

MAKING A MBT-BASED TEST PROCESS MORE EFFICIENT BY THE REUSE OF ANALYSIS MODELS

Munich, 18th September 2014



LIFE IS FOR SHARING.

AGENDA

1 MOTIVATION AND OBJECTIVES

2 GENERAL APPROACH

3 CASE STUDY: SEPA

4 CONCLUSION

MOTIVATION AND OBJECTIVES

Motivation

- **Many different tools** for model-based testing (MBT) are available that support the generation of abstract as well as of executable test cases.
- Usually, the tools **require tool-specific test models** that serve as input for the test case generation.
- A **test model has to be specified** with a particular textual or graphical notation that defines the expected behaviour of the application under test and further information required for test case generation.



Objectives

- An approach that facilitates **the reuse of already existing analysis models for test case generation** shall be analyzed.
- The approach shall be applicable for tool-independent **analysis models** that specify use-cases for enterprise systems.
- Required test models shall **not be created from scratch**.
- Redundant tasks shall be avoided so that **expenses, time and effort can be decreased**.



AGENDA

1 MOTIVATION AND OBJECTIVES

2 GENERAL APPROACH

3 CASE STUDY: SEPA

4 CONCLUSION

THE MAJOR PROBLEM: TEST MODELS ARE USUALLY TOOL-SPECIFIC

Starting point

Tool-independent analysis models that consist of UML use-cases and activity diagrams, which specify the behaviour of an enterprise system

Goal

An MBT tool-specific test model shall be available that is created by reusing an existing analysis model.

Common test model issues

- Not all kinds of UML diagrams and elements are useable for test models.
- Usually, elements of test models have to be augmented with a tool-specific action language which is used to specify conditions of branches, to initialize variables or to assign values.

The way to a solution

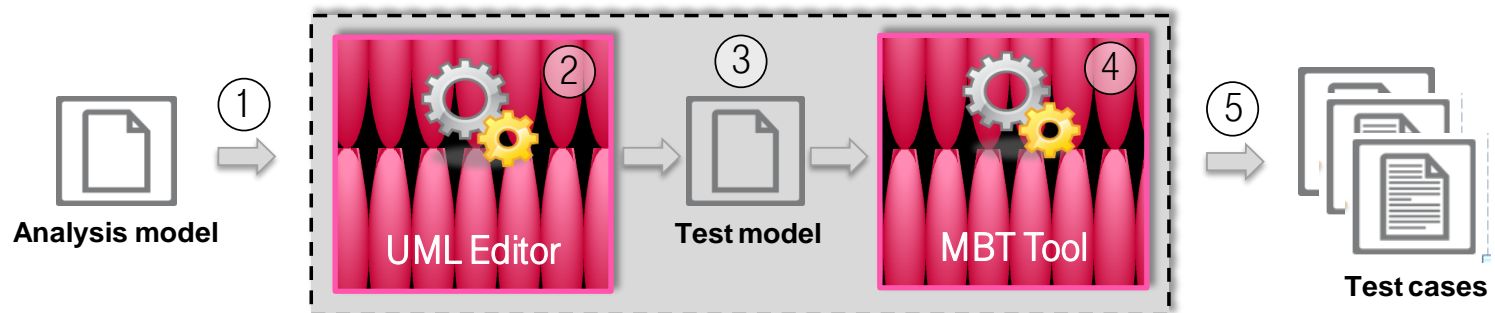
1. Analyze the commonalities and differences of existing analysis models and MBT tool-specific test models.
2. Define an appropriate (manual or automated) transformation process for analysis models.
3. Define the set of information that needs to be added manually to test models.

GENERAL APPROACH

FROM ANALYSIS MODELS TOWARDS TEST MODELS

The general workflow

1. Transform and import an already existing UML analysis model to an UML editor.
2. Refine and enrich the analysis model with test related information so that requirements of the particular test model are met.
3. Export/import the test model to the used MBT tool.
4. Generate test cases with the MBT tool.
5. Export generated test cases to a test management tool.



AGENDA

1 MOTIVATION AND OBJECTIVES

2 GENERAL APPROACH

3 CASE STUDY: SEPA

4 CONCLUSION

CASE STUDY: SEPA

USED EXAMPLE AND EVALUATED MBT TOOLS

USED EXAMPLE

- The Application Under Test (AUT) is a web-based software used in the domain of eGovernment.
- Among other functionalities, the AUT comprises a payment function that can be used to arrange bank transfers.
- Due to the introduction of the Single European Payment Area (SEPA), the payment function had to be adjusted.
- Hence, additional use cases were specified that define this new functionality.
- The use cases were taken to evaluate the reuse of analysis models for the creation of test models.



