

Path simulation in BPMN workflow using resource aggregation

Ougaabal Kawtar ^{1,4}, Zacharewicz Grégory ², Ducq Yves ¹, Tazi Said ³

¹ IMS Laboratory, Bordeaux University, France

² LG2IP, IMT Mines Ales, Ales, France

³ Pau et Pays de l'Adour University, Anglet, France

⁴ Exakis Nelite, Bidart, France

November 18, 2020

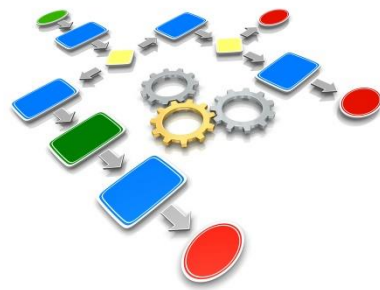
I-ESA'20 , Tarbes-France

PLAN

- 1- Research context
- 2- Material and methods
- 3- Pathway of performance aggregation
- 4- Pathway of displaying results
- 5- Pathway of the general methodology



Process automation
(with workflows)



GOAL IS



Bridge the gap between business requirements
and technology



Researchers focused on control flow and data flow and less attention has been devoted to the resources used



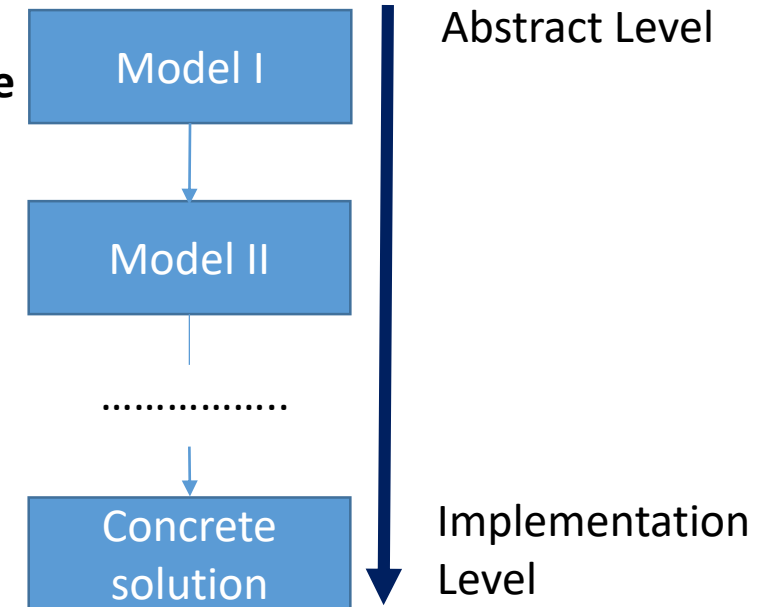
Contribution to a methodology for process automation based on resource analysis

❑ MODEL DRIVEN ENGINEERING (MDE) :

- Software engineering methodology where **models are the core asset**
- To describe smoothly ideas and business needs from a **high level of abstraction to the concrete solution.**



Models + Transformations = Software



“Design once, build it on any platform”

□ MDSEA is a model driven engineering methodology that includes resources in the early steps of modelisation

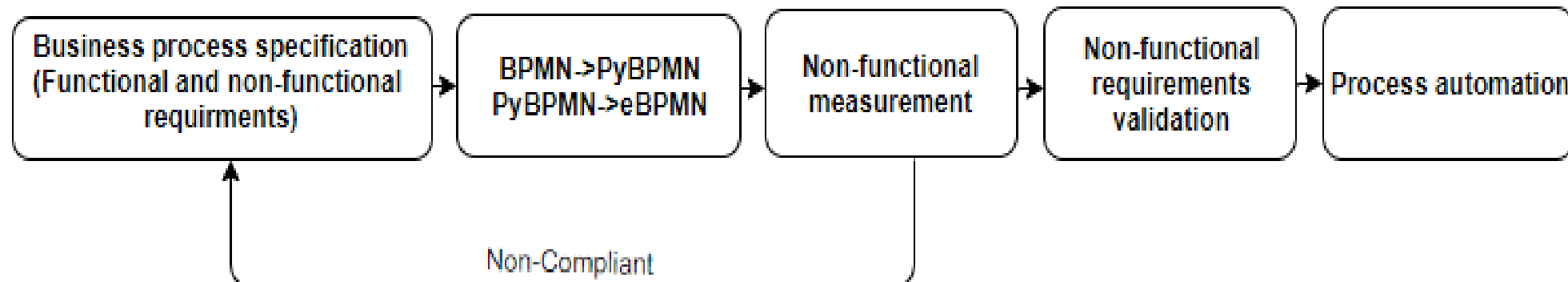
Physical means: resources are the tangible goods used in a process to carry out its activities

Human resources: individuals who work to fulfill their tasks according to their role within a process

IT resources: all hardware, software and infrastructure used to accomplish the work required in a process

