EXPLORE DESIGN PERFECTION

Workflow Modeling for Collaborative Engineering

Vicenza, October 9th 2018

esteco.com

About ESTECO

VOLTA

Web-based solution for multidisciplinary business process optimization and simulation data management

modeFRONTIER

Desktop solution for process automation and optimization

ESTECO ACADEMY

Community of practice dedicated to students, researchers and professors in optimization-based design projects

BEEPMN

Free BPMN web editor facilitating collaborative Business Process management

Today's Agenda

How can you maximize the use of workflow modeling?

- From Process to Business Process Management
- Business Process Model and Notation
- BPMN use case within Composelector
- Workflow modeling for industrial applications

Today's Speakers

Piero Donat
Web Marketing Specialist

Marco Turchetto
Support Engineer

Alessandro Turco
Project Manager

Dario Campagna
Agile Coach

Process or Project?

ONE LETTER AT A TIME

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BeePMN

Process or Project?

ONE LETTER AT A TIME

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Project defined by:

- Fixed time
- Scope
- Resources

Project's goal:

- Execute change
- Incorporate it into the day-to-day processes of the company

Process or Project?

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Process:

‘An entire set of activities that start with a triggering event and end with some output being delivered’

From *Business Analysis* (3rd Edition) by Debra Paul, James Cadle and Don Yeates, published by BCS, The Chartered Institute for IT

Process or Project?

ONE LETTER AT A TIME

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Process

- Defined by cycles
- Similar to a project
- Has a beginning, middle and end
- Cycle repeats itself over an average period of time

Business Process

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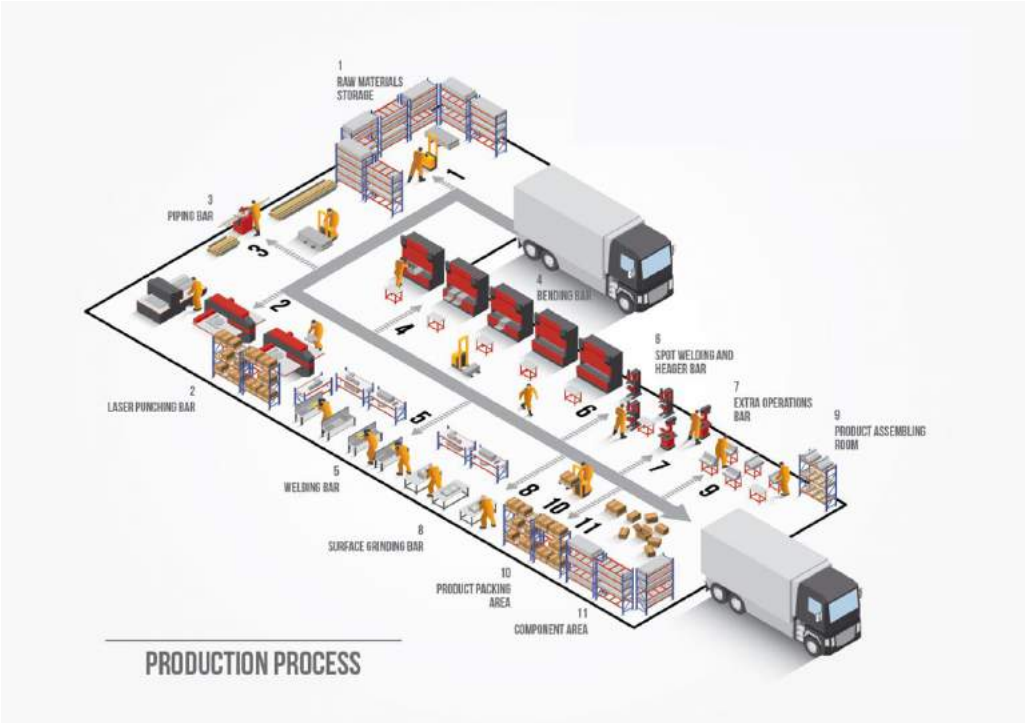

Business Process

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"A linked set of tasks performed by a business in response to a business event. The business process receives, manipulates and transfers information or physical items, in order to produce an output of value to a customer."

From *Business Analysis* (3rd Edition) by Debra Paul, James Cadle and Don Yeates, published by BCS, The Chartered Institute for IT

Business Process

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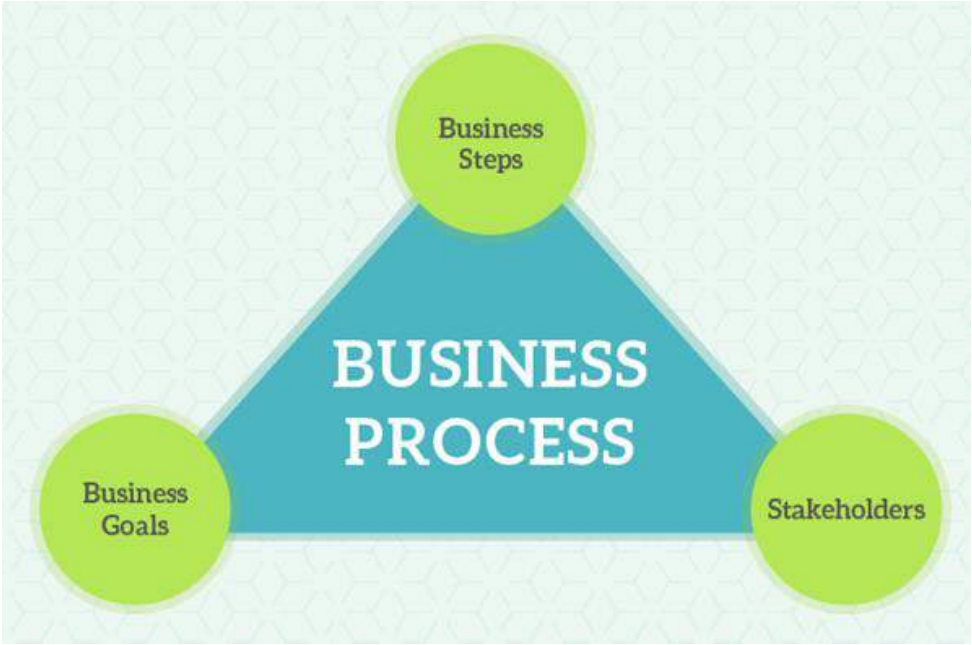
...in a few words:

a series of steps performed by a group of stakeholders to achieve a concrete goal



Business Process

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- Finite
- Repeatable
- Creates value
- Flexibility

Business Process Management

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“A discipline involving any combination of modeling, automation, execution, control, measurement and optimization of business activity flows, in support of enterprise goals, spanning systems, employees, customers and partners within and beyond the enterprise boundaries.”

"What is BPM? - Workflow Management Coalition". wfmc.org

Business Process Management

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...in a few words:

BPM focuses on improving corporate performance by managing business processes

Business Process Management

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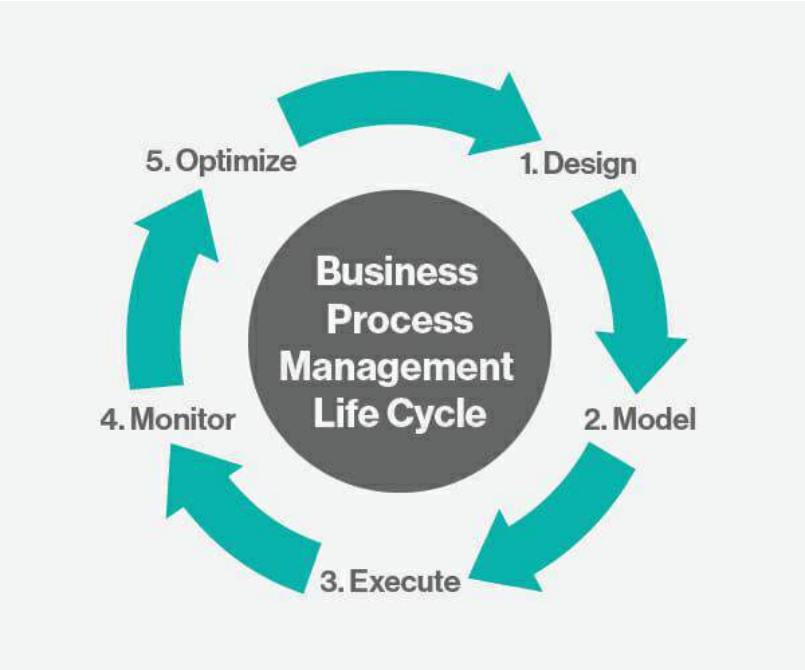
BPM activities:

- Design
- Model
- Execute
- Monitor
- Optimize



Business Process Management

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Process design includes:

- Identification of existing processes (‘as is’)
- Design of ‘to-be’ processes
- Areas of focus:
  - Process flow and its factors
  - Alerts and notifications
  - Escalations
  - Standard operating procedures
  - Service level agreements
  - Task hand-over mechanisms

Business Process Management

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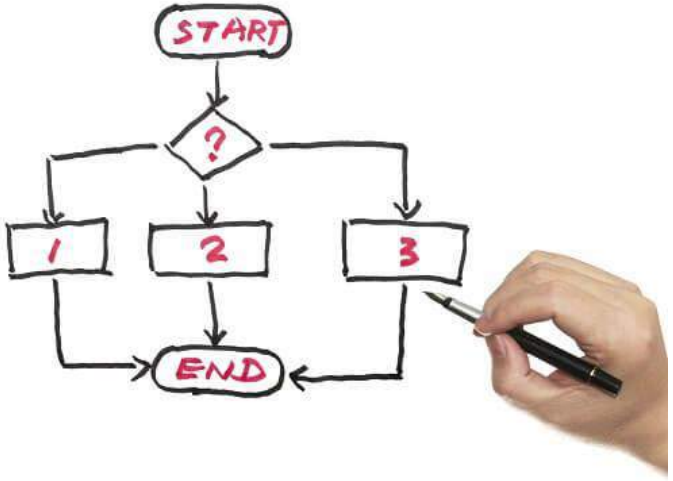
Modeling takes the theoretical design and introduces combinations of variables



Business Process Management

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Execution is broadly about enacting a discovered and modelled business process. This can be done:

- Manually
- Automatically
- With a combination of manual and automated business tasks

Business Process Management

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Monitoring

- Tracking of individual processes
- Improving processes to work with customers and suppliers
- Process mining

Business Process Management

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Optimization

- Retrieving process performance information
- Identifying bottlenecks and cost savings
- Applying enhancements to design process

Business Process Model and Notation

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- International Standard (OMG – ISO)
- Widely adopted
- Model and Notation
- Execution semantic
- Rich and Extensible
- DMN - CMMN

Business Process Model and Notation

ONE LETTER AT A TIME

- P
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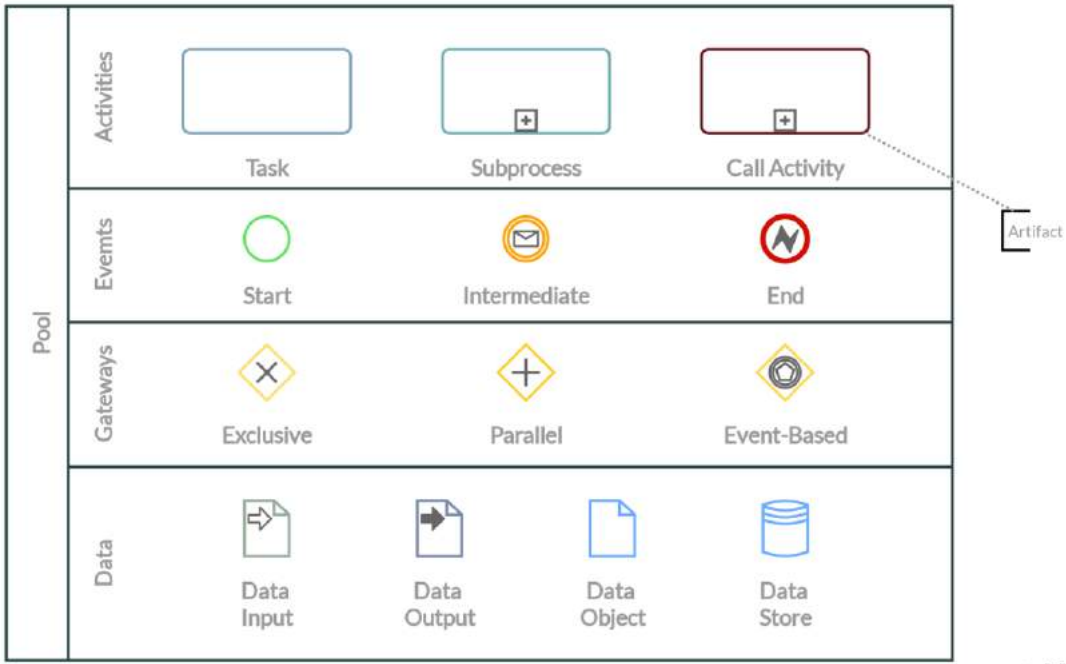
- BPM
- BPMN
- BeePMN

