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MODEL-BASED TESTING OF LARGE-SCALE ENTERPRISE IT SYSTEMS

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Smartesting

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- Specialized in MBT
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Tutorial Agenda

- MBT for Large IT Systems
 - Current challenges of testing large-scale applications
 - Levels of testing addressed by model-based testing
- Modeling Business Processes and Business Rules
 - Business Process Modeling
 - Business Rules and requirements
 - Test generation and implementation
- Didactic example
- Reuse and packaged applications
- Lessons learned

MBT for Large IT Systems



Full IS level testing End-to-end testing
Critical business processes
ERP...

Limited number of tests, high value of each test

Integration level testing Multi-applications validation tests

User-oriented test cases

Application level Functional test of a single application

Large number of test cases, thorough technical validation

MBT for Large IT Systems

- Information System level testing characteristics:
 - Small number of tests
 - Functional knowledge from multiple areas, difficult to acquire
 - Low level of technical skills
 - Potentially high cost of execution (test environment, time, resources)
 - Focus on scenarios testing
 - Multiple actors/contractors

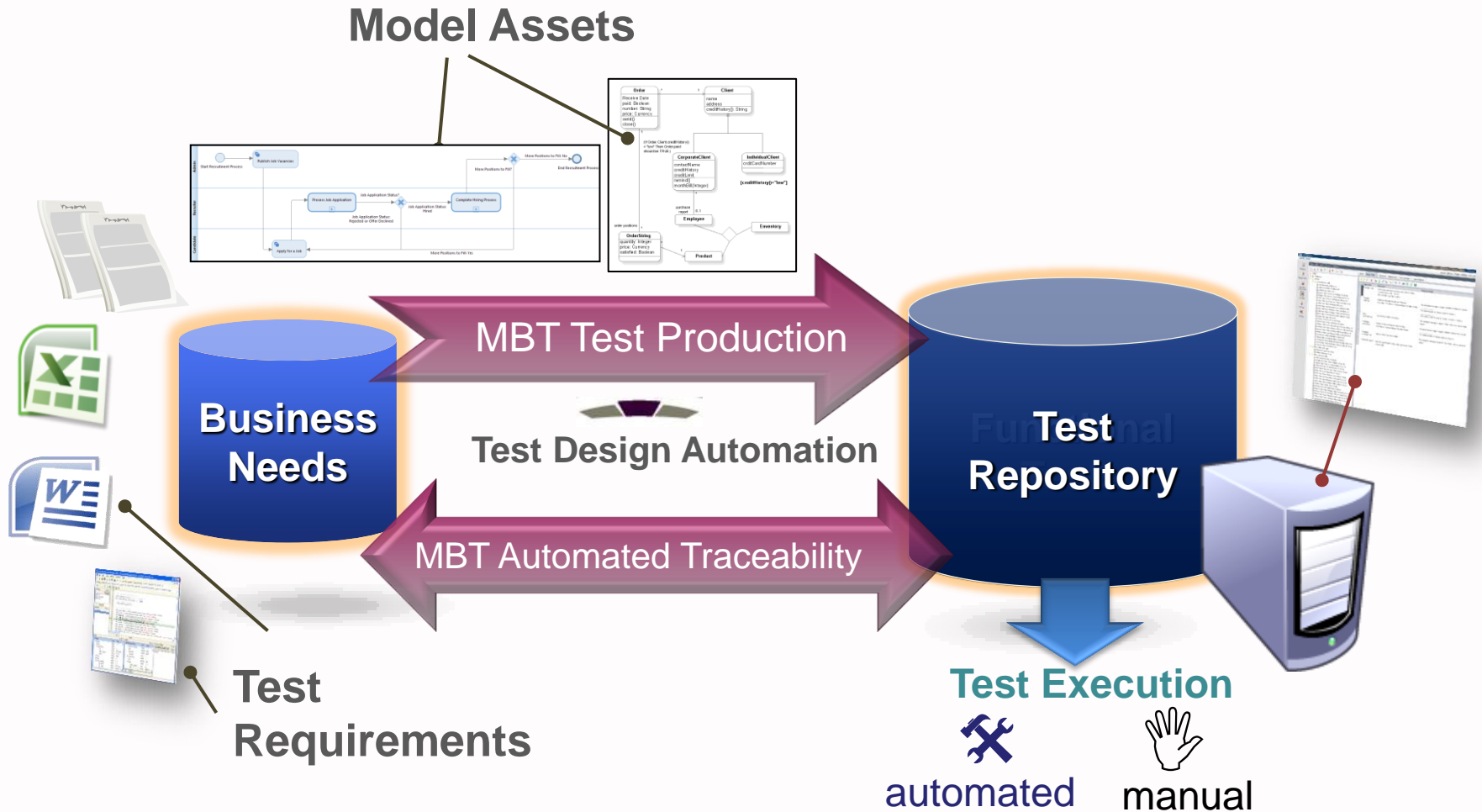
MBT for Large IT Systems

- Integration level testing characteristics:
 - Environment simulation
 - Data injection and control
 - Mix of scenarios and functional testing
 - Various levels of maturity in requirement management
 - Test objectives elicitation
 - Multiple actors/contractors

