

## 7 Test Risk Analysis

### 7.1 Introduction

Most of today's test projects are based on risks. In risk-based testing (RBT), the test approach is determined by the risk the organization runs when the system goes live. The scope and depth of the tests vary according to the risk.

The advantage of risk-based testing is that time is spent on and attention given to things that have added value for the anticipated goal [Pinkster et al, 2004]. A test risk analysis is carried out to determine the risks that jeopardize the anticipated goal. The insight provides a guideline for decisions that have to be made at various points during the test project.

The TRA is used to determine the test strategy. There is rarely enough time in a test project to test everything. The TRA can be used to set priorities, i. e. indicate what the test activities should focus on. For example, the test coordinator can use the TRA to determine which things will be tested less thoroughly or not at all. The TRA supports the choice for the test design techniques that are applied.

During reviews and smoke tests, the TRA can be used to ensure that important components will be paid more attention than less important ones. During testing, the TRA is used to establish the sequence in which the tests are run. It is common to start with the most important tests because it increases the chance of finding the important errors quickly. It also has the advantage that the most important tests will have been run should the test be stopped prematurely. The risks are referred to in the test report. The benefit of this is that the test report contains information

about things that appeal to the stakeholders, namely the risks for the anticipated goal.

There are two types of TRA that can be used alongside each other.

### 1D TRA

The one-dimensional TRA determines the relative importance of the test object's various components. A functional decomposition is used to create an overview of the functions the system should be able to support. The TRA defines which functions are important and which are less important.

The system specifications or the requirements are used as input for the 1D TRA because they describe the functions the system should support. The product of the 1D TRA is a list of these functions ranked by their relative importance. The 1D TRA can be used to determine the test depth for each function as well as the sequence of the tests.

### 2D TRA

The two-dimensional TRA maps out the threats to the anticipated goal. For each threat, the chance that it really will occur and what its impact would be are estimated.

The threats that were indicated by the stakeholders are used as input for the 2D TRA. The product of the 2D TRA is an "impact x probability" matrix in which each risk is positioned. The 2D TRA can be used to determine which tests have to be run. This will often result in the testing of non-functional quality attributes.

The advantage of the 2D TRA is that it is the more accurate of the two TRAs and ties in best with the anticipated goal. The 2D TRA maps out the risks for the business and stimulates testers to look beyond the system specifications or the requirements. The test risk analysis can reveal risks that were not addressed in the system design. If the risks that were overlooked are discovered on time, they can be processed in the design before coding starts and thus prevent errors occurring early in the product life cycle.

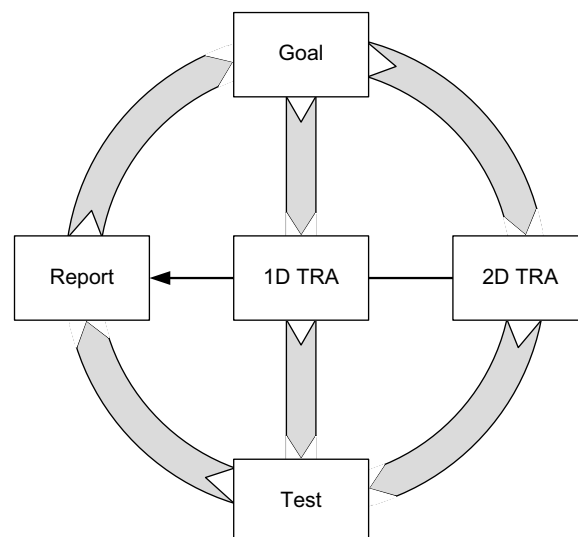
In the testing world, risk-based testing is a household word. But there are still a number of organizations that do not do it. Experience shows that organizations have difficulty allocating the time and applying the discipline required to carry out a 2D TRA. Not only does a 2D TRA take more time than a 1D TRA, the customer might not appreciate

a process that questions the system design. Whether wise or not, there are projects in which the assignment forces the system to be built according to the design. The customer uses testing to demonstrate that the system works according to the specifications and has no interest in demonstrating that the design can be improved.