BPMN – main elements



Business Process Model and Notation

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Activities

Business Process Model and Notation

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Activities

Business Process Model and Notation

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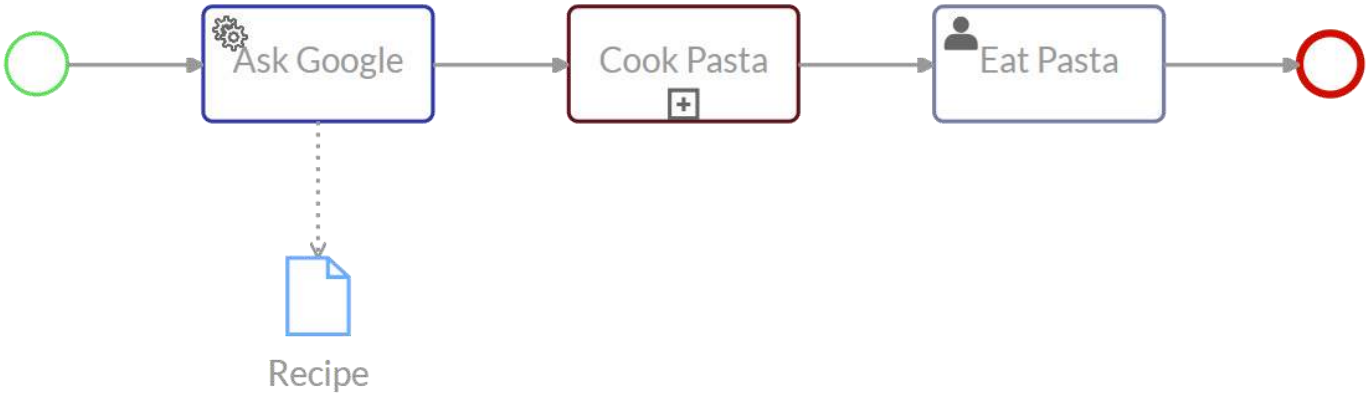
Data



Business Process Model and Notation

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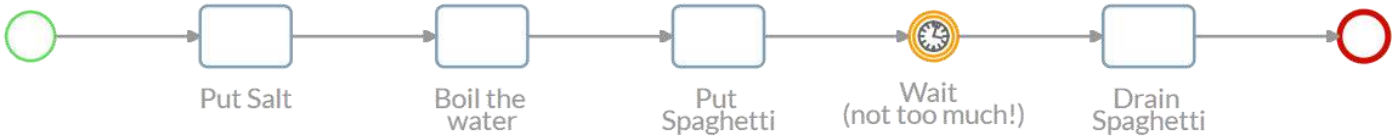
Events



Business Process Model and Notation

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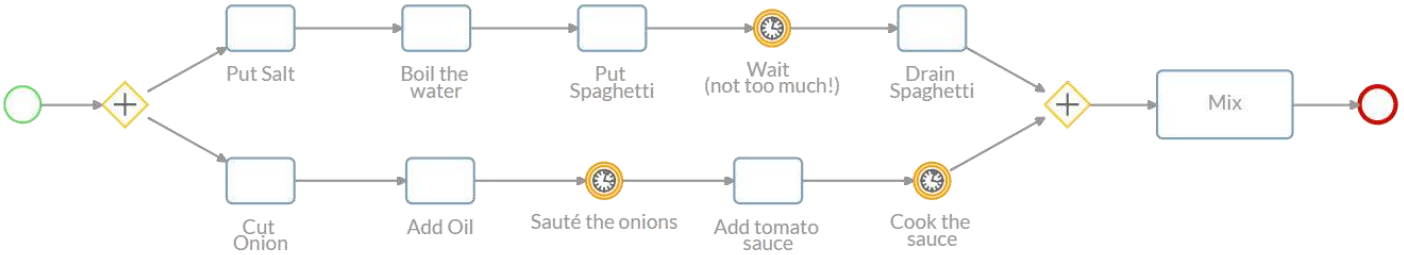
Parallel Gateway



Business Process Model and Notation

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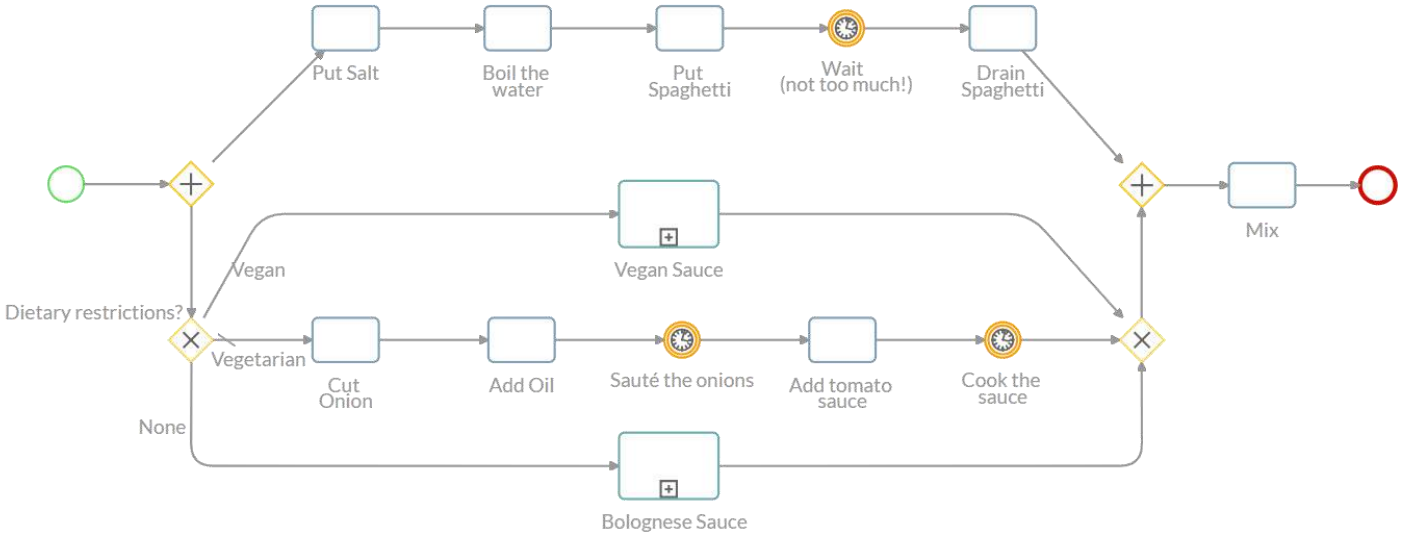
Exclusive Gateway



Business Process Model and Notation

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Boundary events

Business Process Model and Notation

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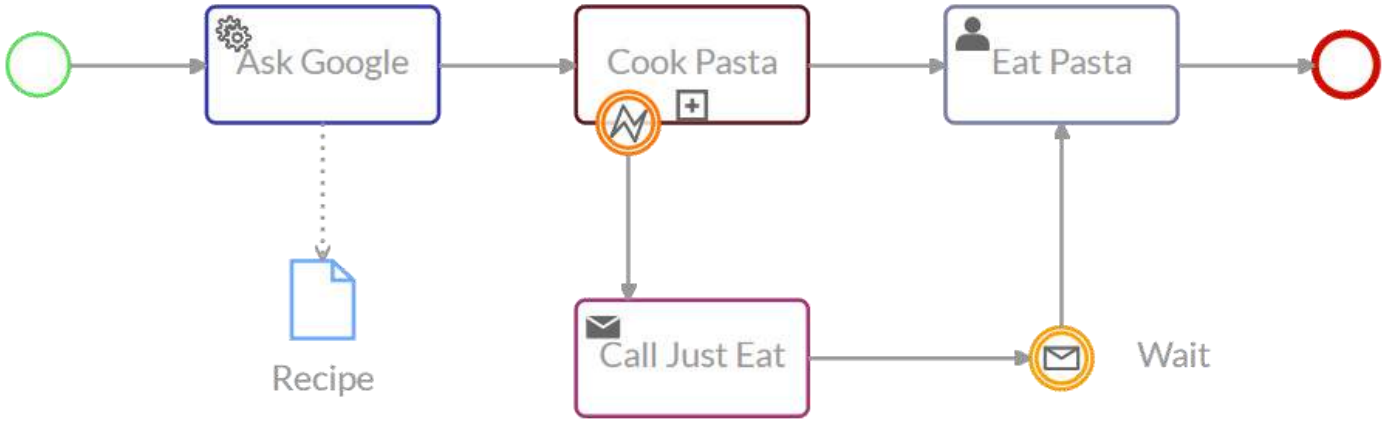
Boundary Events



Business Process Model and Notation

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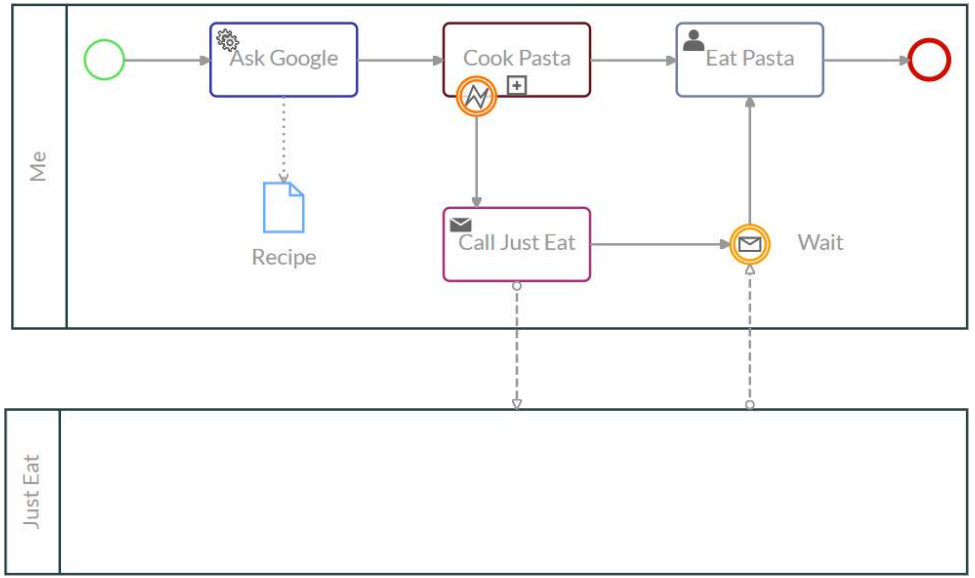
Pools and Messages



Business Process Model and Notation

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BPMN – XML

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Business Process Model and Notation

ONE LETTER AT A TIME

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BeePMN

BPMN – Live Demo

BPMN & DMN

ONE LETTER AT A TIME

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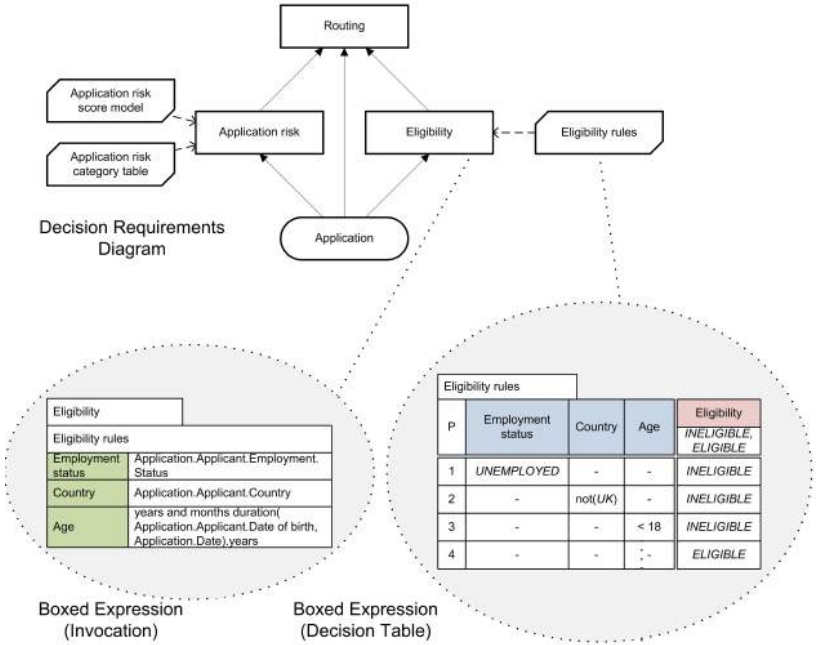
DMN