EVALUATED TOOLS

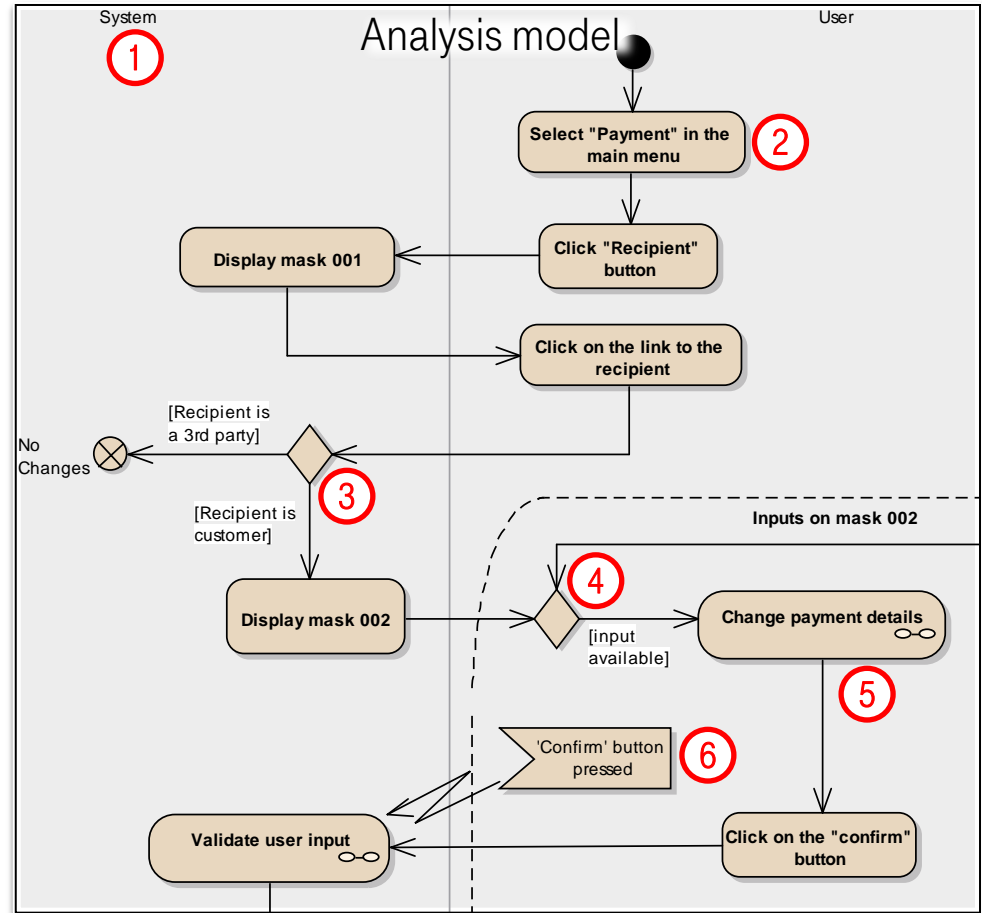
- Major requirement:
 - Support of activity-based test models
- The selected tools:
 - MBTSuite from Sepp.med and
 - Creator from Conformiq