In these situations the 1D TRA is often sufficient. It is relatively easy to do, is easy to understand and still provides clear starting points to differentiate test depth. The 1D TRA helps determine the sequence of the test and can be used to introduce risk-related thinking. When the organization realizes what the advantages of risk-based testing are, it can always move on to 2D TRA. In short: a 1D TRA should always be done, and if there is room and time for a 2D TRA, consider doing it as well.

Step 2 – Approach

Testing is the reduction or the removal of risks. The art consists of choosing a strategy that provides insight into the real risks as efficiently as possible. It is also important to be able to relate the test results to the identified risks. The tester reports the test results during and after testing. By specifying in the test report how testing has removed certain threats, he demonstrates the added value of testing and indicates the issues business management no longer has to worry about. Linking the anticipated goal to the TRA in the test report gradually increases confidence in the quality of the system. This is displayed in the below figure.



**Fig. 7.1** The circle from goal to goal: The figure shows that the anticipated goal is the start and end point of the TRA, testing and the test reports

The figure shows that the anticipated goal is the starting point for all test activities. The TRA maps out which risks jeopardize the goal. The TRA is used to derive the points that need the most attention during testing. Testing itself is an activity that is carried out to examine the extent to which the risks are real. For example, if the tester is afraid that a calculation error will result in the creation of wrong invoices, he can test the calculation. He eliminates the risk by demonstrating that the calculation does not contain any errors (see the discussion on the test report). The tester relates the test results to the previously established risks, and can thus state the extent to which he thinks the anticipated goal will really be achieved.

In principle, it is not desirable to do a separate test risk analysis for each test project because it's not efficient. And because all of the activities related to the development project should be aiming for the same goal, the same test risk analysis should apply to all of the test projects. It is therefore best to do an umbrella TRA that applies to every test project. But sometimes there simply is no generic test risk analysis, and it's not possible to do an umbrella one either. This being the case, the test coordinator needs to do his own TRA.

The next section describes how a TRA is done.

## 7.2 The 1D Test Risk Analysis

### 7.2.1 *Introduction*

To do a one-dimensional test risk analysis, a test tree is created by decomposing the test object into functions and areas of attention. During the test risk analysis, the relative importance is determined for each branch of the tree. The result is a one-dimensional TRA matrix, i.e. a list of the risks ranked by their relative importance. See Table 7.1.

The test risk analysis is done during a workshop that is attended by various stakeholders. The stakeholders' field expertise enables them to identify the functions and areas of attention and assign them a priority. The TRA is organized by the moderator, who also guides the group through the analysis and processes the data at the end of the session. The test coordinator is often the moderator.

**Table 7.1** A one-dimensional risk matrix for a navigation system

Risk category	Risk area	Relative importance
Critical	Route calculation – Standard calculation	270
	Navigation – Entering destination	150
High	Route calculation – Find alternative	117
	Accuracy	99
	Navigation – Favorites list	80
Medium	User friendliness	65
	Route calculation – Route type	63
	Extra – Traffic jam info	45
	Performance	45
	Navigation – Recent destination	20
Low	Navigation – Home	15
	Extra – Weather forecast	9
	Settings – Audio	8
	Settings – Maps	6
	Settings – Standard	6

Step 2 – Approach

The 1D TRA consists of the following steps:

1. Identify stakeholders and kick-off
2. Establish the functions and areas of attention
3. Determine the relative importance
4. Data processing
5. Agree on the TRA

The steps are explained in the next sections.