BPMN + DMN

ONE LETTER AT A TIME

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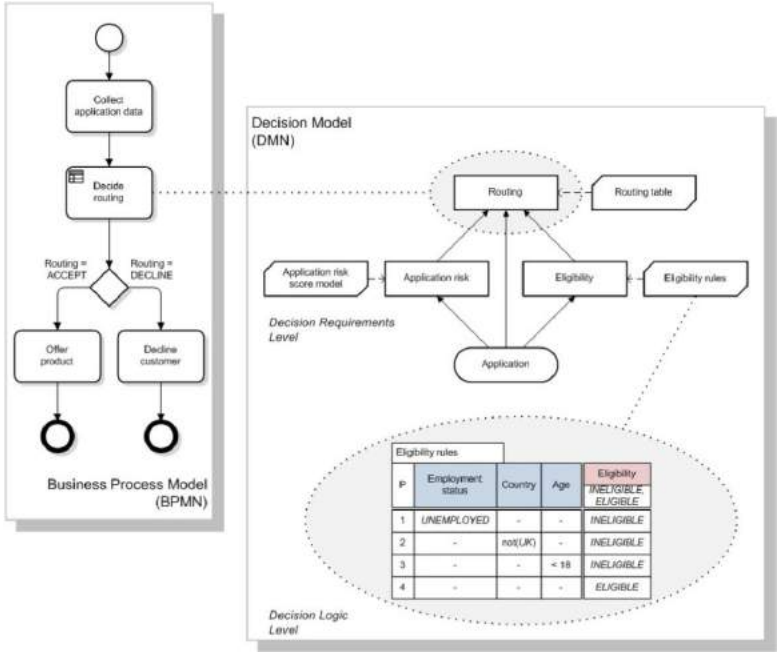
BPMN + DMN



Mission

Develop a Business Decision Support System (BDSS) for the selection and design of polymer-matrix composites.

Partners

COMPOSELECTOR
Polymer Composites
Business Decision Support System

ONE LETTER AT A TIME

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BeePMN

Integration of

Material modeling, multi-criteria optimization, business and decision processes (BPMN, DMN).

Application cases

Dow – composite leaf-spring

Dow Leaf Spring Application Case

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BeePMN

- **Composite** suspension leaf spring
- Carbon reinforced polymers in parallel with glass-reinforced polymers
- BDSS for material and manufacturing process selection for **large production**
- **KPIs** include weight, stiffness, time cycle, material costs, etc.

Hierarchical Top-down Modeling

ONE LETTER AT A TIME

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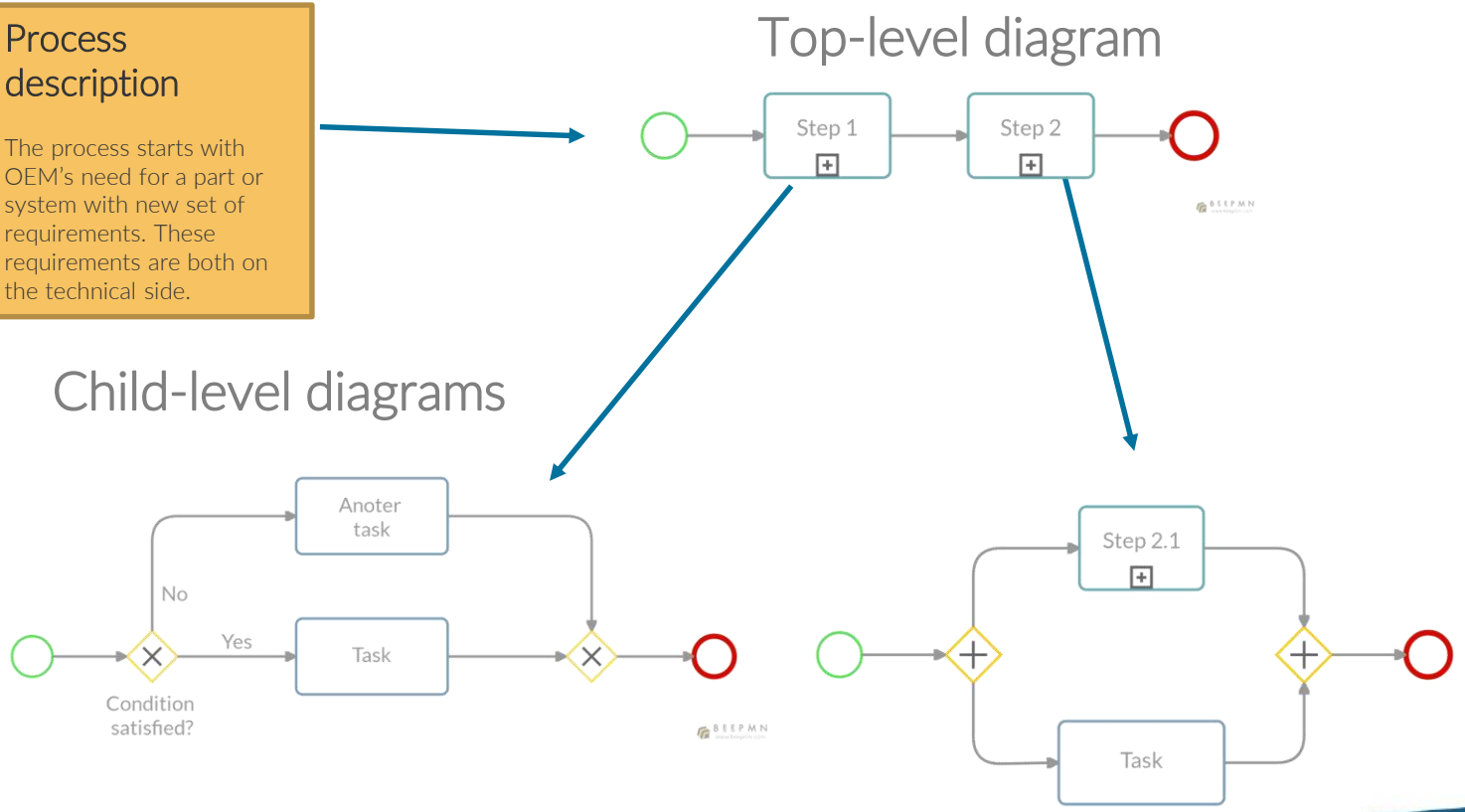
- BeePMN

Process description

The process starts with OEM's need for a part or system with new set of requirements. These requirements are both on the technical side.



Hierarchical Top-down Modeling

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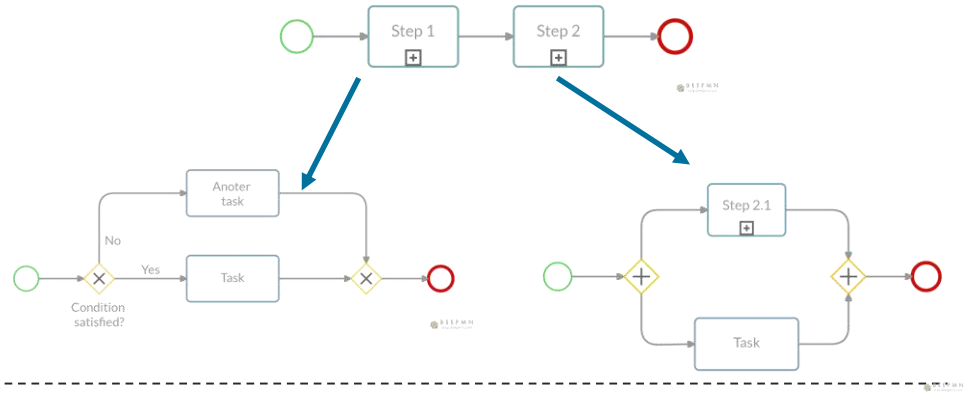
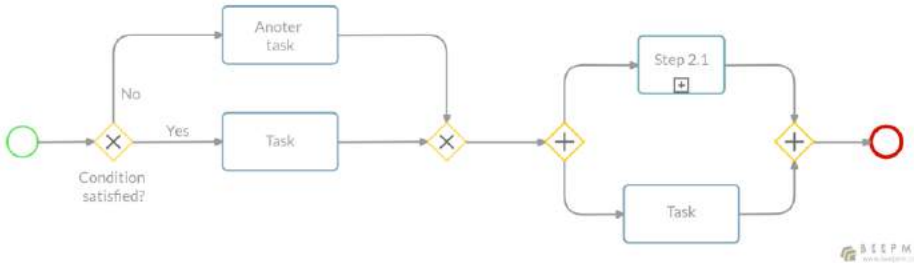
- BPMN
- BeePMN

Hierarchical



vs

Flat



Dow Top-level Diagram

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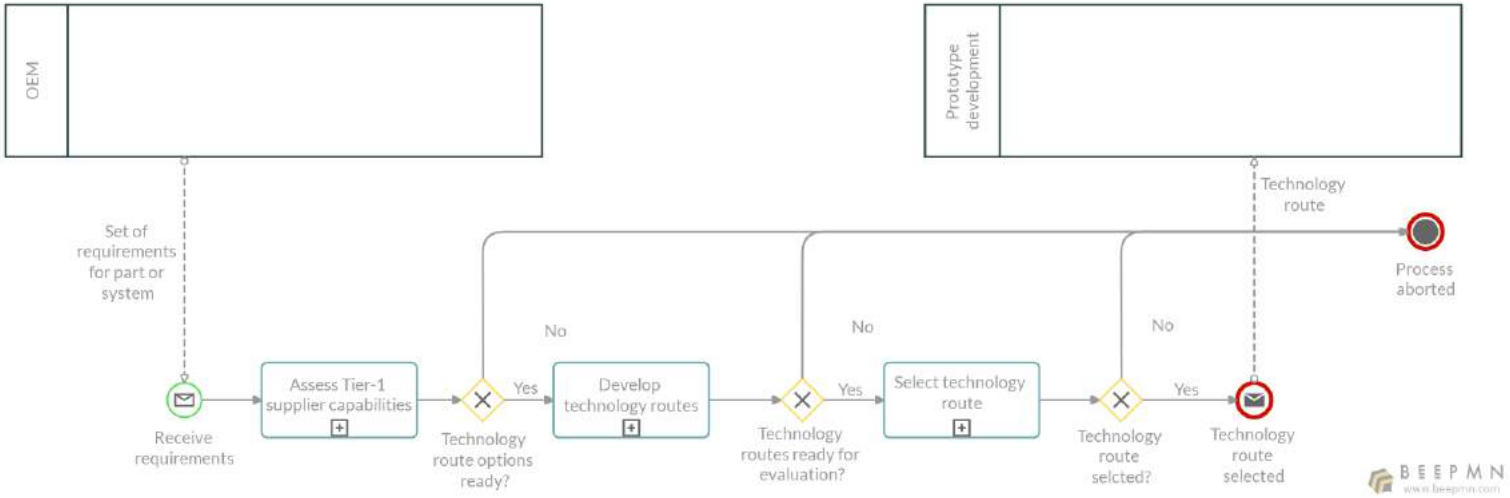

Dow Child-level Diagram

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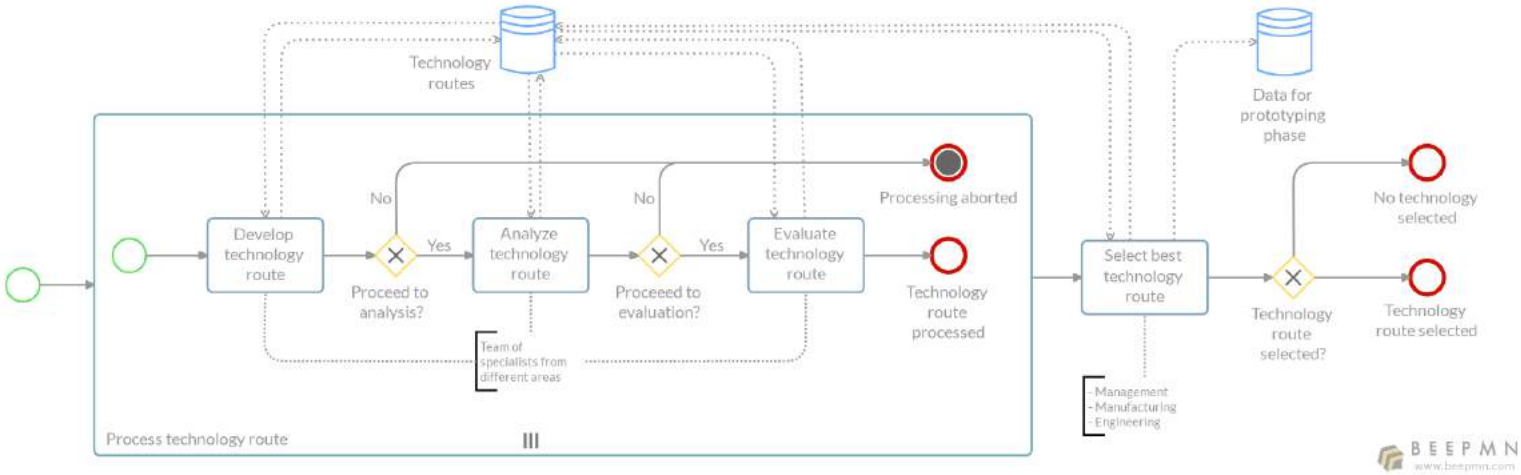