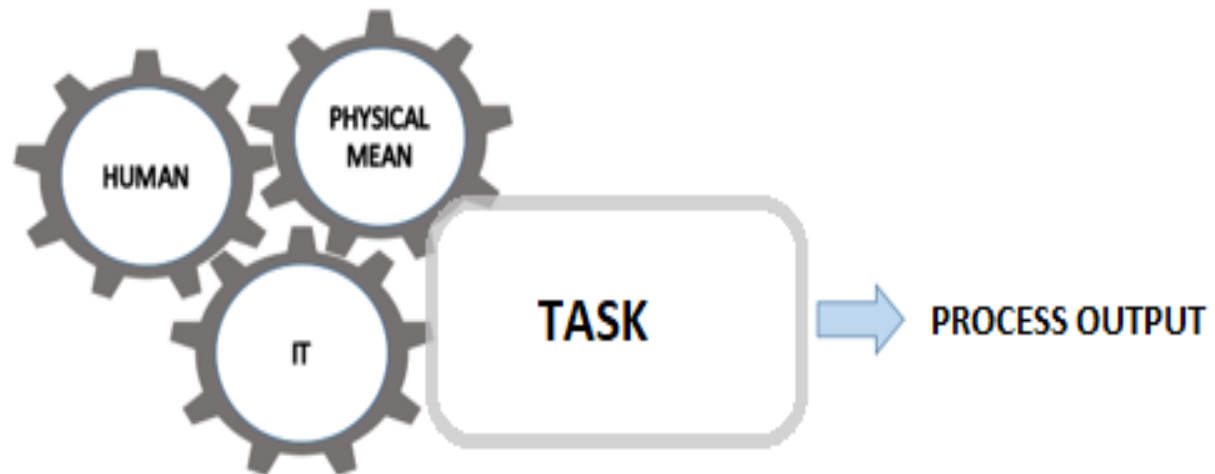
□ eBPMN language aims to :

- Allow **non-functional simulation** through **process resources** by using **text annotation**
- Take into consideration **composite resource**
- Merge modelling and simulation at the same step using a model-driven method **to automatically build executable simulation code from BPMN**
- Guaranty the compatibility of the model by **not modifying the BPMN metamodel** and implementing eBPMN according to the **BPMN execution semantics**



□ Enhancing eBPMN language by :

- Distinguishing resources type
- Aggregating resource performance
- Providing the simulation results of each path instead of each task only