CASE STUDY: SEPA

THE ANALYSIS MODEL

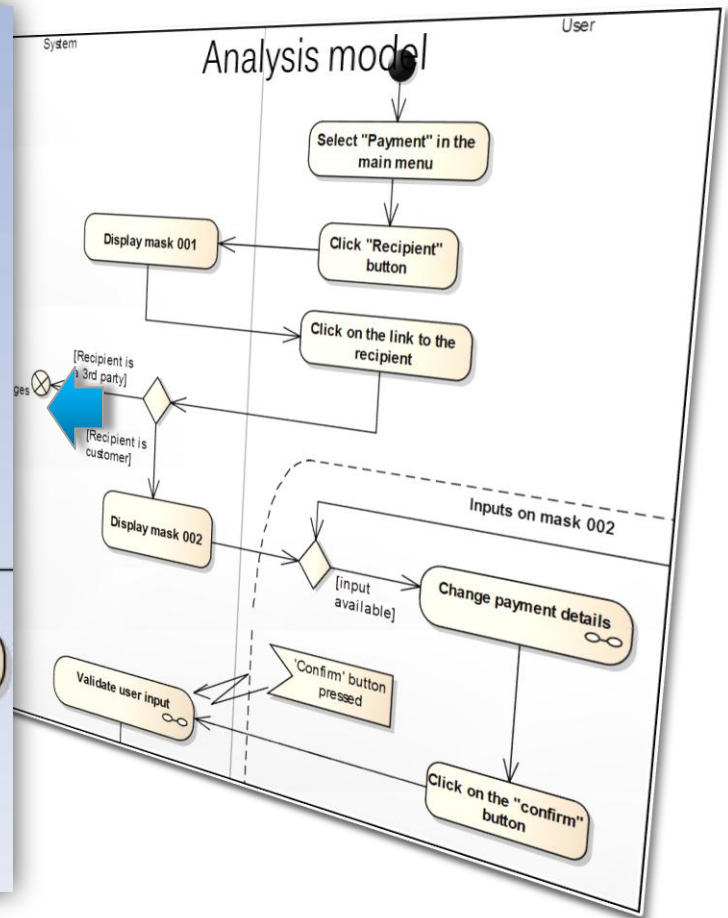
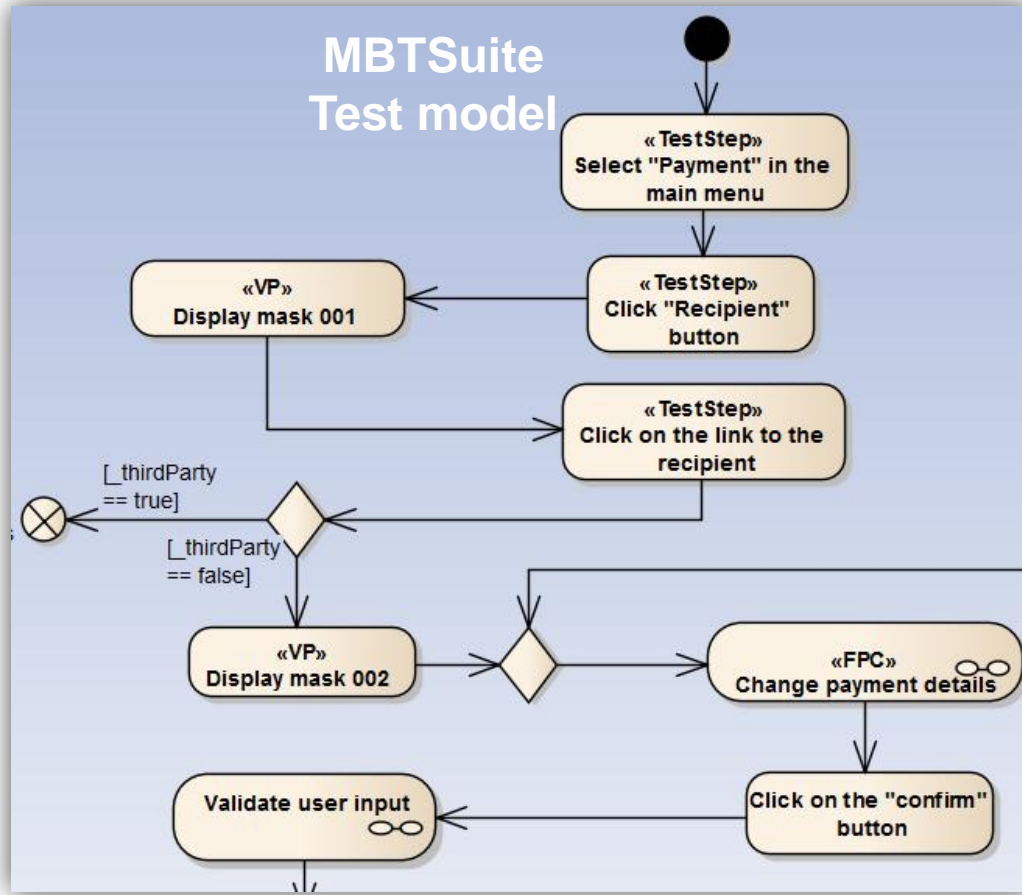
ELEMENTS OF THE ANALYSIS MODEL

1. **Swim lanes** used to separate actions of the user and of the system.
2. **Action nodes** specify the action of the user or system.
3. **Choice nodes** used to redirect control flows depending on constraints.
4. **Merge nodes** combine different control flows.
5. **Behaviour call actions** invoke other activities.
6. **Interruptible activity regions** contain actions that can be interrupted by particular signals.