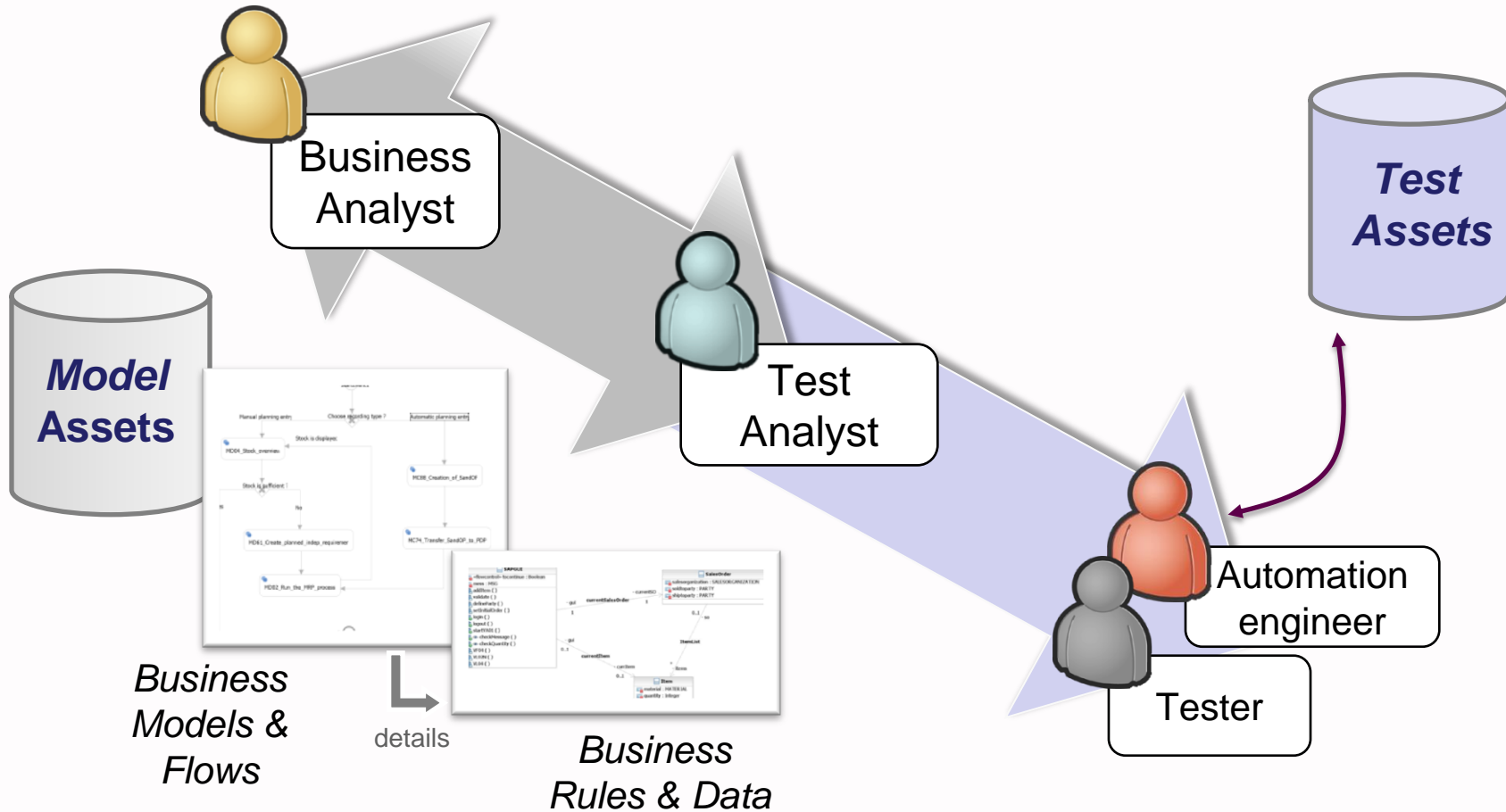
MBT for Large IT Systems

- Consequences on MBT for this kind of system:
 - Testing a path is more important than testing a single function – end-2-end testing and workflow testing
 - Modeling must remain simple even when representing complex functional rules/data
- MBT Value added:
 - Improves communication and helps share understanding
 - Model can be considered as a knowledge base
 - Helps control requirements and functional coverage
 - Ensure test content consistency