Modeling Business Decisions

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- Application cases' BPMN models highlighted **business decisions** on materials and processes
- **BPMN** and **DMN** will be used to model business decisions
- BDSS will run BPMN models including
  - DMN decisions
  - Material and process simulations
  - Engineering related activities (human-in-the-loop)

EXPLORE DESIGN PERFECTION

Workflow Modeling for Industrial Applications

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Industrial Application

- Experts should focus on more added value engineering
- Simulation is automated: engineer focuses on the idea
- Corporate knowledge has to be captured and re-used

Scenario

Analysis Model Preparation

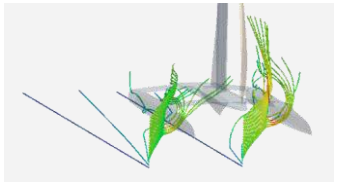
Logic Process Preparation

Run Simulation

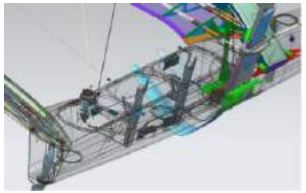
Analyze Data

Decision

Complex System

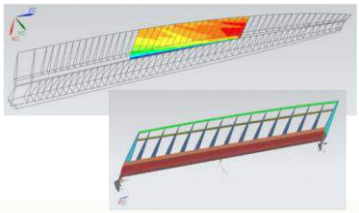


Hydrofoil Systems



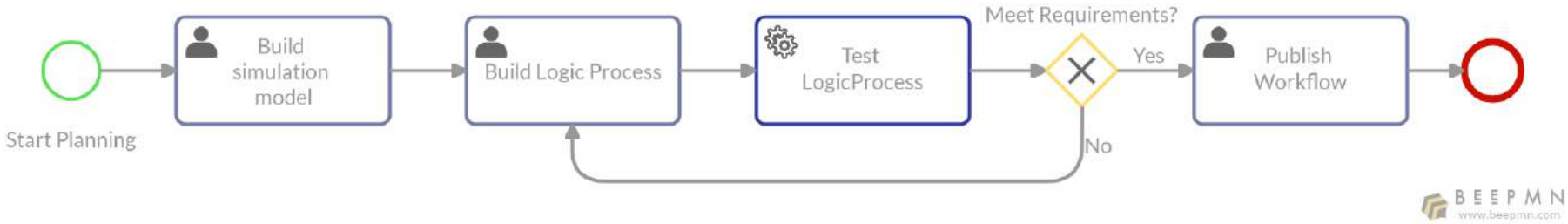
System & Control

Structural Response

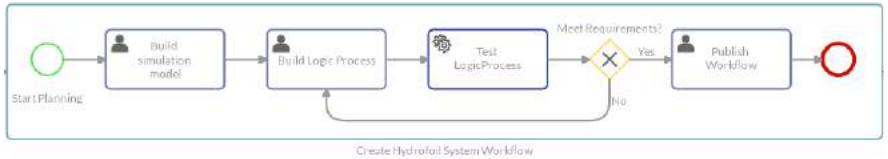


Wing Flap

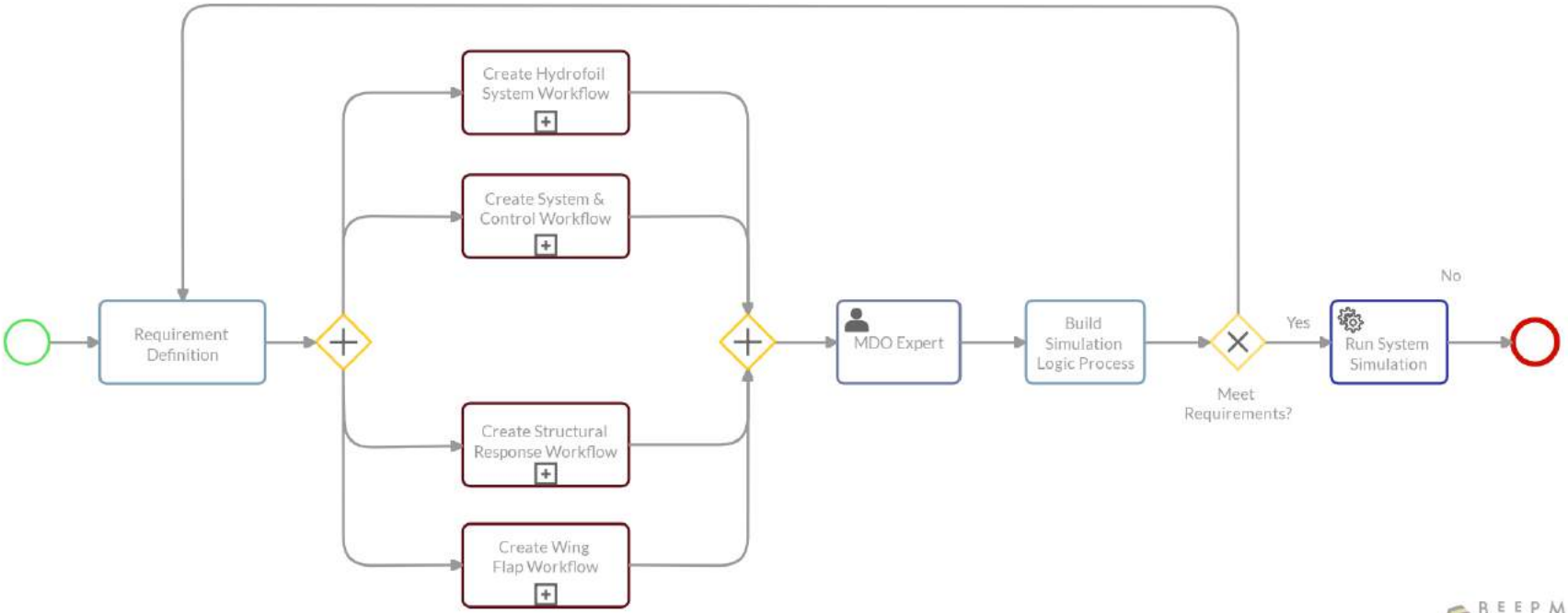
Hydrofoil System



Complex System



Complex System



Scenario

Analysis Model Preparation

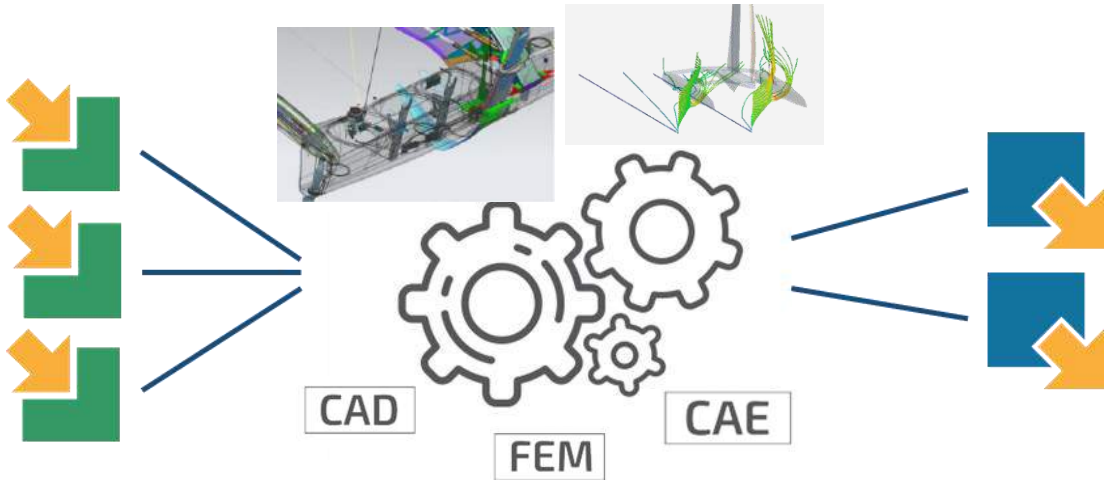
Logic Process Preparation

Run Simulation

Analyze Data

Decision

Main requirements from Industry



Input Variables

Black Box

Output Variables

INTEGRATION & PROCESS AUTOMATION

Powerful Workflow

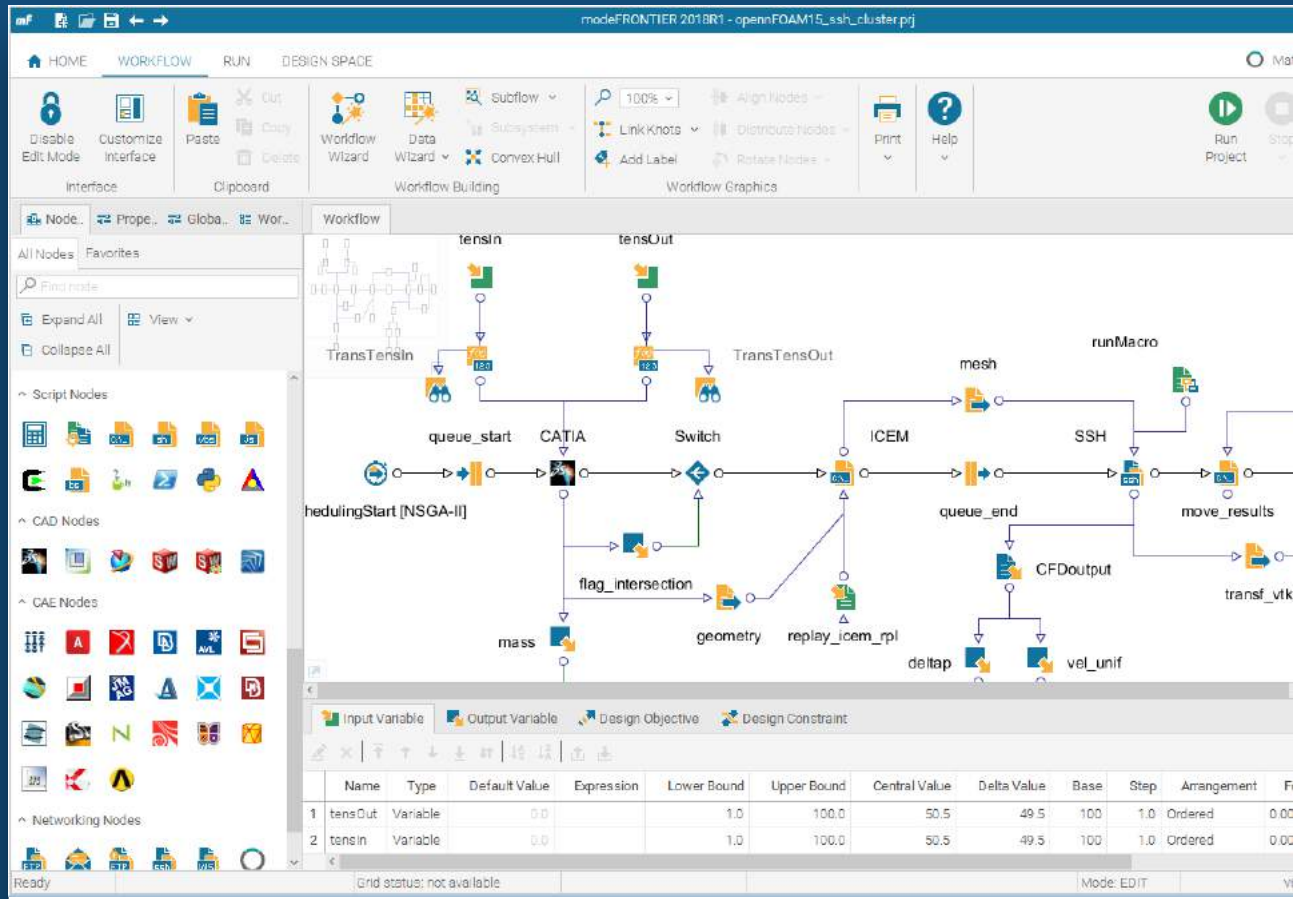
Streamline and automate your engineering process within an integrated workflow.