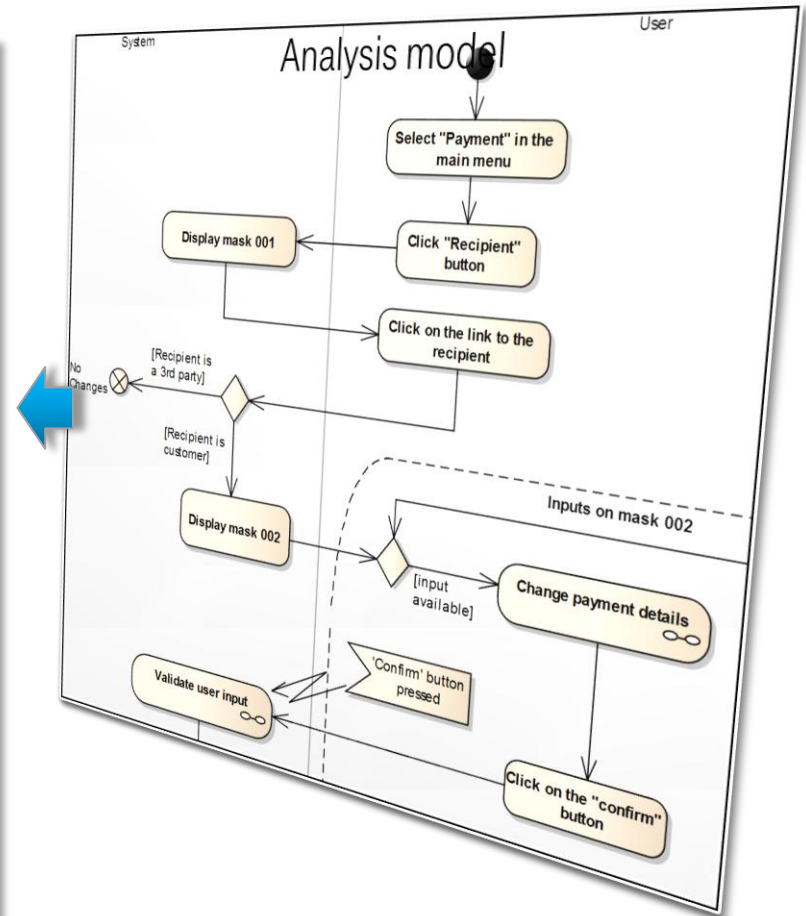
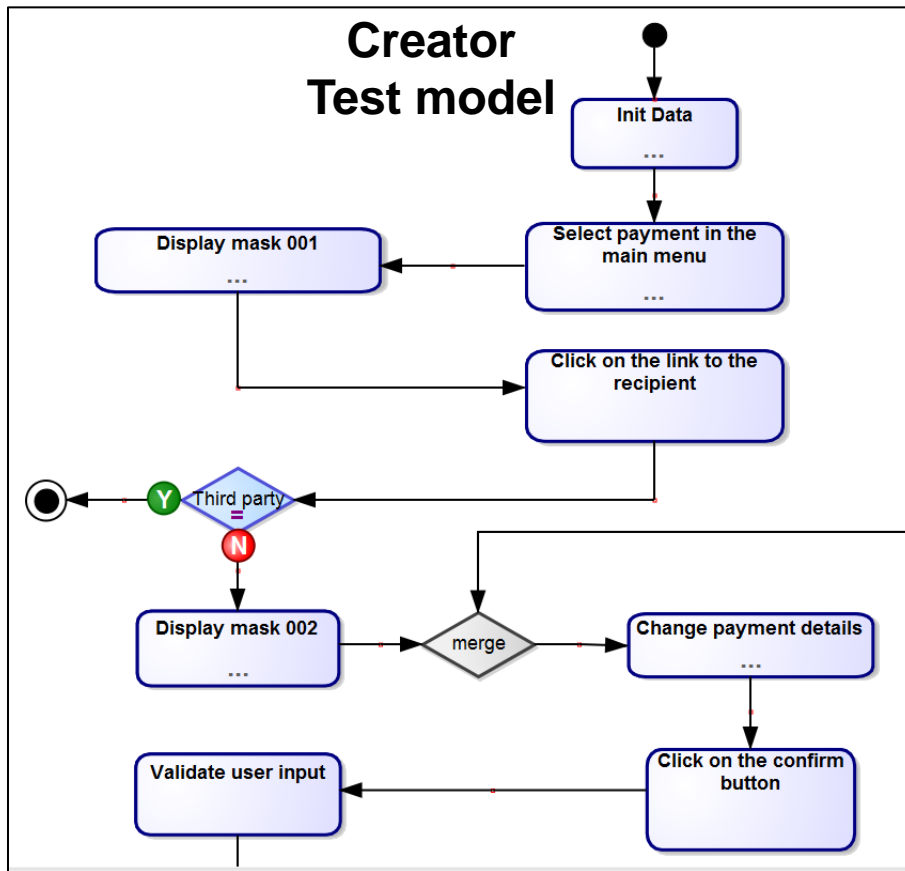
CASE STUDY: SEPA