Modeling Business Processes and Business Rules

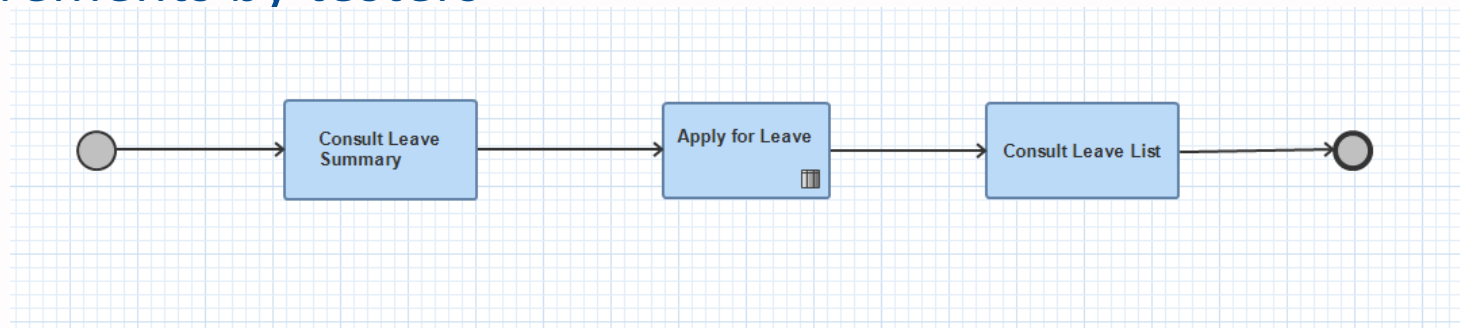


Modeling Business Processes and Business Rules



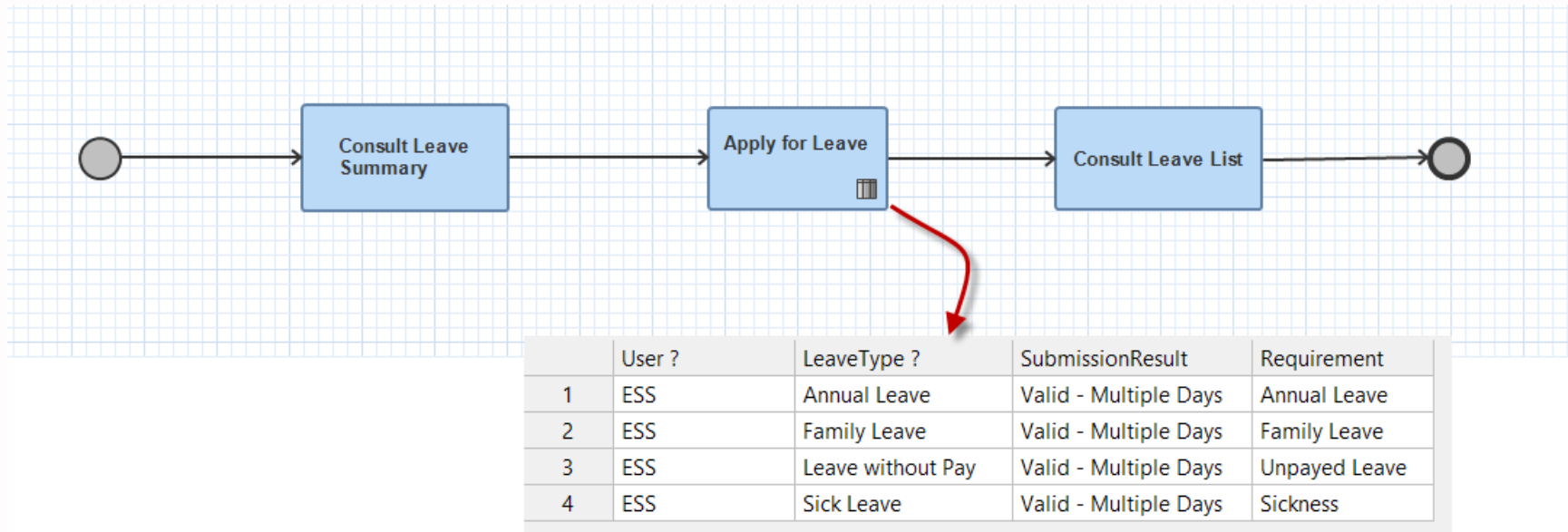
Modeling Business Processes and Business Rules

- Business process modeling is the best choice for modeling in this context
 - Focus on scenarios
 - Easy to understand by all stakeholders (including Business Analyst)
 - Sometime already used in organizations (in such case, also provides BP validation)
- Business process models can be considered as a requirements by testers



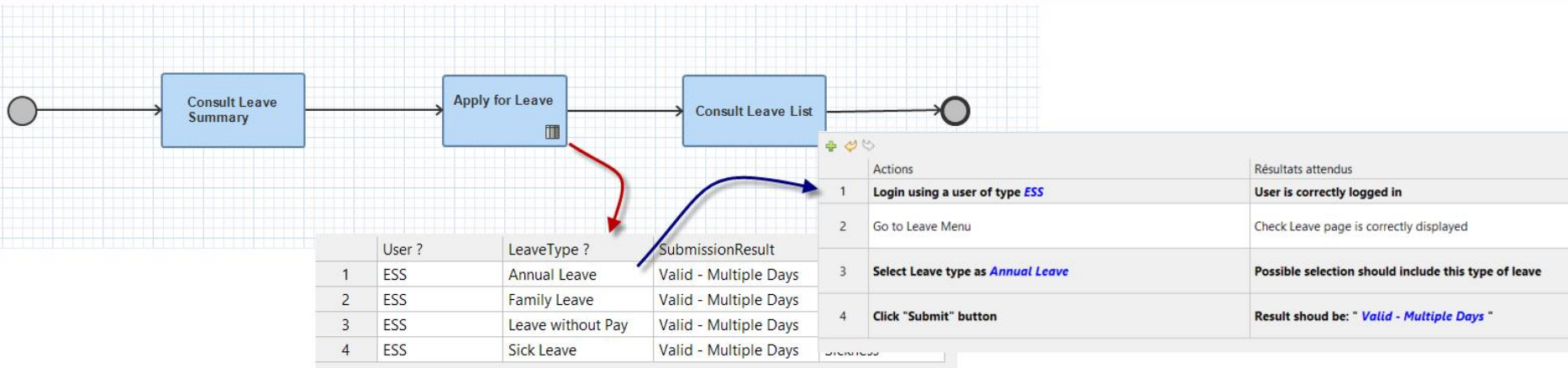
Modeling Business Processes and Business Rules

- Business Rules modeling using **decision tables**
 - Business rules are associated to Business process tasks
 - A requirement can be related to a specific part of a business rule
 - Both relationships can be represented by a decision table



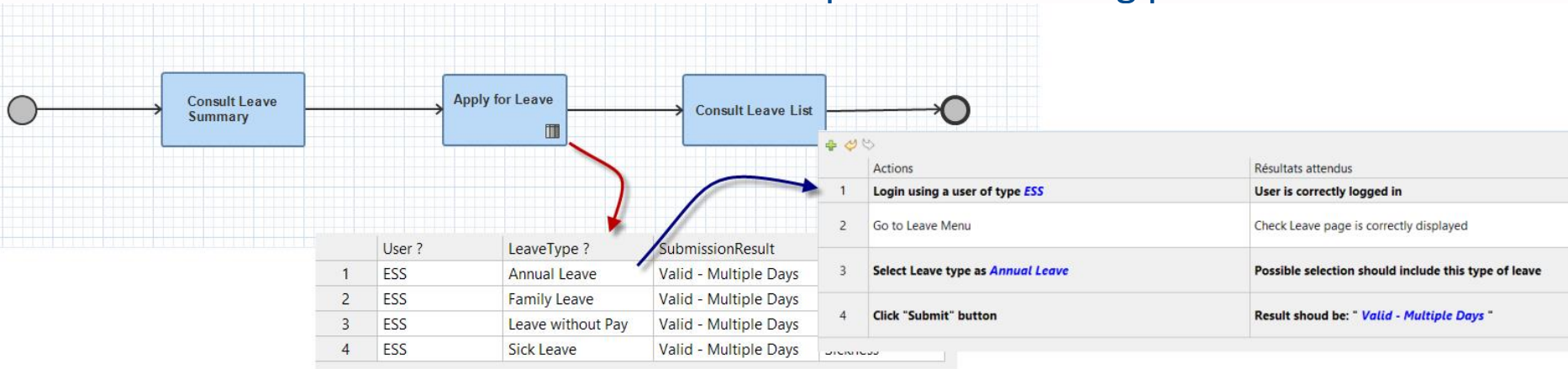
Modeling Business Processes and Business Rules