Direct Integration

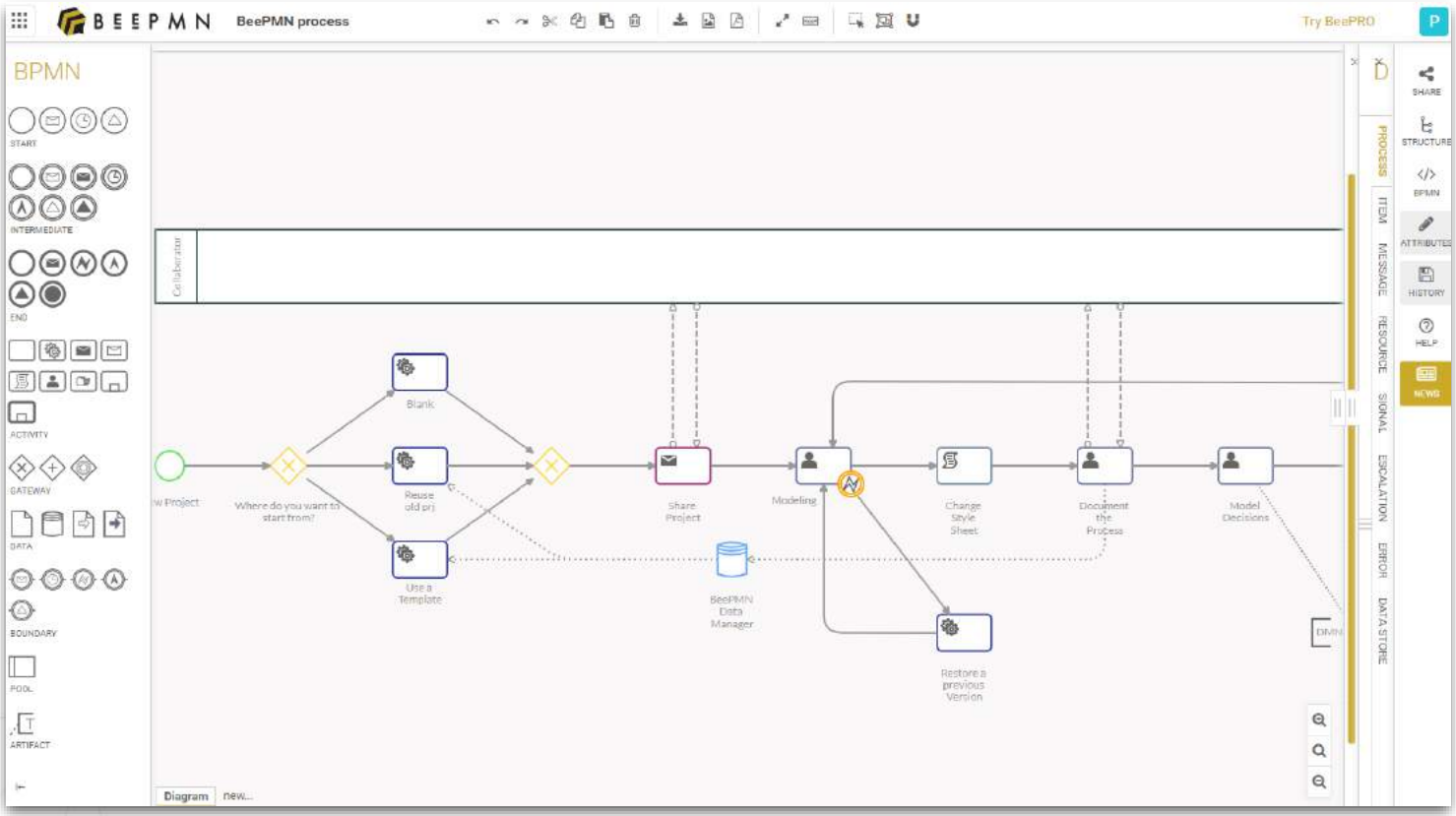
seamlessly integrate third-party solvers into a unique, automated workflow.

Save Time

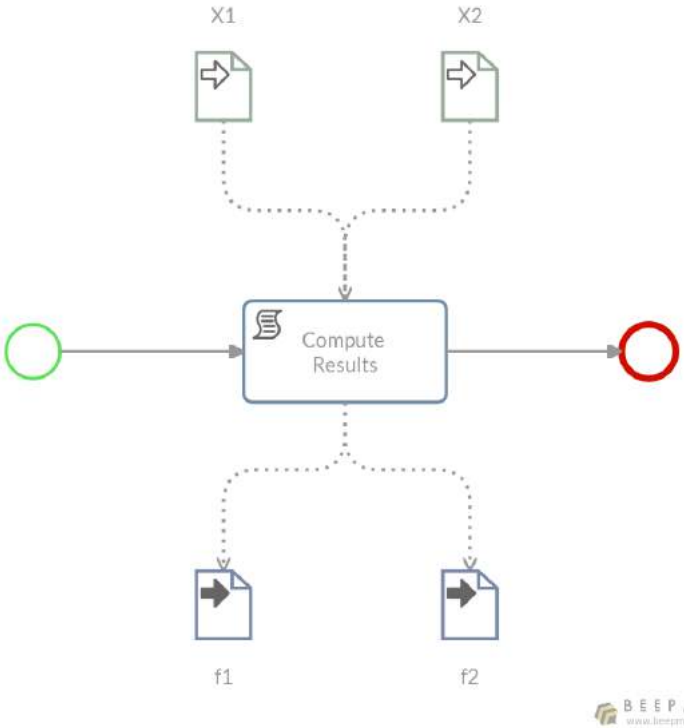
automatically run repetitive simulations and avoid the process of manually combining the output from multiple applications.