TRANSFORMATION TO MBTSUITE TEST MODELS



CASE STUDY: SEPA

TRANSFORMATION TO CREATOR TEST MODELS

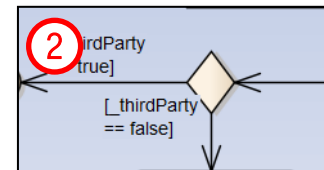
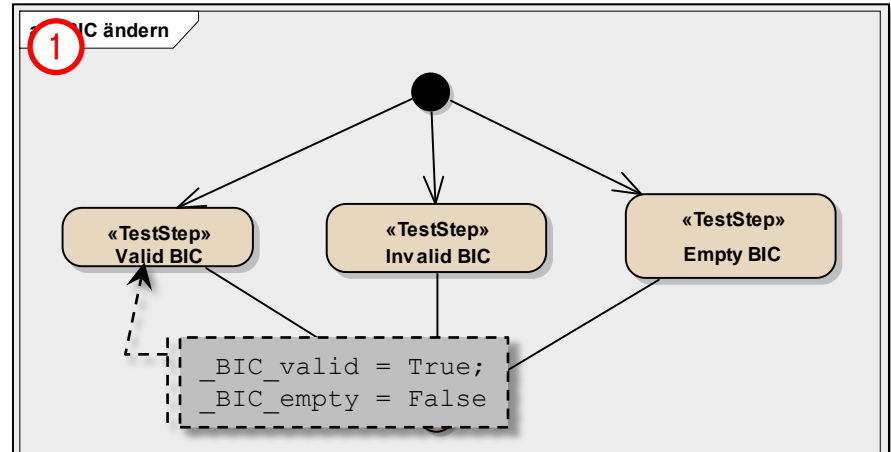


CASE STUDY: SEPA

TOOL-SPECIFIC TEST MODEL REFINEMENTS (1/2)

SEPP.MED MBTSUITE SPECIFIC REFINEMENTS

1. Define all required test data combinations in terms of action nodes. Then assign corresponding values to Python variables.
2. Specify constraints for outgoing control flows of decision nodes by using Python expressions.
3. Optional: If executable test cases shall be generated, appropriate fragments of the used “target language” have to be specified for test steps and verification points.



3

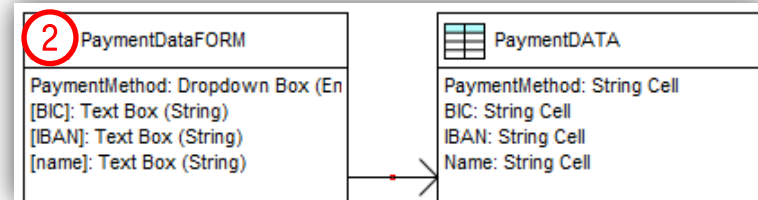
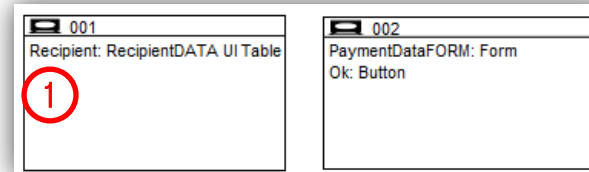
```
Check Value: "Mask_002#PRESENT" = "YES"  
Check Value: "Forename#CONTENT" = "${_FORENAME}"  
Check Value: "Surname#CONTENT" = "${_SURNAME}"  
Check Value: "Bank#CONTENT" = ""  
Check Value: "BIC#CONTENT" = ""  
Check Value: "IBAN#CONTENT" = ""
```

CASE STUDY: SEPA

TOOL-SPECIFIC TEST MODEL REFINEMENTS (2/2)

CONFORMIQ CREATOR SPECIFIC REFINEMENTS

1. Define all required widgets of the application under test.
2. Specify all kind of data types that are associated with the widgets.
3. Refine actions in the activity diagrams with appropriate expressions of the action language.