### 7.2.2 *Identify Stakeholders and Kick-off*

It is likely that the project stakeholders were identified during the assessment of the anticipated goal. This being the case, the moderator invites them to do the TRA. In the best of worlds, the stakeholders will represent a number of different disciplines. Different stakeholders probably have different visions on the anticipated goal and the risks [Thompson, 2004]. Involving various disciplines helps create a balanced and well-considered risk assessment. The group of stakeholders could be made up of, for example:

- **The Customers**  
End-users, operators, business managers or system administrators
- **The Builders**  
Analysts, system designers or programmers

- **The Project Owners**

Project managers or customer

After the participants of the TRA have been selected and invited, it's time to kick off the project. The moderator explains why the TRA is done, how it works and what is expected from the stakeholders.

It is important that each party that is involved in the TRA is deemed competent by the group he represents. This ensures that the participant can make well-founded statements about the priority and that his assessment will be accepted by his group. This may seem to be a trivial issue, but it isn't. Consider the following case:

*Example 7.1: A Web-based application*

The organization is building a Web-based application that enables customers to place orders online. During the TRA, the project leader indicates that the project has a rather short runtime. As a result, more concessions will have to be made to the delivered functionality. The participants agree that the part the customers will be seeing cannot be compromised on. The Web interface must be developed and tested with diligence. But the application has another interface, namely the screens the employees will be using to process the orders. During the TRA, it is agreed that the screens have to work but that the user friendliness does not have to be tested.

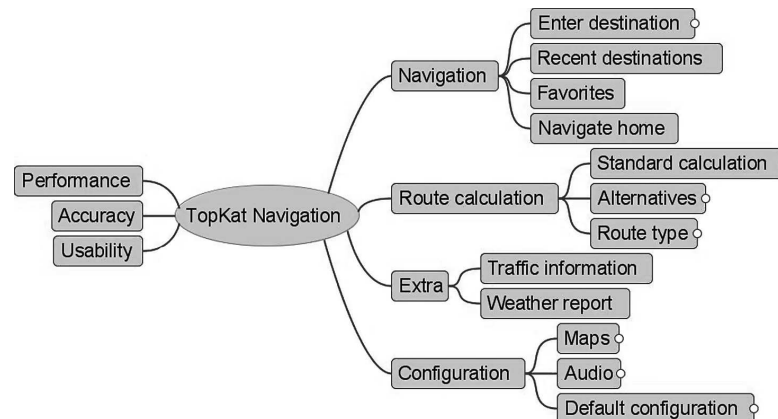
The user representative knows that his group will not be happy with this decision. The fact that this interface will not have been thoroughly tested may impact their work. Nonetheless, he agrees with the decision because it seems to be the wisest and he knows the users will respect his decision.

### 7.2.3 ***Determine the Functions and Areas of Attention***

Before the moderator can assign priorities to the risk areas, he has to map them out. This he does by creating a test tree. A test tree is a kind of mind map in which each function or area of attention is a branch in the tree. If necessary, functions and areas of attention can also have branches, meaning that one branch can be split up into multiple branches.

The below figure shows the test tree for a simple navigation system. A number of main functions can be recognized: Navigation, Route calculation, Extra and Settings. Each of the main functions, also called function groups, is a collection of functions. The main function, Navigation, contains all of the ways in which a trip's final destination can be entered. As can be seen in the test tree, this can be done in several ways: by entering a new destination or by selecting a destination from the list of recent or favorite destinations. It is also possible to be guided home. The left side of the test tree displays some non-functional areas of attention that can also be branched out. Accuracy, for example, can be branched out into the calculation of the trip time, the timely indication of an exit or, not unimportant, the correct indication of the fastest route.

Using a test tree as the basis for the test risk analysis has a number of advantages. During the TRA, the test tree can be used as a checklist to ensure that no functions are forgotten and later as a framework for the physical test design. This also makes it easy to relate the test results to the test risk analysis and report them back to the stakeholders.



**Fig. 7.2** Test tree for a simple navigation system

The functions in the test tree are derived from the test base (for example, functions described in the requirements, the functional design and use cases). The areas of attention are mentioned by the stakeholders and originate in the

- business
- processes
- functionality and technique
- quality attributes

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