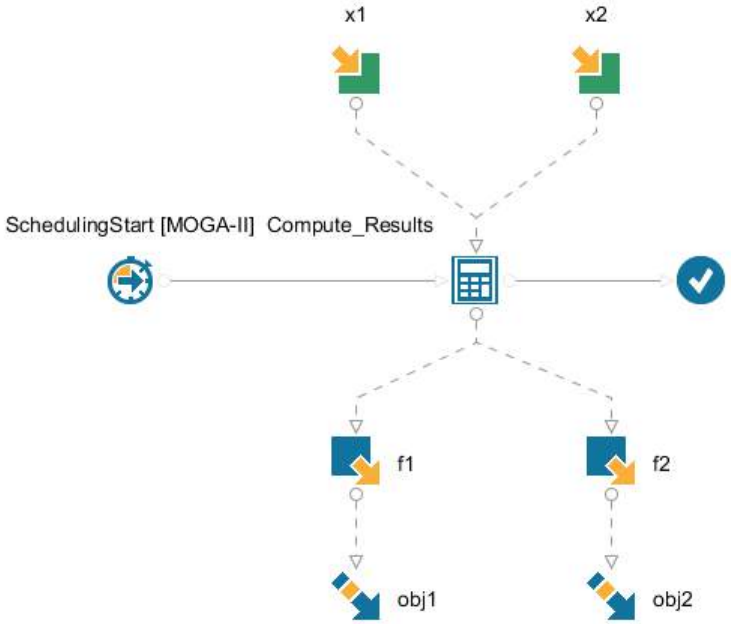


From BPMN to Industrial Complexity

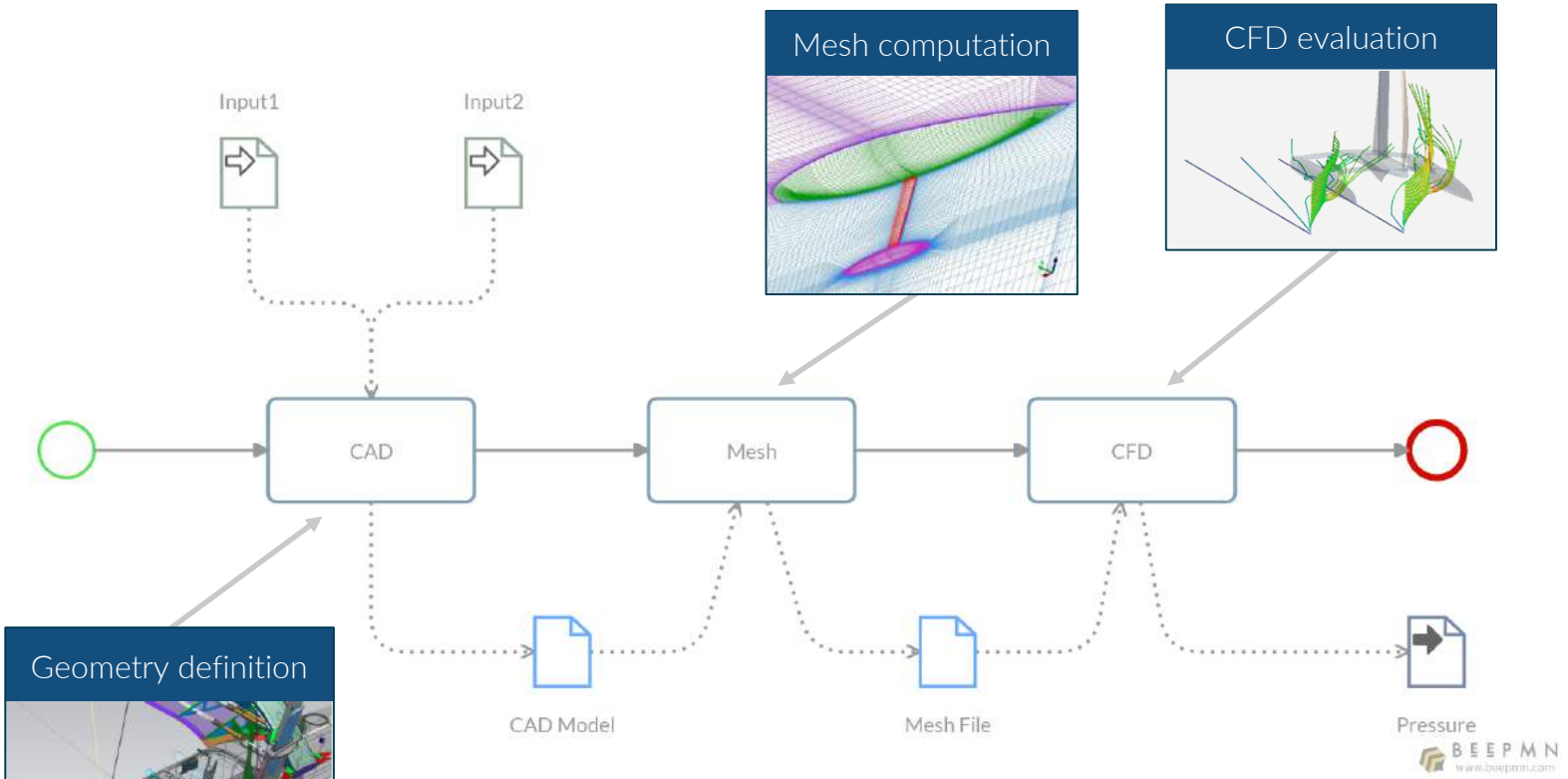


From BPMN to Industrial Complexity

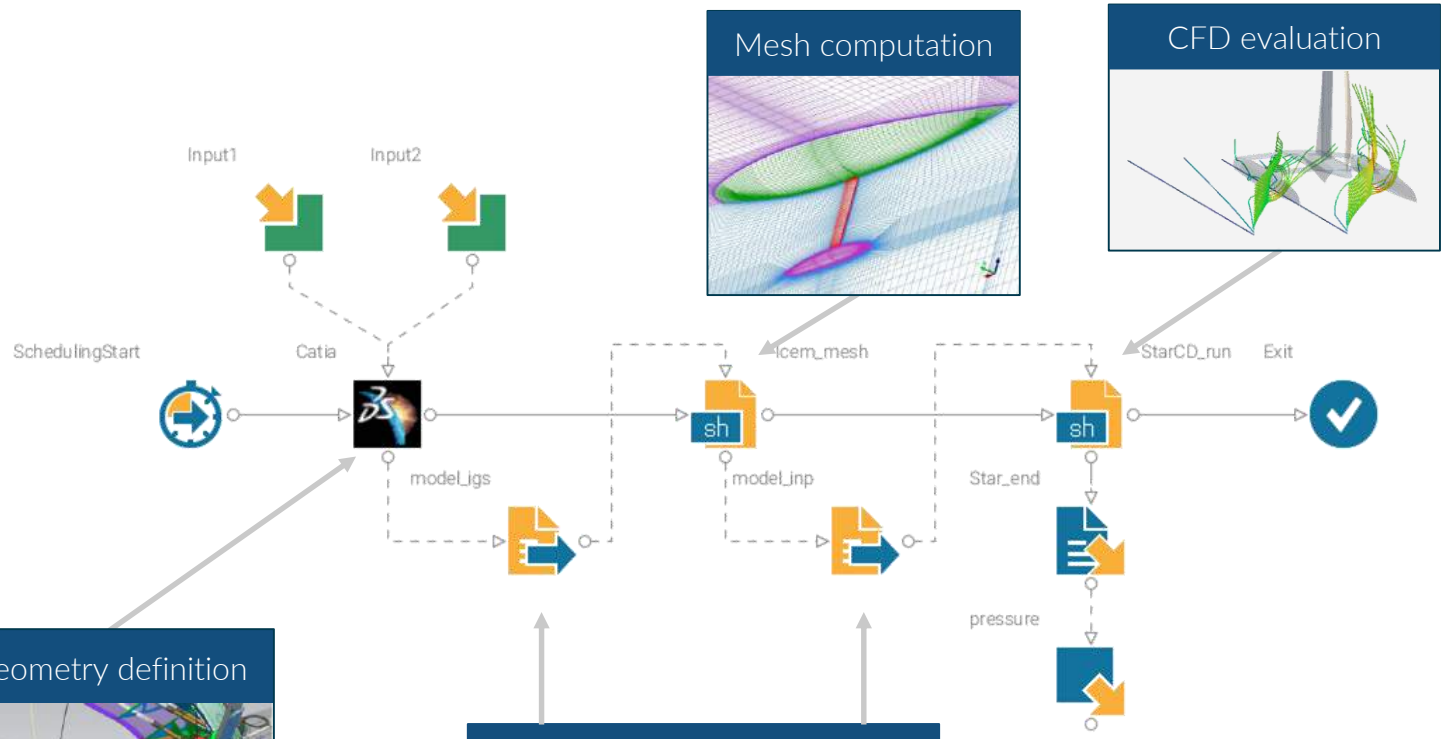




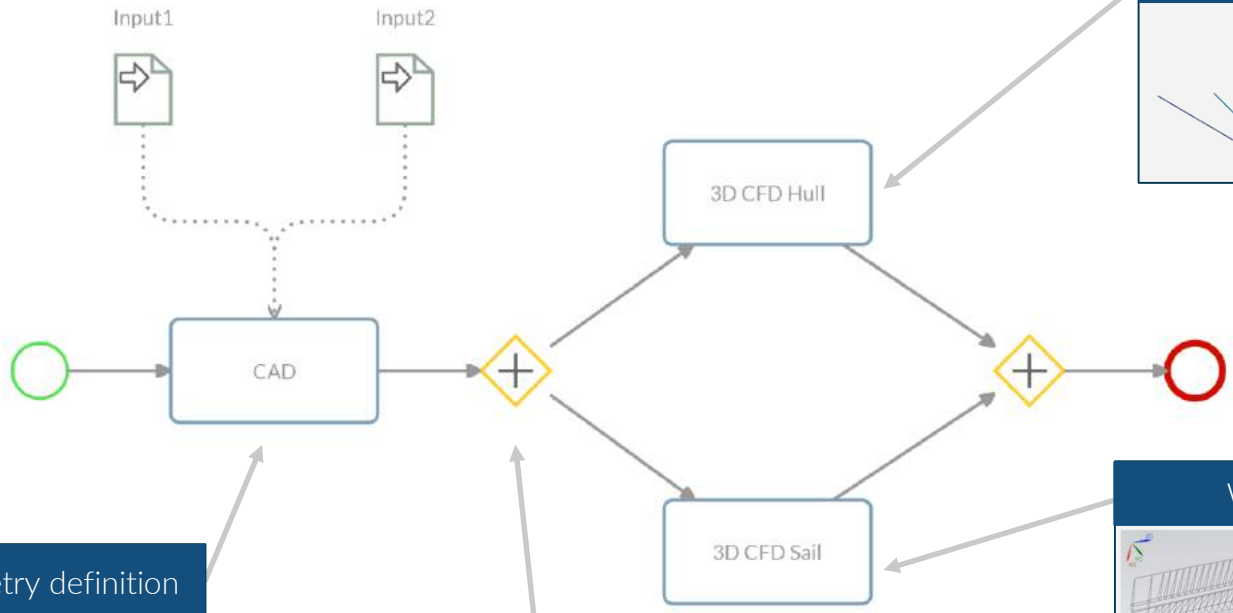
Sequential execution



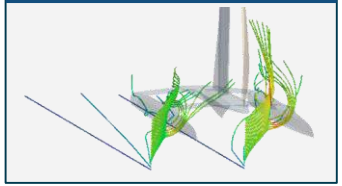
Sequential execution



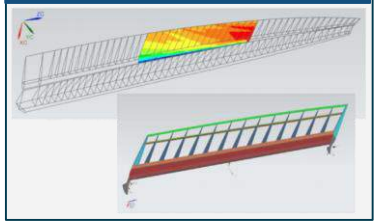
Modelling Workflow Complexity: parallel execution



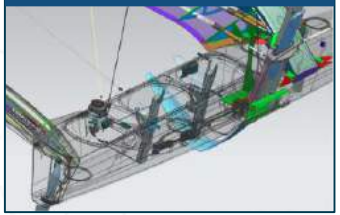
CFD evaluation



Wing Flap

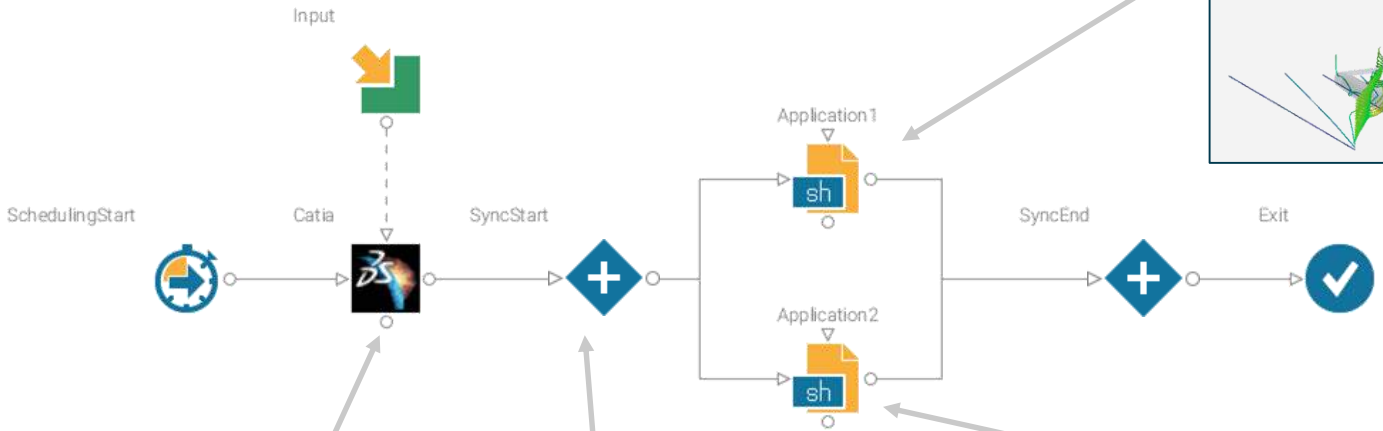


Geometry definition

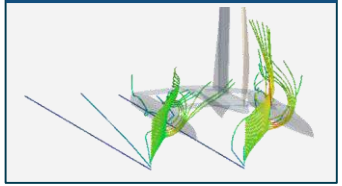


Parallel Execution:
Wait for both application to be completed

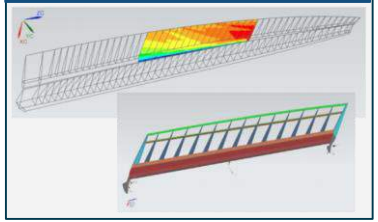
Modelling Workflow Complexity: parallel execution



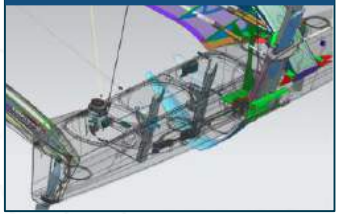
CFD evaluation



Wing Flap

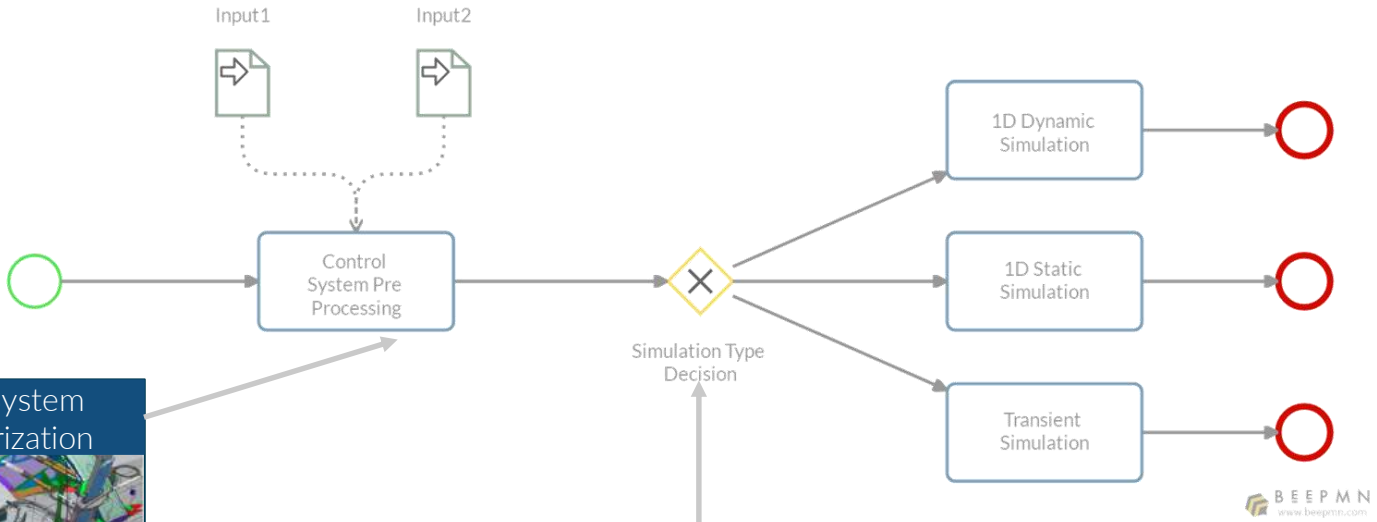


Geometry definition

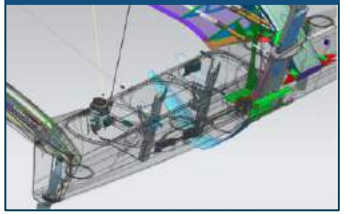


Parallel Execution:
Wait for both application to be completed

Modelling Workflow Complexity: conditional execution



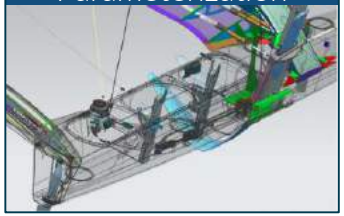
Control System Parameterization



Switch: the given expression can assume different values.