- Test steps descriptions from Business Process Tasks
 - Action details are related to BP task execution
 - Content depends on data input and expected results
 - Content is also related to decision table



Modeling Business Processes and Business Rules

- Data can be concrete or abstract in the model
 - As long as a business rule applies the same way, abstract data can be used (equivalent classes)
 - Ex : user can be ESS (standard user) or ADMIN
 - ESS can be used as a type, or replaced by a concrete username
 - Abstract to concrete values will be processed during publication



Modeling Business Processes and Business Rules

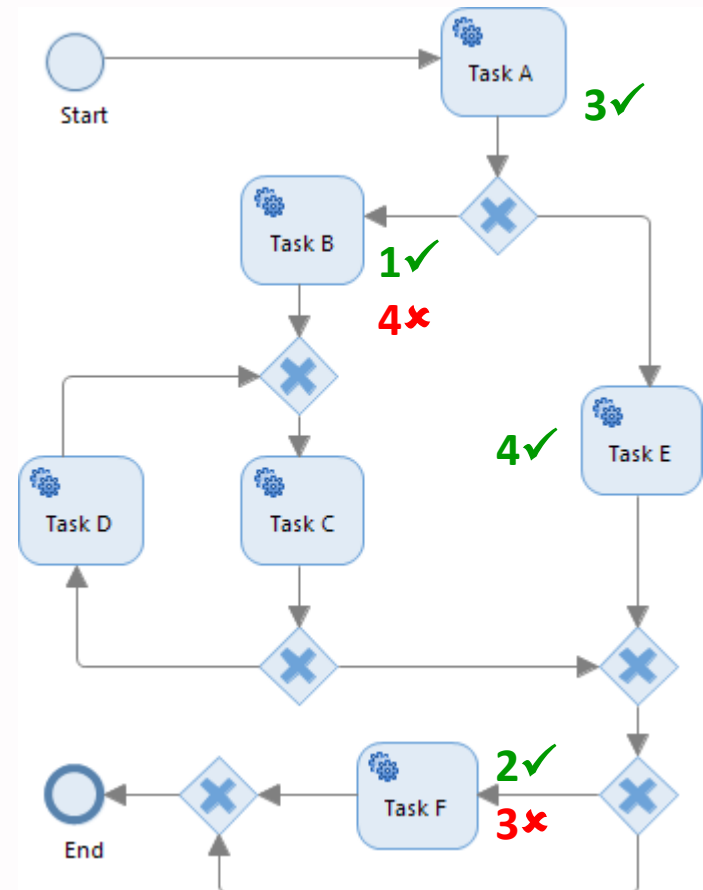
- Test Generation needs to provide complete implementation
 - Data inputs
 - Expected results
 - User actions
 - Requirements traceability
 - Pre-requisites
- No modification should be necessary after Test Generation/Implementation

Modeling Business Processes and Business Rules

- Test Generation
 - From each Business Process Task
 - From each line in each decision tables
 - Based on partial or complete path coverage of the Business Process
 - Consistent with data values and conditions in tables

Modeling Business Processes and Business Rules

- Test Generation
 - Path selection in process
 - Each line in decision table represents passing / non passing configuration