3- Pathway of performance aggregation

Aggregation of resource performance

LEVEL 0

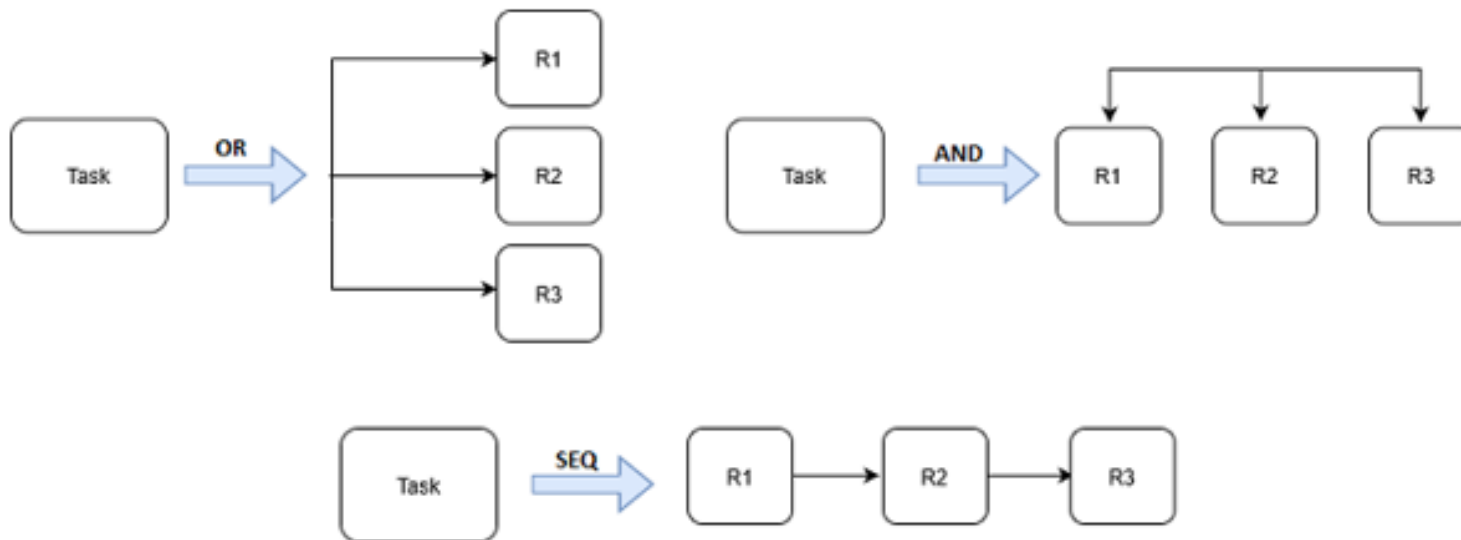
LEVEL 1

LEVEL 2

Model operational detail of a process

Break down each task into an atomic subtask

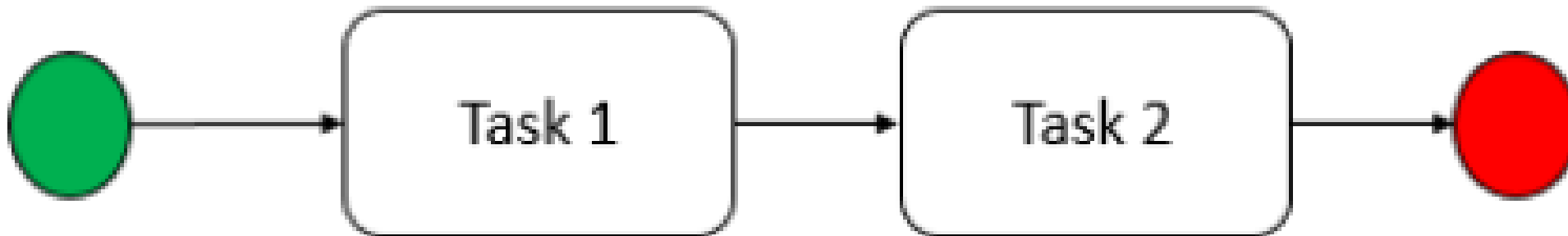
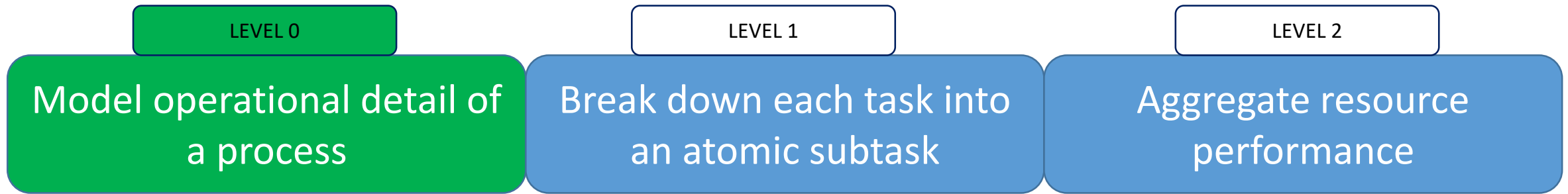
Aggregate resource performance



Configuration	Time	Reliability
SEQUENTIAL 	$\sum_{i=1}^r T_i$	$\prod_{i=1}^r R_i$
AND 	$\text{Max}(T_1, \dots, T_i)$	$\prod_{i=1}^r R_i$
OR 	$\text{Max}(T_1, \dots, T_i)$	$\text{Min}(R_1, \dots, R_i)$