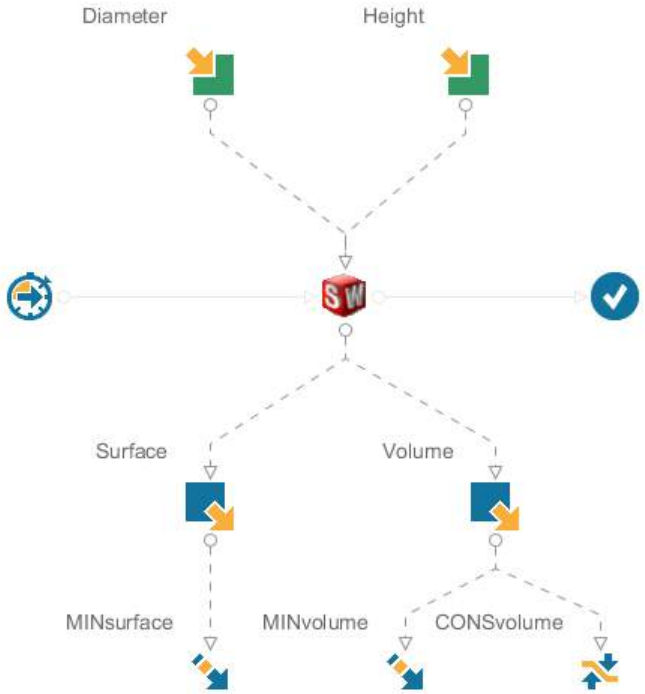
Modelling Workflow Complexity: conditional execution

Control System Parameterization



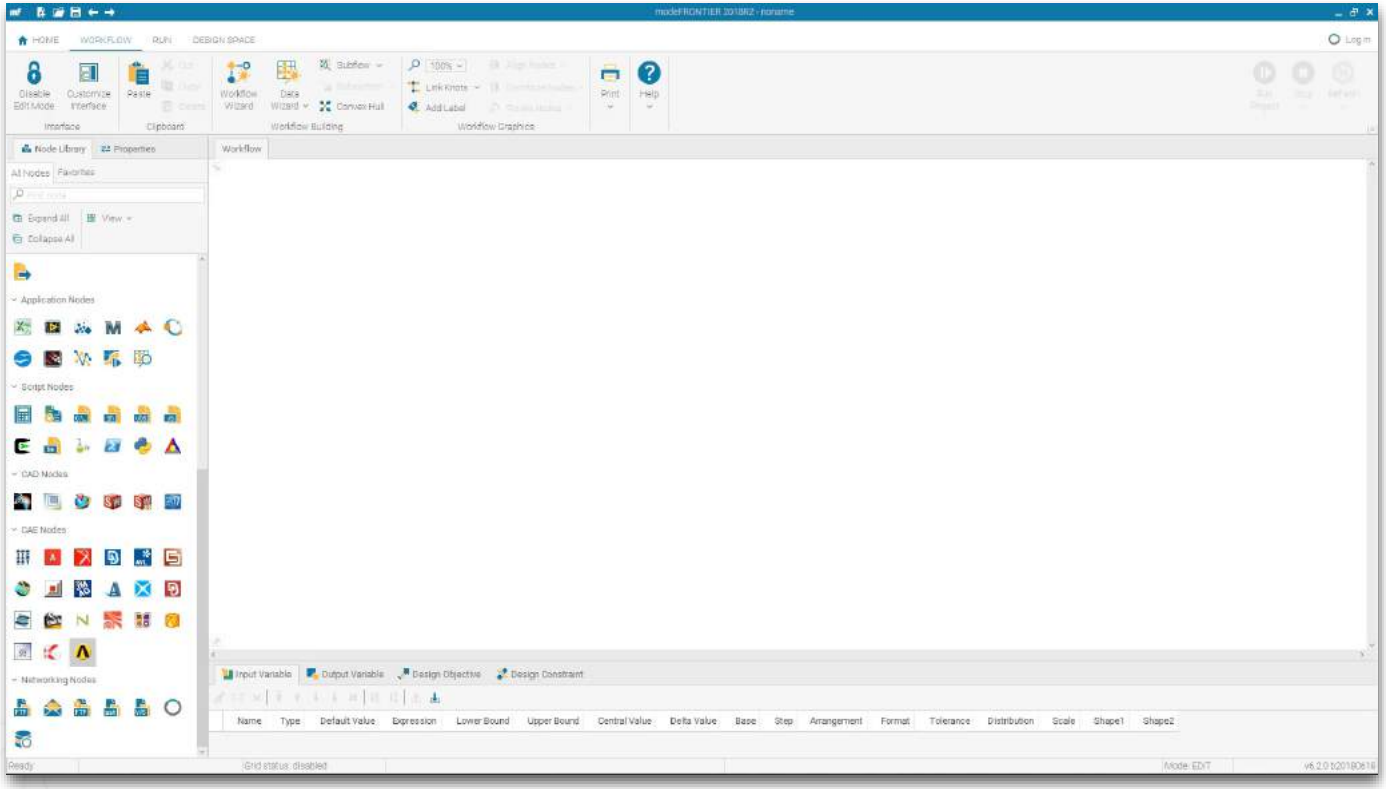
Switch: the given expression can assume different values.

Process Automation: CAE interfaces

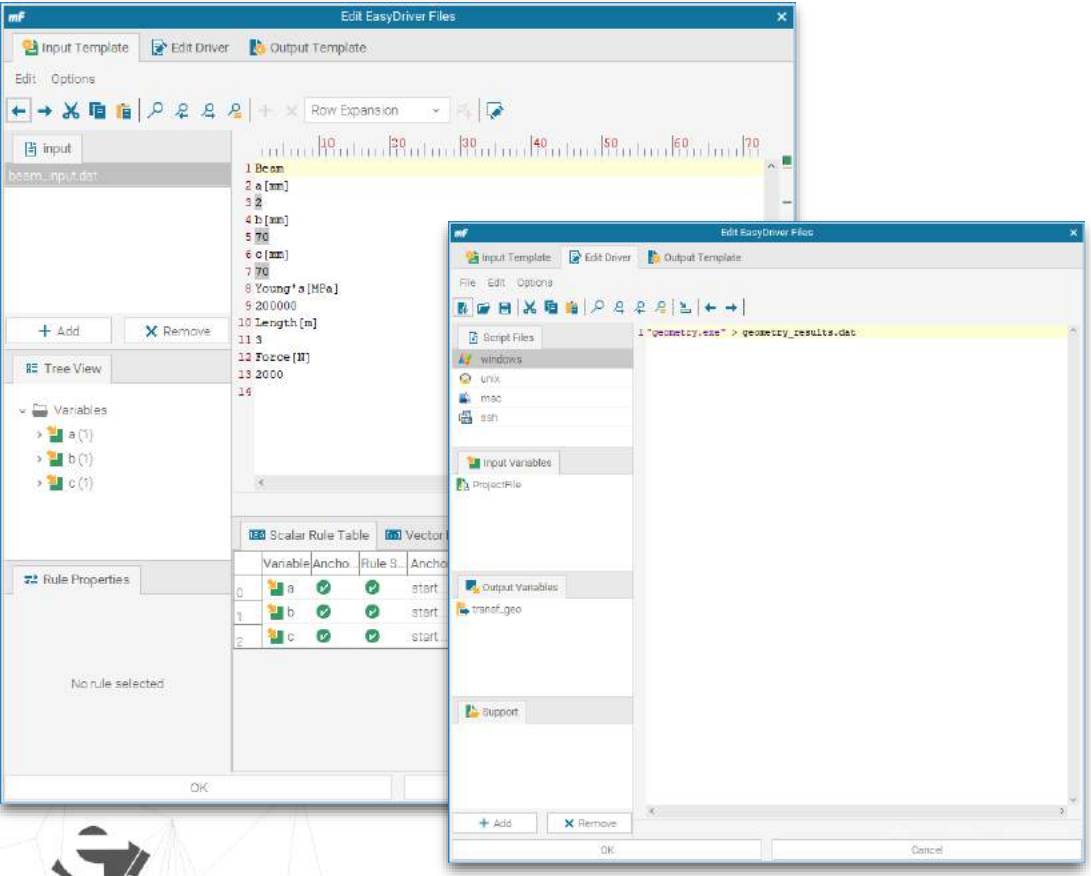


- Select the CAE model file
- Introspection: uses API to identify I/O parameters of the model
- Assign model parameters to workflow entities

Process Automation: CAE interfaces



Process Automation: Generic Integration

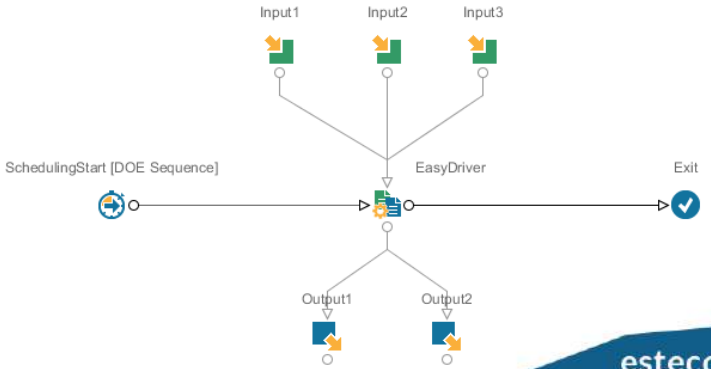


Input/Output template:

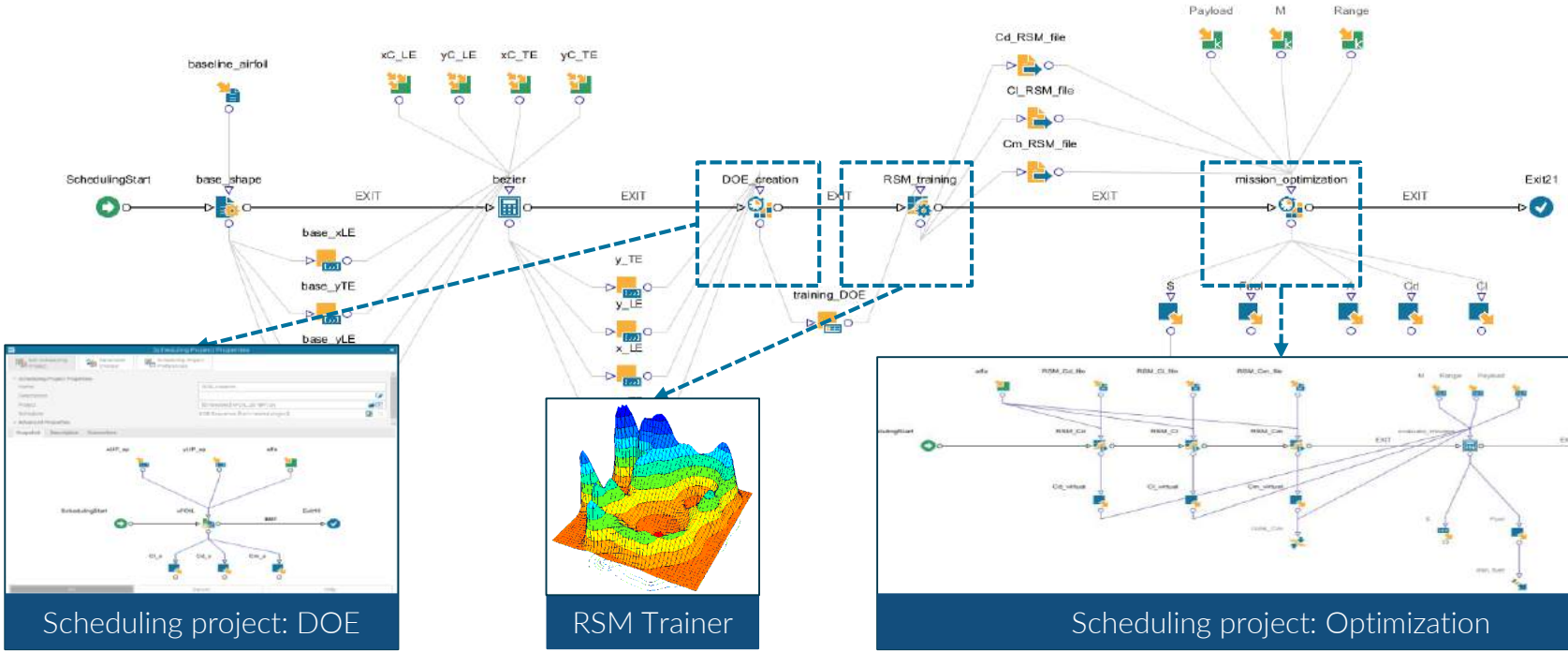
Define I/O template rules for each variable to be updated/retrieved

Driver:

Define script commands to batch run the solver



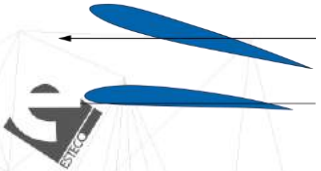
Modelling Workflow Complexity: nested workflows