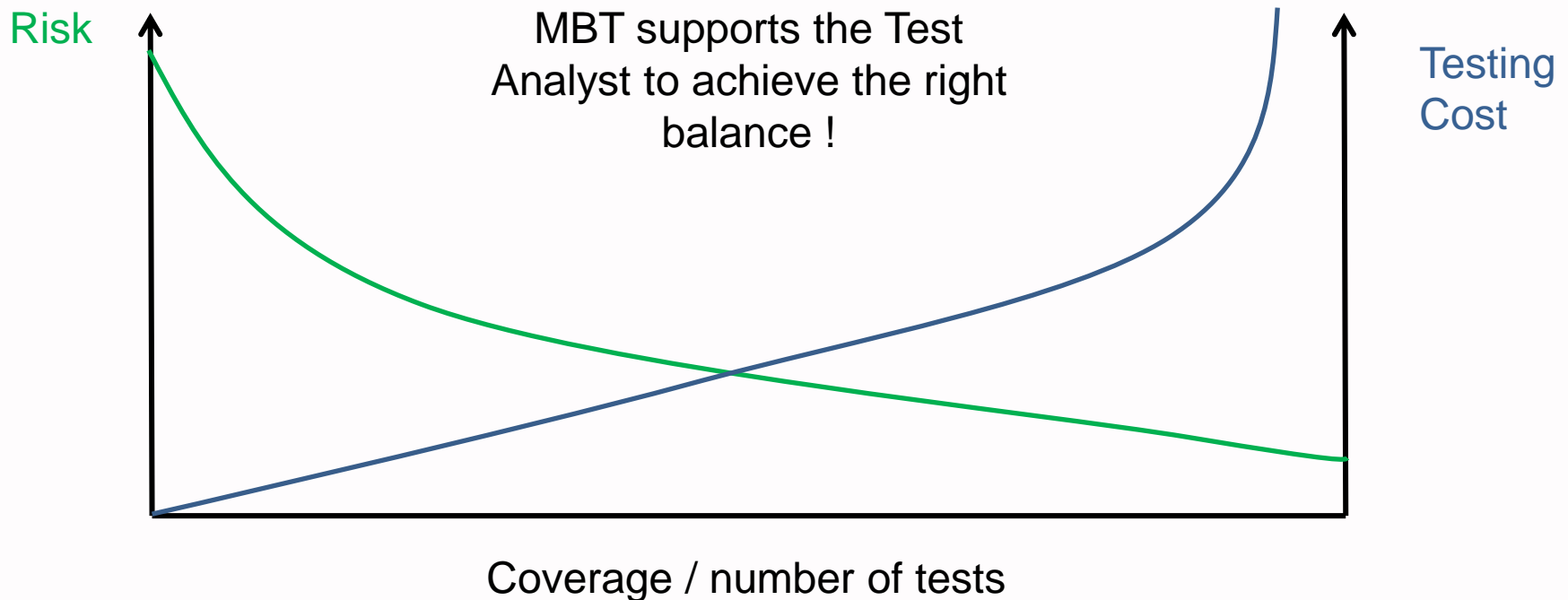


Modeling Business Processes and Business Rules

- What is the best number of test cases?
 - $NbTasks * NbLines(Task) * 1.7 + NbTasks / 2$?
 - $NbTasks * NbLines(Task)^2 - NbLines(Task) / 4$?
 - ...

Modeling Business Processes and Business Rules

- The best number of test cases is a tradeoff between risk and testing cost



Modeling Business Processes and Business Rules

- Test Implementation and Test publication
 - Test cases are stored in a standard Test Repository (HP ALM, TestLink, etc)
 - Each project has its own test organization in the test repository
 - Test publication must conform to project usage
 - MBT Tool is NOT the only source of test implementation (there are still some tests built manually)
- Test publication must be highly customizable
 - Test repository organization
 - Project/repository management attributes (priority, functional domain, ...)
 - Only manual test scripts or automated test scripts or both

Modeling Business Processes and Business Rules

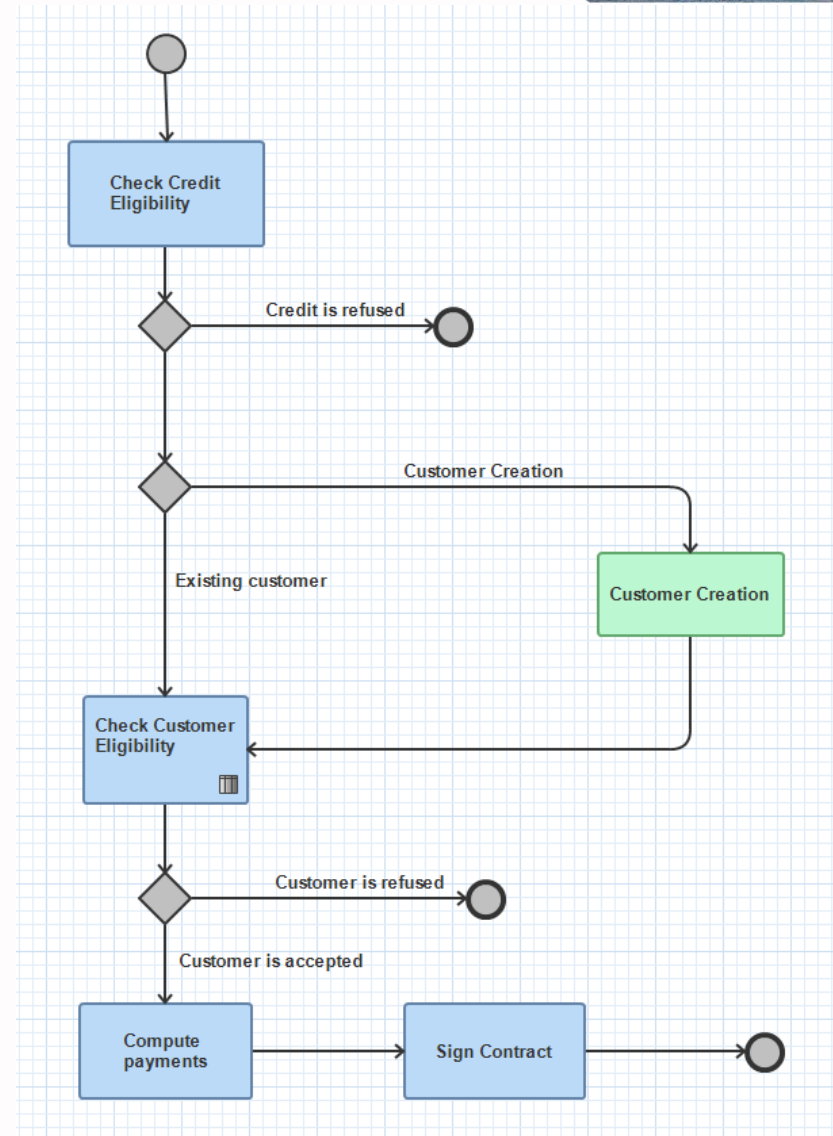
- Test publication and data
 - For abstract data, the generation has defined tests with abstract values.
 - Test publication will transform this abstract data to concrete data
 - Multiple tests can then be published from one generated test
 - Ex : user ESS becomes abo, you, someoneelse, etc
 - Test by test or by groups with strategies
 - Creating test data or using existing ones

Didactic example

- Example of a consumer credit
 - Credit is defined in a dedicated application, linked to an existing CRM
 - Credit is acceptable if the credit details fulfill conditions defined in specifications
 - Customer is acceptable if his situation fulfills conditions defined in specifications.