3- Pathway of performance aggregation

Aggregation of resource performance



3- Pathway of performance aggregation

Aggregation of resource performance

LEVEL 0

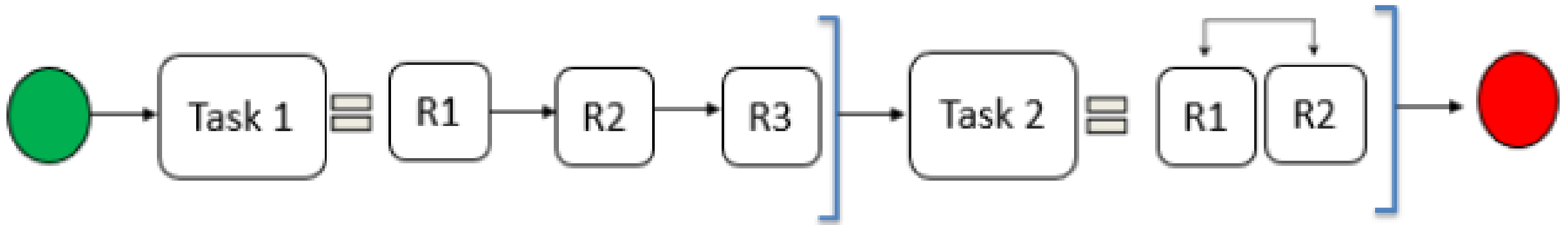
Model operational detail of a process

LEVEL 1

Break down each task into an atomic subtask

LEVEL 2

Aggregate resource performance



3- Pathway of performance aggregation

Aggregation of resource performance

LEVEL 0

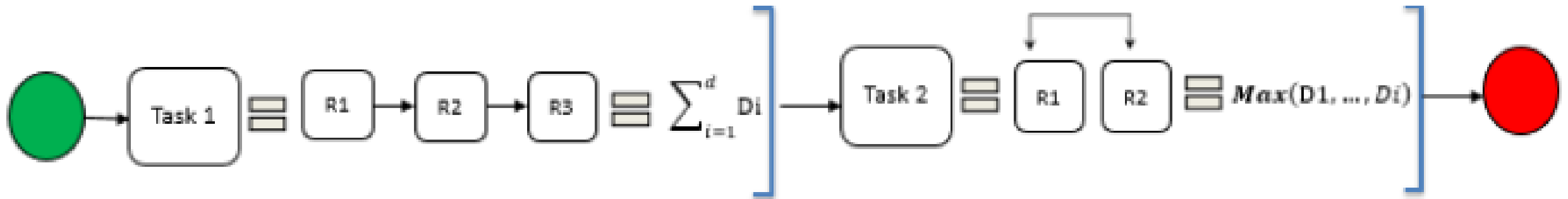
Model operational detail of a process

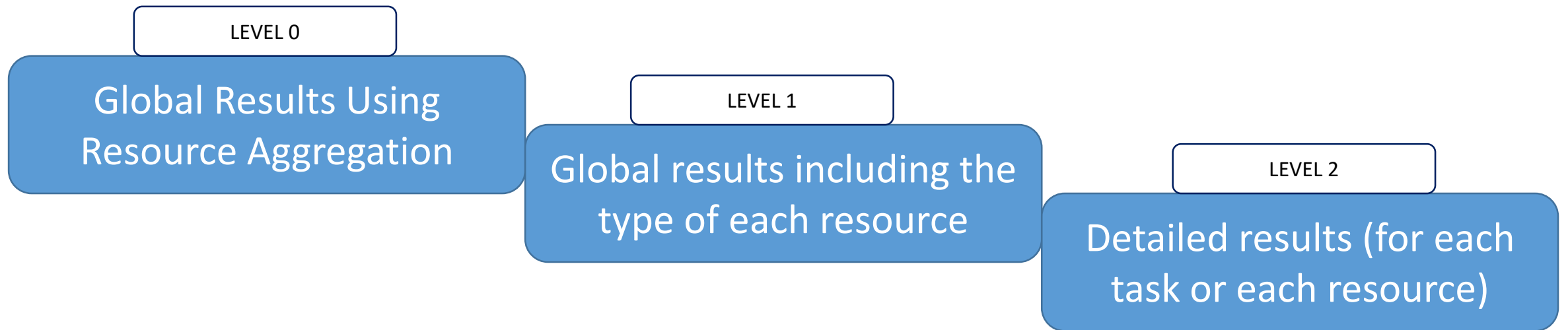
LEVEL 1

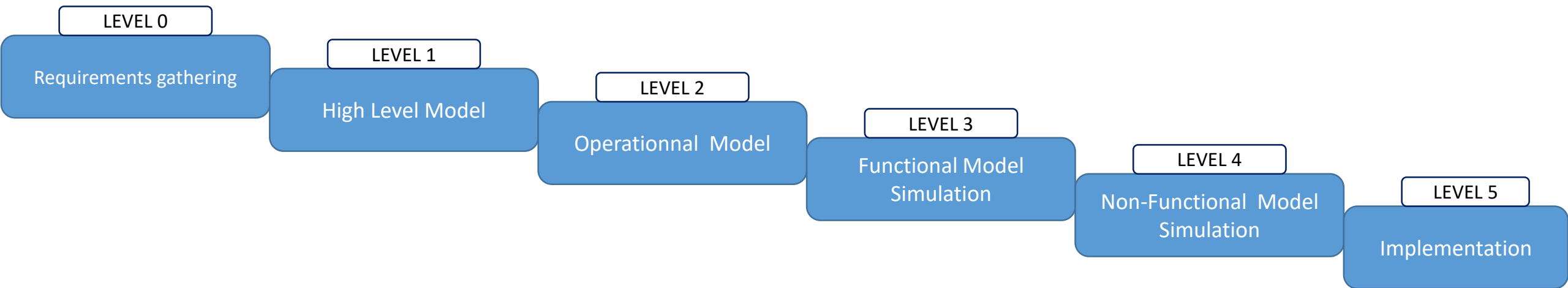
Break down each task into an atomic subtask

