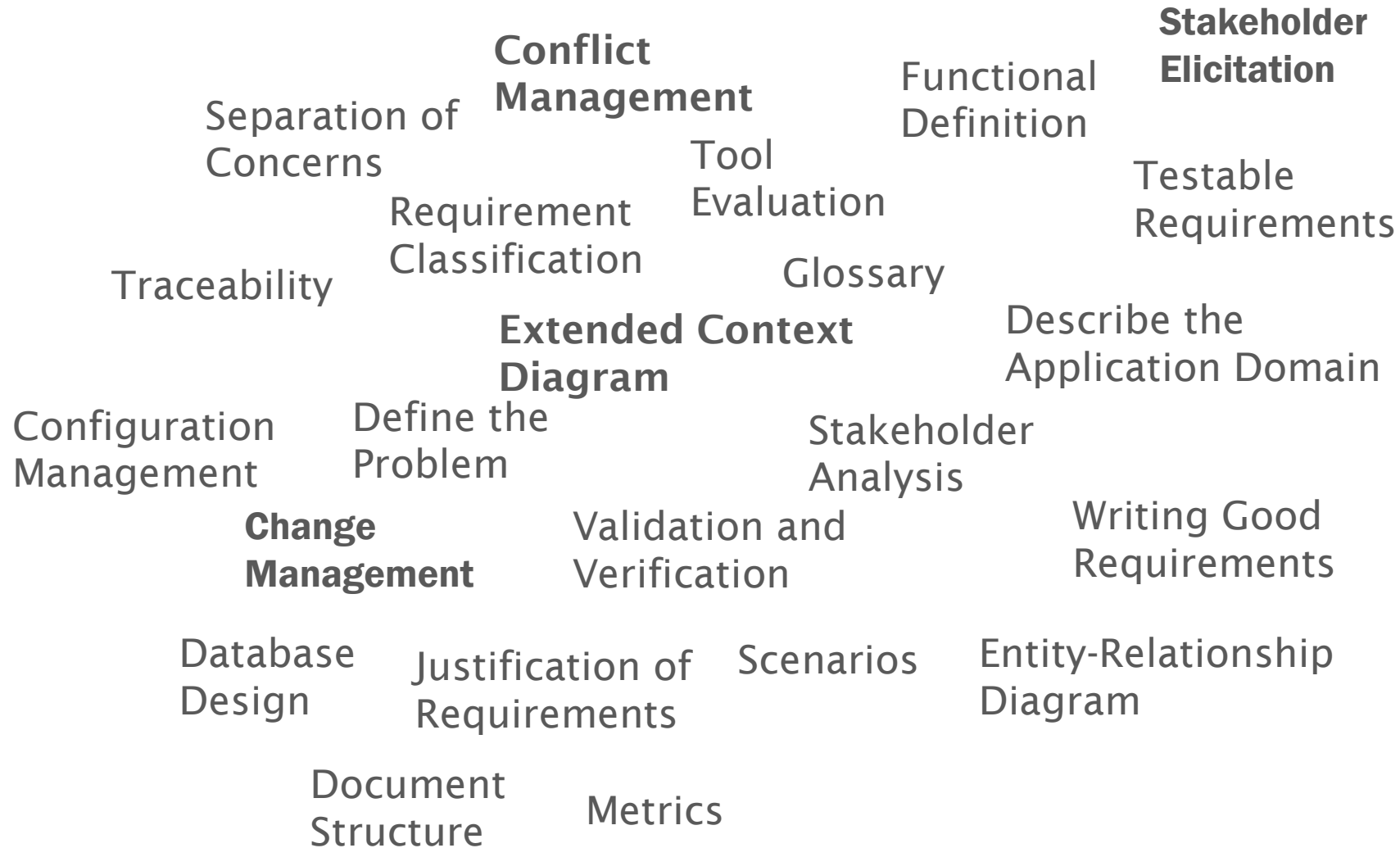
Altran's **REVEAL** is
a requirements **process**,
consisting of
requirements **techniques**,
built on rigorous
requirements **concepts**,
that can be used
by requirements **tools**.

The REVEAL Process



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

REVEAL Techniques



REVEAL Concepts

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 (ℑ) : 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 (℘) : 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

SA The delay between the traffic light showing red and the pedestrian light showing green is sufficient for traffic to stop in time and allow the pedestrian to safely cross the road.

D Drivers stop at red lights

D: Pedestrians push the button when they want to cross

D : A driver can stop within 2 seconds

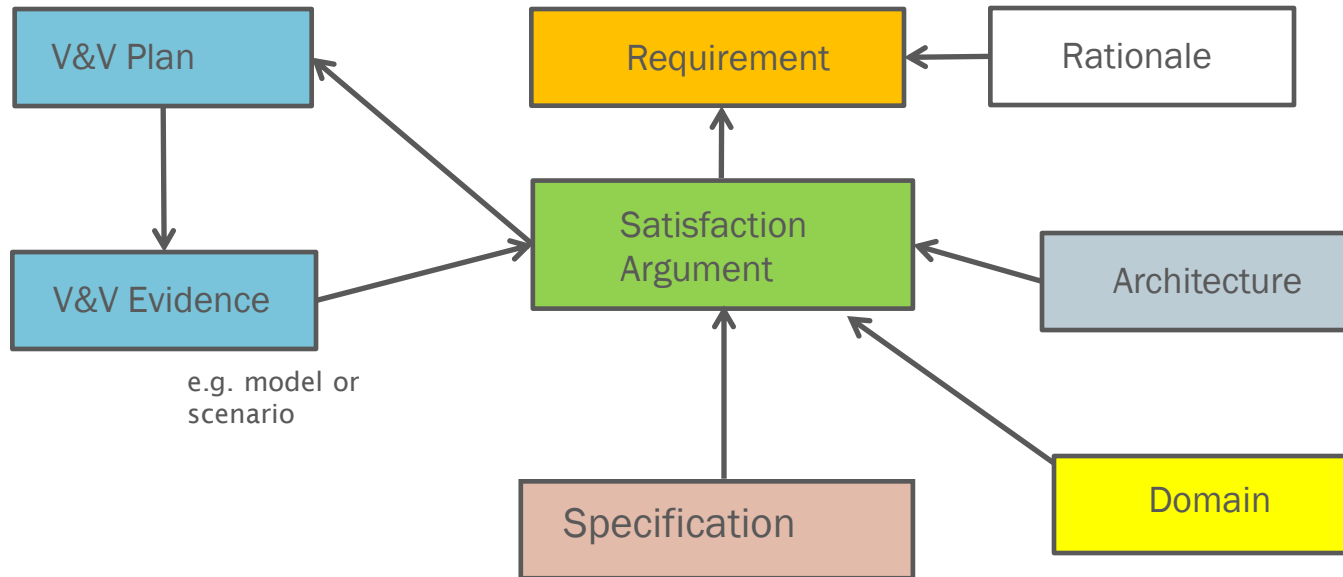
D : Pedestrians cross when they have a green light

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

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

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Railway Route Modernization



Railways (Operator)



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

Transport (Marine Plant)

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

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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?

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