Didactic example

- Business Process



Didactic example

- Decision table
 - Check Credit Eligibility Task

	Amount ?	Duration ?	TypeOfGoods ?	Eligibility	Outcome	Requirement	Test Objective
1	Less than 300€	Less than 12 months	Games	Eligible	Credit is accepted	Credit for Gaming	Less than 300€
2	Less than 1500€	Between 12 and 48 months	Video	Eligible	Credit is accepted	Credit for Video	Middle Video
3	Less than 1500€	Between 12 and 48 months	Appliances	Eligible	Credit is accepted	Credit for Appli...	Less than 1500€
4		More than 48 months		Duration is too long	Credit is refused	Credit refused	Long duration
5	More than 4000€			Amount is too high	Credit is refused	Credit refused	High amount

Didactic example

- Decision table
 - Check Customer Eligibility Task

	Age ?	ProfessionalStatus ?	EligibleCustomer	Outcome	Requirement	Test Objective
1	Over 18	Student	Eligible	Customer is accepted	Customer Eligibility	Student over 18
2	Over 18	Employee	Eligible	Customer is accepted	Customer Eligibility	Employee over 18
3	Senior	Employee	Eligible	Customer is accepted	Customer Eligibility	Employee Senior
4	Senior	Retired	Not Eligible	Customer is refused	Customer Eligibility	Retired Senior
5	Under 18		Not Eligible	Customer is refused	Customer Eligibility	Under 18

Didactic example

- High Level description for actions
 - Check Customer Eligibility Task

	Age ?	ProfessionalStatus ?	EligibleCustomer	Action	Outcome	Requirement	Test Objective
1	Over 18	Student	Eligible	Customer details: Age: Over 18 Professional Status: Student	Customer should be Eligible Customer is accepted	Customer Eligibility	Student over 18
2	Over 18	Employee	Eligible	Customer details: Age: Over 18 Professional Status: Employee	Customer should be Eligible Customer is accepted	Customer Eligibility	Employee over 18
3	Senior	Employee	Eligible	Customer details: Age: Senior Professional Status: Employee	Customer should be Eligible Customer is accepted	Customer Eligibility	Employee Senior
4	Senior	Retired	Not Eligible	Customer details: Age: Senior Professional Status: Retired	Customer should be Not Eligible Customer is refused	Customer Eligibility	Retired Senior
5	Under 18		Not Eligible	Customer details: Age: Under 18 Professional Status: any	Customer should be Not Eligible Customer is refused	Customer Eligibility	Under 18

Didactic example

- low Level description for actions
 - Check Customer Eligibility Task

	Actions	Expected results
1	Enter customer details	Details page must be displayed
2	Enter customer age : <i>Over 18</i>	For an existing customer, the age must be displayed
3	Enter customer professional status : <i>Student</i>	For an existing customer, the professional status must be displayed
4	Run customer eligibility check	The following message must be displayed : Customer is <i>Eligible</i>

Didactic example

- Test implementation
 - An example in HP ALM

Details Design Steps Parameters Attachments Test Configurations Req Coverage Link			
Step Name	Description	Expected Result	
Step 1	Enter credit duration: between 12 and 48 month		
Step 2	Enter credit amount: less than 1500 euros		
Step 3	Enter goods type: Appliances		
Step 4	Select "Check Credit Eligibility"	Credit should be Eligible	
Step 5	Enter customer details	Details page must be displayed	
Step 6	Enter customer age: Over 18	For an existing customer, the age must be displayed	
Step 7	Enter customer professional status: Student	For an existing customer, the professional status must be displayed	
Step 8	Run customer eligibility check	The following message must be displayed: Customer is Eligible	
Step 9	Select Compute Payments	Payments list should be displayed	
Step 10	Select Contract Signature and sign contract	Signature must be accepted	
Step 11	Select Existing Contracts for customer	The signed contract must appear	

Reuse and packaged application

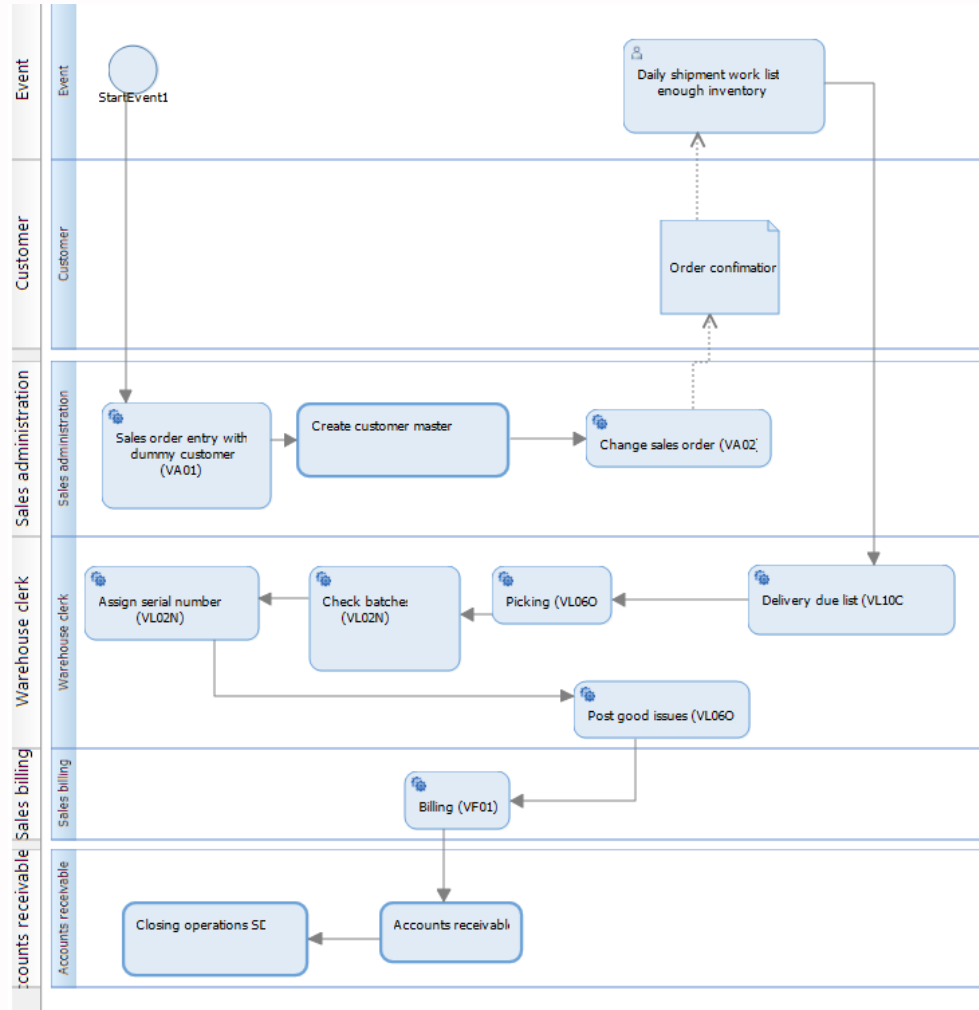
- Multiple flavours for reuse
 - A model is easy to copy and to modify for a different context
 - Families of similar projects
 - A 'generic' model can be defined, to be customized in a real project
 - Project template, always customized
- Generic models can be designed for:
 - A precise business need with multiple implementations
 - Ex: HR declined by country / by company / by software
 - A packaged application with customized usage
 - Ex: ERP like SAP