LEVEL 2

Aggregate resource performance





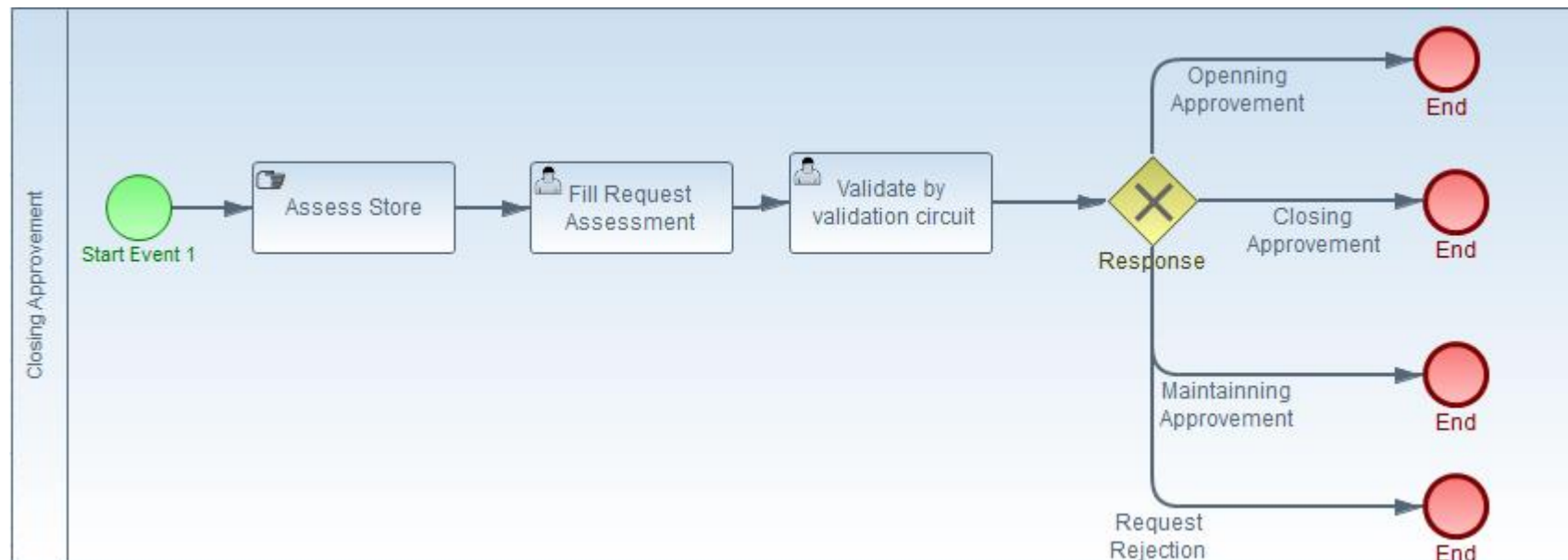


LEVEL 0 – Requirements gathering

- Clarify functional requirements
- Clarify non-functional requirements
- Identify resource needs
- Distinguish resource's type
- Identify the performance characteristics of each resource

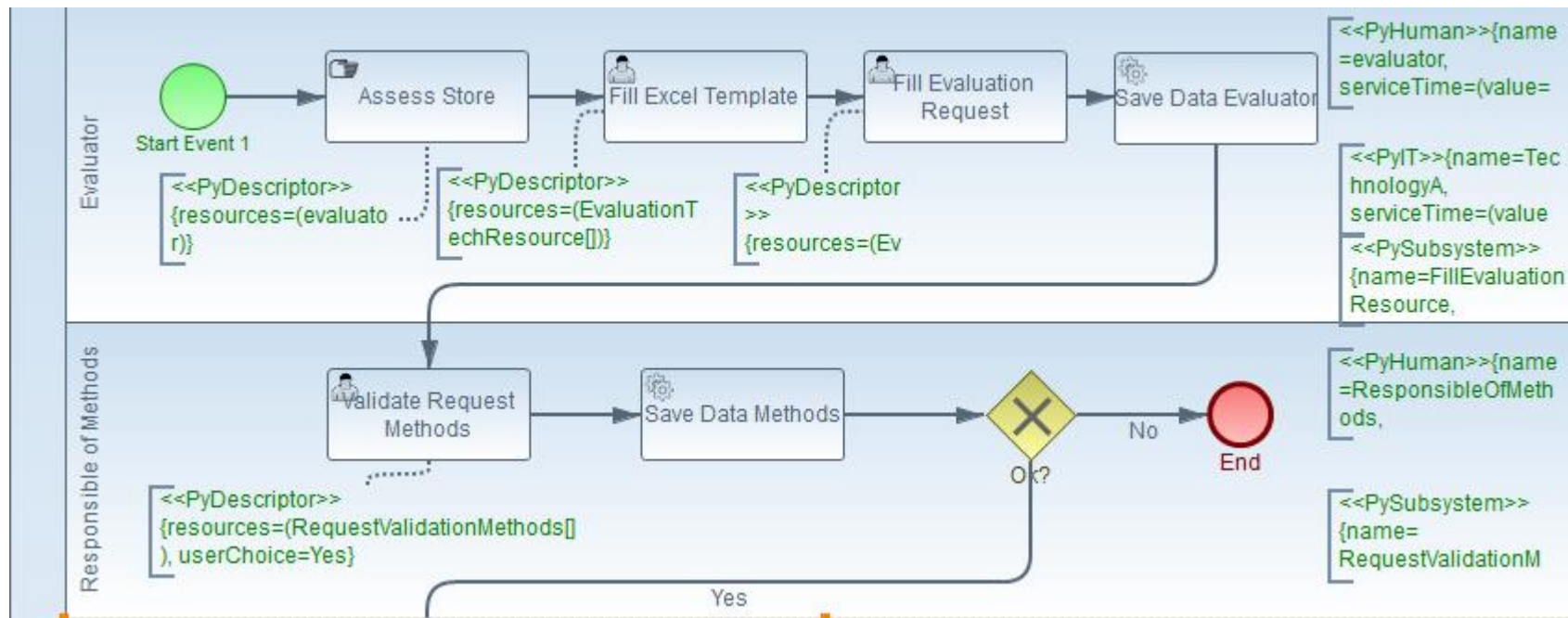
LEVEL 1 – High Level Model using BPMN

- Model in a more formal way the process to be automated
- Distinguish resources using only the different types of tasks of BPMN (user task, manual task service task, etc.)