Object type	Activity
Name	Display mask 002
Actions	Add...
Display 002 Screen	DS: 002
Pre-Condition	Attach New...
PaymentDataFORM Form Data	Attach New...
PaymentDataFORM Form Widget Status	3 widgets enabled widgets hidden
Zahlungsart Dropdown Box Status	enabled
BIC Text Box Status	enabled
IBAN Text Box Status	enabled
name Text Box Status	hidden
Ok Button Status	enabled
Description	

CASE STUDY: SEPA

LESSONS LEARNED

Points observed

- Analysis models that consist of use cases refined with activity diagrams can be reused for the creation of test models for both evaluated MBT tools.
- Activity diagrams of an appropriate analysis model shall only consist of a minimal set of different element kinds: preferably, only those kinds used in the analysis model of the case study.
- Currently, tool-independent analysis models have to be manually transformed to tool-specific test models.

Expected potential

- It is expected that an automated transformation of tool-independent analysis models to test models can minimize their initial creation efforts.
- With an automated model transformation, requirements linked with elements in an analysis model could be preserved in test models.

CASE STUDY: SEPA

POTENTIAL FOR AN INDUSTRIAL APPLICATION

APPLICABLE FOR A REAL WORLD AUTOMATED TESTING SCENARIO

- ✓ The used SEPA example for the case study is taken from a currently running software project.
- ✓ The exemplary analysis model could be refined and enriched to obtain test models that comply with the requirements of both used MBT tools.
- ✓ Executable test cases could be generated in the same keyword-based test notation with both MBT tools.
- ✓ The requirement coverage of the generated test cases is the same as of manually specified test cases.

AGENDA

1 MOTIVATION AND OBJECTIVES

2 GENERAL APPROACH

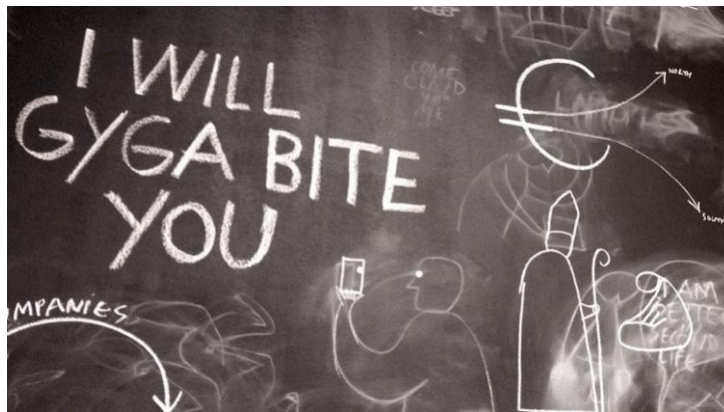
3 CASE STUDY: SEPA

4 **CONCLUSION**

THE STUDY PROVED EFFICIENT USAGE OF ANALYSIS MODELS OF OUR PROJECT.

CONCLUSIONS CONCERNING OUR PROJECT

- The SEPA case study proved that tool-independent analysis models of our project can be reused for the creation of initial test models for both analyzed MBT tools.
- The efforts for the initial creation of test models can be minimized with an automated transformation, because they have not to be created from scratch.
- However, the definition of MBT tool-specific information (e.g. test data and test control information) can not be automated, because they are not a part of the analysis models.



MAYBE YOU NEED A SIMILAR CASE STUDY FOR YOUR PROJECT AS WELL?



ADVICES FOR OTHER PROJECTS

- If you are using similar analysis models as discussed in your project, you can implement the presented approach without changes and by using one of the mentioned MBT tools.
- When you have analysis models that comprise also other kinds of elements/diagrams, you have to analyze if they can be mapped or transformed to corresponding test model elements/diagrams.
- If you want to use another MBT tool in combination with another kind of models, then you should perform a similar case study as presented.

QUESTIONS?

THANK YOU!



LIFE IS FOR SHARING.