Reuse and packaged application

- Sample nominal process for SAP Sales order processing

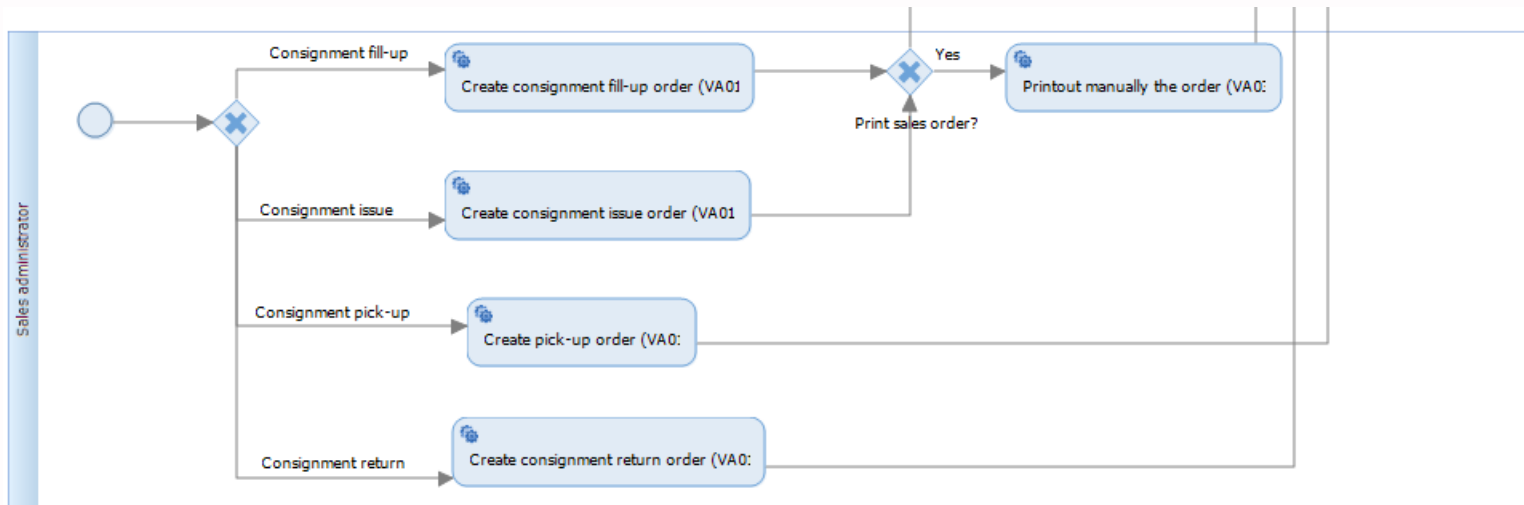
From generic process, customization of

- Processes
- Tasks
- Decision tables
- Descriptions



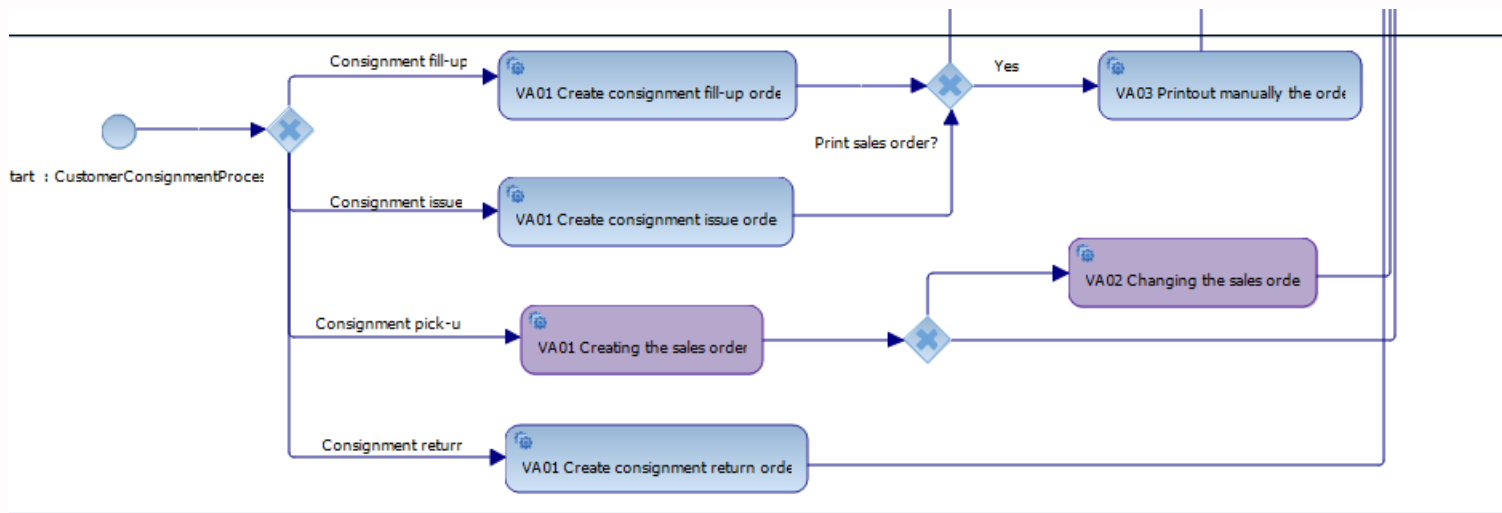
Reuse and packaged application

- Example of customization.
- Customer Consignment Process
- Partial Generic Process



Reuse and packaged application

- Example of customization.
- Customer Consignment Process
- Same part customized



Lessons learned

- Team skills
 - High business skills
 - Low technical skills
 - Testers are more business experts than programmers
 - Some types of graphical modeling are understandable, but not scripting nor object concepts
 - Simplify MBT concepts is key, but productivity gains must be kept

Lessons learned

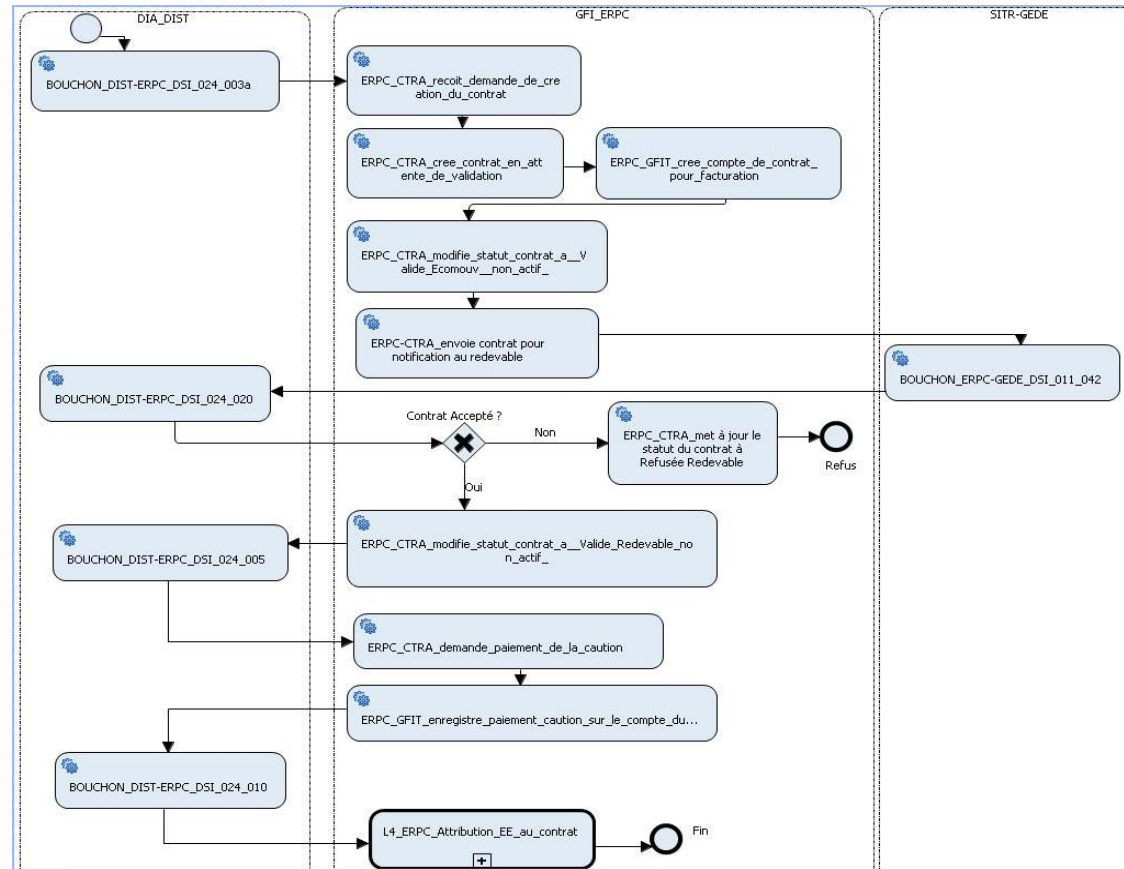
- Communication and teams
 - Usually multiple contractors are involved
 - Modeling can be seen as a knowledge base
 - Modeling can be seen as a communication asset
 - Introducing MBT is a transformation project

Lessons learned

- Importing Processes from Business Team
 - In some organization, the business team uses BPM
 - These processes can be directly imported and reused by Testers
 - BUT, as the processes are only used as documentation:
 - The BPM can be semantically wrong
 - The BPM can be old
 - The BPM can be addressing a different level of abstraction

Lessons learned

- Importing Processes from Business Team
- Importing also means:
 - Controlling
 - Managing life cycle
 - Reshaping



Lessons learned

- Automation
 - Automation is only used for regression testing
 - Usually felt as a pain
 - MBT allows to have the same design for manual and for automated test
 - MBT is a real opportunity by separating business and technical concerns

CONCLUSION

- MBT can be used for large IT Systems
- Productivity gains come from:
 - Improved communication
 - Knowledge consolidation
 - Easier automation
- Challenge is technical complexity of modeling

QUESTIONS ?