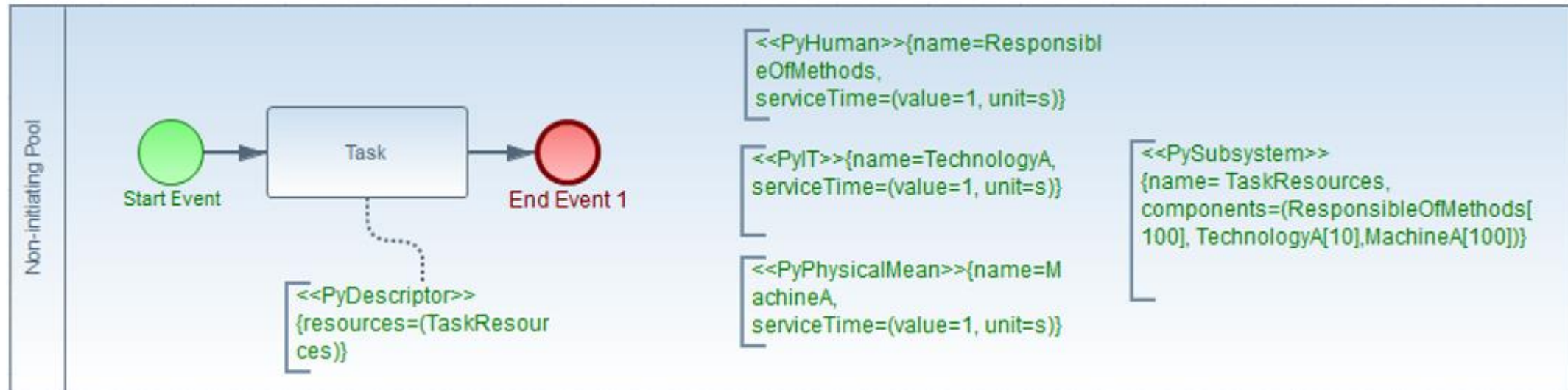
LEVEL 2 – Operational Model using BPMN

- Model functional operation of the process without implementation details using BPMN
- Model resources of each task using eBPMN
- Assign to each task its resources

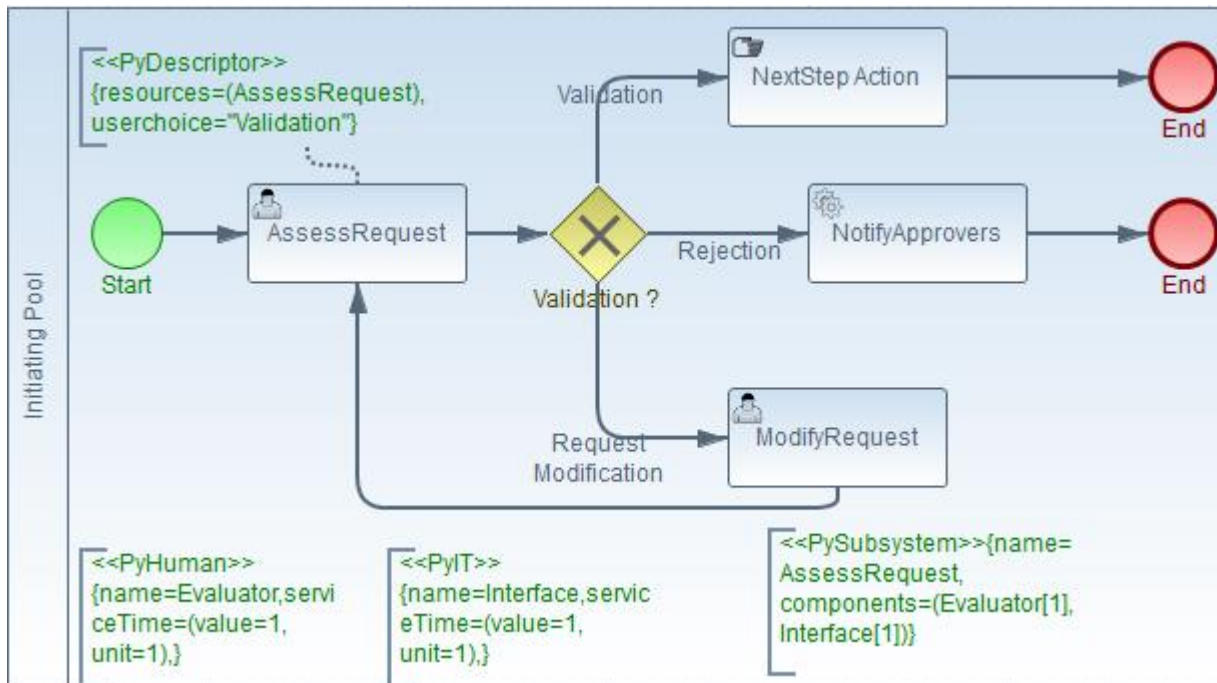


LEVEL 2 – Operational Model using BPMN

- Defining atomic resources
- Defining composite resources
- Assign the composite resource to the task

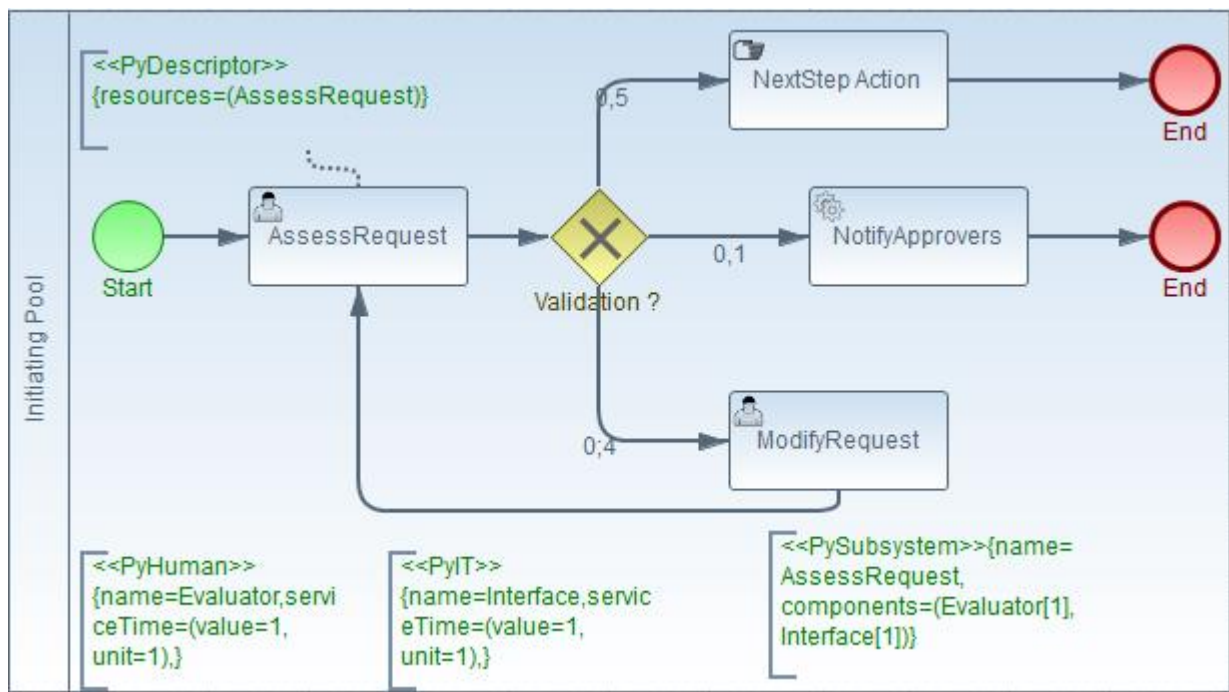


LEVEL 2 – Operational F Model using BPMN



Choose the paths to investigate by using the user choice or probability method

LEVEL 2 – Operational F Model using BPMN



- Choose the paths to investigate by using the user choice or probability method

LEVEL 3 – F Model simulation using eBPMN

- Carry paths verification to make sure they are reachable and compliant with functional requirements

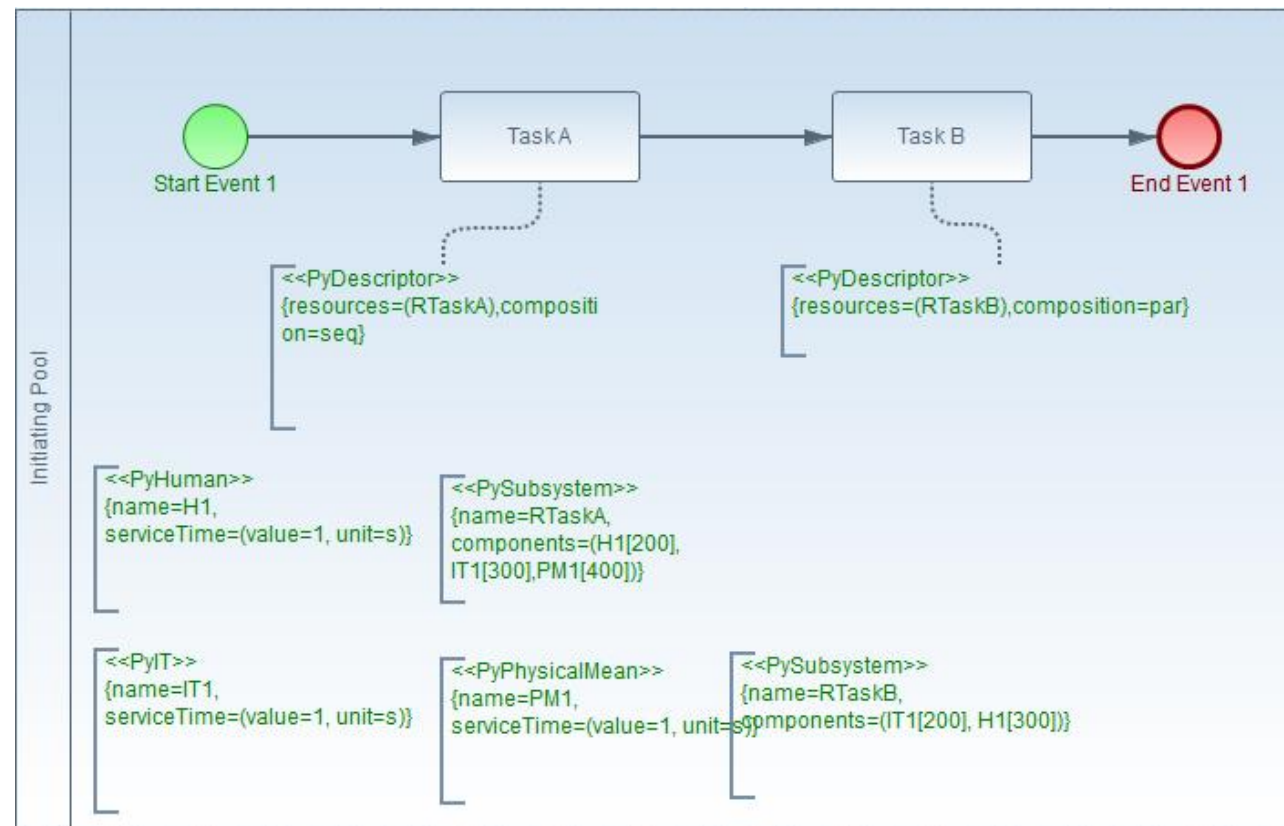
```
=====
                        PATH REACHABILITY
=====
=====
```

1. Start==>AssessStore==>FillTemplateFile==>FillEvaluationRequest==>SaveDataEvaluation==>ValidateRequestMethods==>SaveDataMethods==>RequestQualityValidation==>SaveDataQuality==>CheckLegalConditions==>SaveDataALegal==>AssessLegalConditions==>SaveDataRLegal==>ValidateRequestEvaluation==>SaveDataMFranchise==>NotifyEvaluatorAndOperators==>End
2. Start==>AssessStore==>FillTemplateFile==>FillEvaluationRequest==>SaveDataEvaluation==>ValidateRequestMethods==>SaveDataMethods==>RequestQualityValidation==>

```
=====
```

LEVEL 4 – Operational NF Model using eBPMN

- adding in details of the non-functional requirements of each type of resource



Global Simulation Result

=====

PATH STATISTICS: RESOURCE AGGREGATION

=====

Path..... :

Start Event 1=>Assess Store=>Fill Excel Template=>Fill Evaluation
Request=>Save Data Evaluation=>Validate Request Methods=>Save Data
Methods=>Validate Request Quality=>Save Data Quality=>Check legal
conditions=>Save DataA Legal=>Assess Legal Conditions=>Save DataR
Legal=>Validate Request Evaluation=>Save DataM Franchise=>Notify Evaluator and
operators=>End

Mean Service Time: 8780.753 min

Mean Waiting Time: 5639.485 min

=====

Global simulation result of each type of resource

```

=====
                                PATH STATISTICS: RESOURCE TYPE DETAILS
=====

##### Path..... :
Start Event 1=>Assess Store=>Fill Excel Template=>Fill Evaluation
Request=>Save Data Evaluation=>Validate Request Methods=>Save Data
Methods=>Validate Request Quality=>Save Data Quality=>Assess Legal
Conditions=>Save DataR Legal=>Validate Request Evaluation=>Save DataM
Franchise=>Notify Evaluator and operators=>End
Mean Service Time .....: 8800.168 min
Mean Waiting Time .....: 5700.890 min
=====
##### Resources Path..... :

Type Resources..... :

Human Resources:
*****
Mean Service Time .....: 7900.133 min
Mean Waiting Time .....: 4000.226 min
IT Resources:
*****
Mean Service Time .....: 8000.35 min
Mean Waiting Time .....: 5700.890 min
=====

```

Detail simulation result

```
=====
### Element name..... : InterfaceLegalOpinion

Resource Type.....: Interface
Final state .....: Active (with probability 1.0000)
Mean of service time .....: 1830.000 min
Mean of waiting time .....: 600.000 min
=====
```

LEVEL 5 - Implementation

- Describe in more detail how the implementation of a system uses a particular type of resource
- Decide on the precautions to be taken in order to increase the reliability of the process as much as possible

❑ Conclusion

- Proposing a process automation methodology based on resource analysis
 - 1 – Distinguishing resource's type
 - 2 – Aggregation resource's performance
 - 3 – Display path simulation results

❑ Works limitation

- Using text annotation for non-functional properties
- Non-functional requirements are limited to service time and reliability
- Finding a way to establish the relation between the non-functional properties