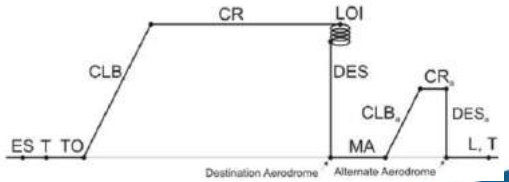


Scheduling project: DOE

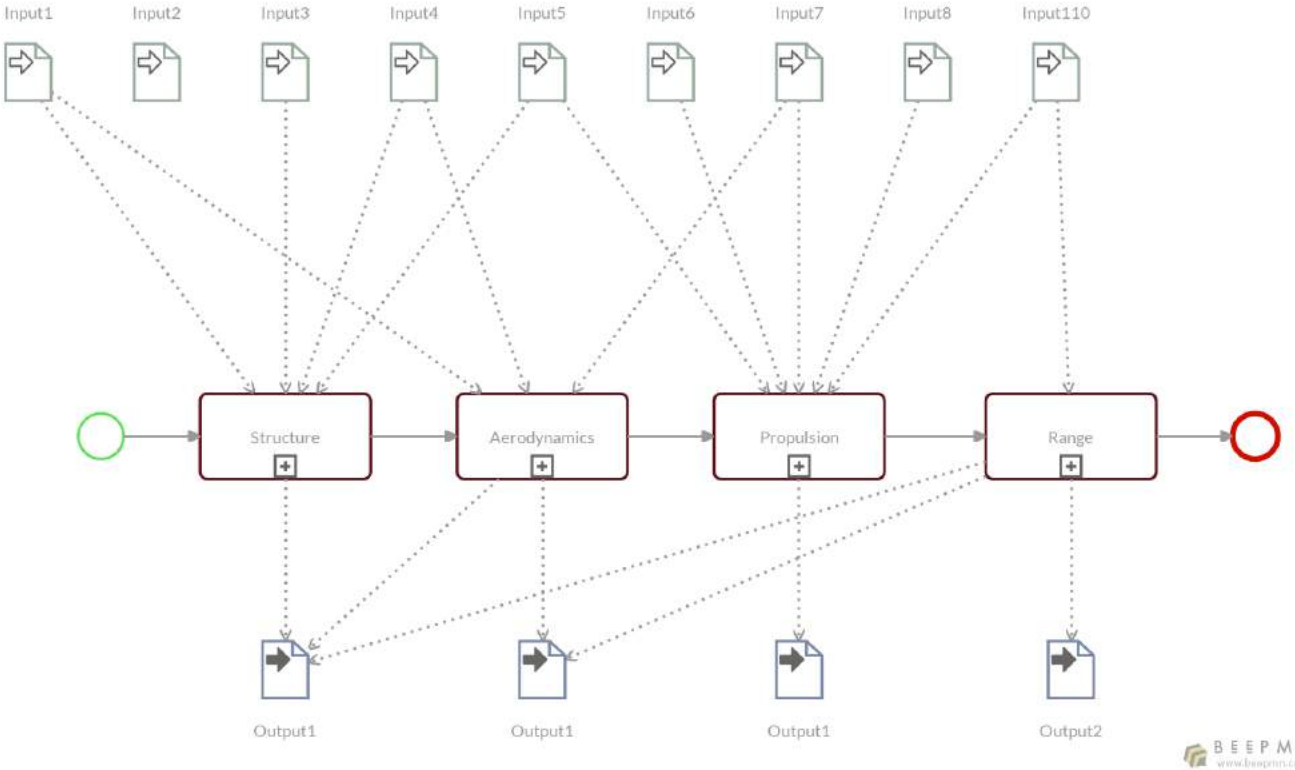
RSM Trainer

Scheduling project: Optimization

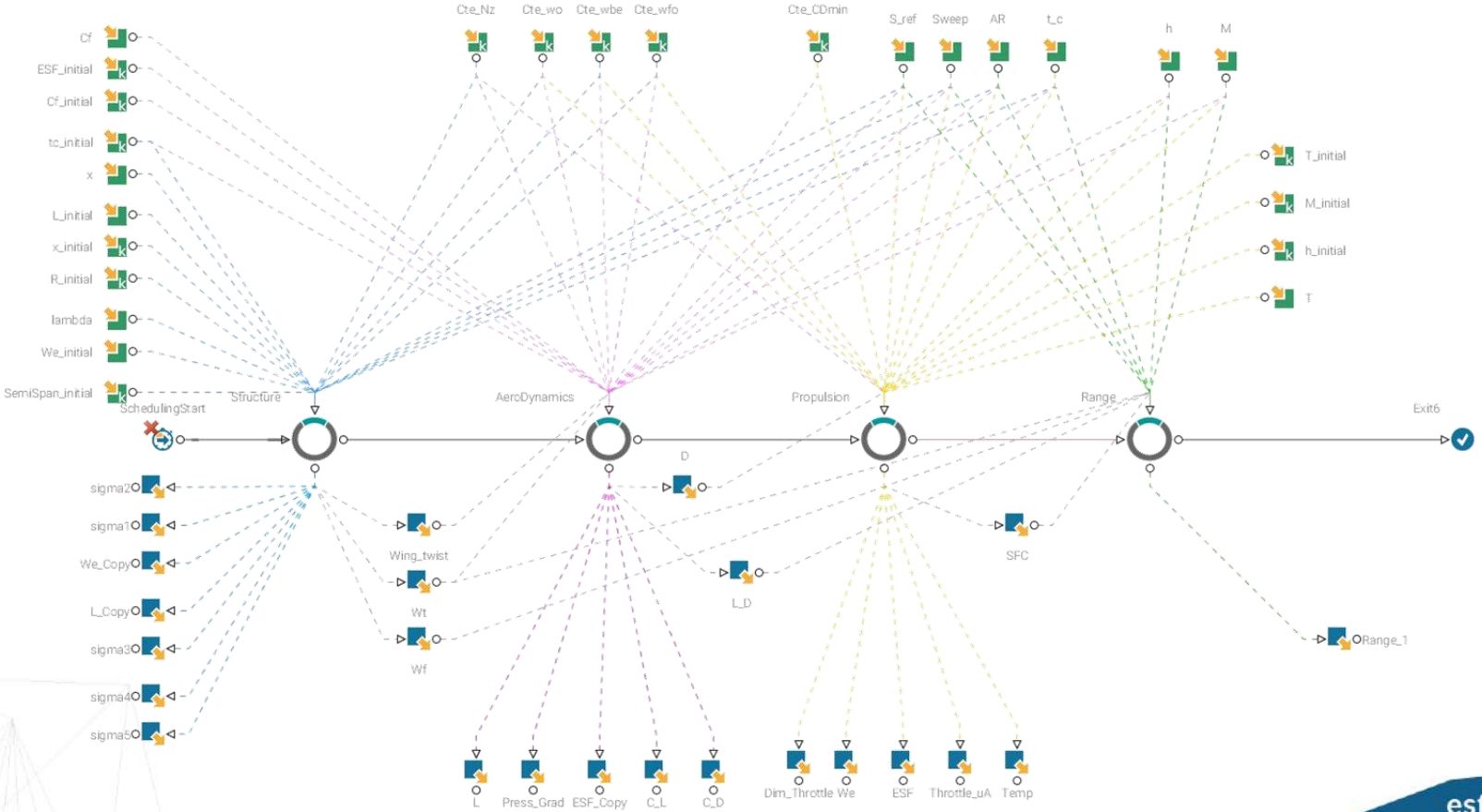




MDO Workflow example



MDO Workflow example



DISTRIBUTED EXECUTION

Leverage Corporate Assets

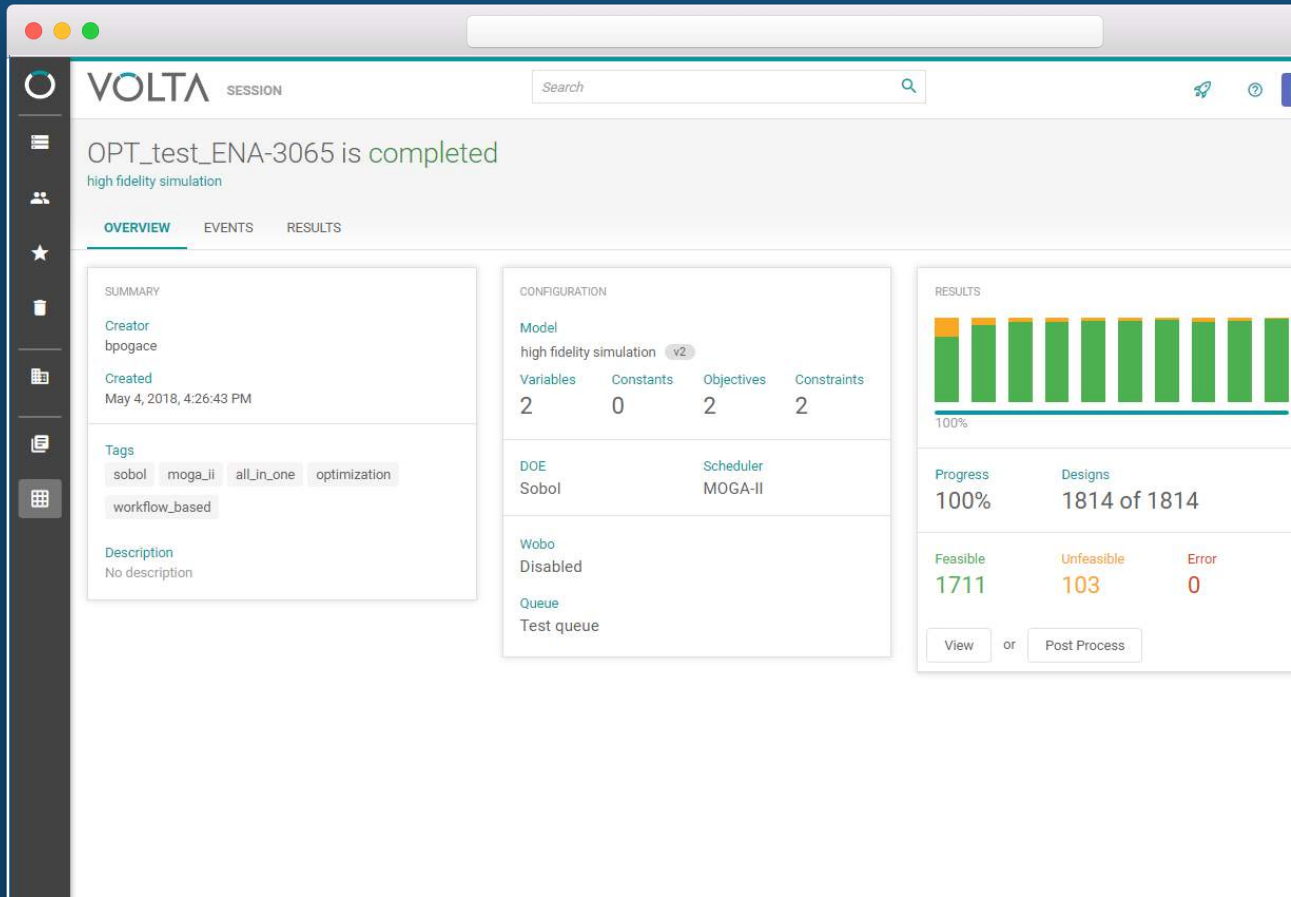
Balance workloads, minimize downtime and integrate different OS environments

Flexible and Secure

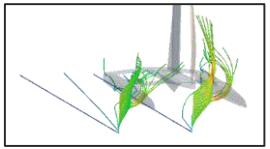
multi-core workstations, HPC clusters and public clouds, while ensuring respect of security standards.

Ease IT Management

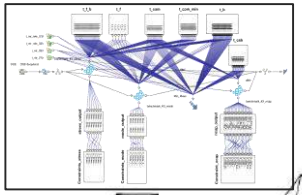
manage different resource environments and deliver high computational power in the hands of design teams.



Collaboration

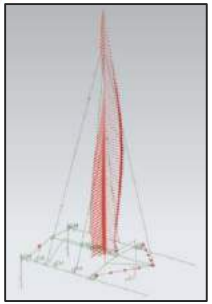


Hydrofoil Systems

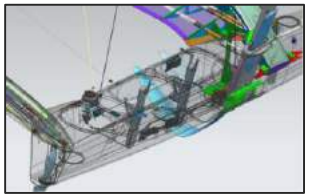


Multi-domain/ System Model Workflow Integration

Run Simulations



Structural Response



System & Control

Artificial Intelligence

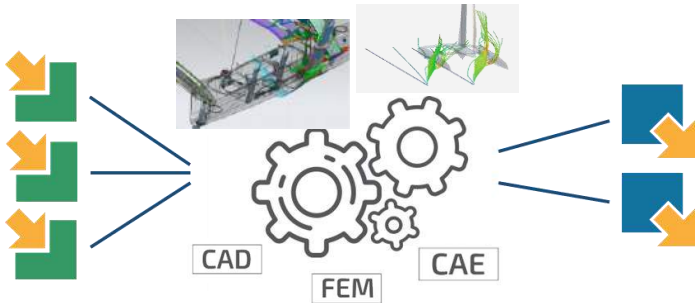
GLOBAL SEARCH → LOCAL REFINEMENT

HEURISTIC	MULTI-STRATEGY	DERIVATIVE FREE OPTIMIZATION	GRADIENT-BASED
EVOLUTIONARY: SIMULATED ANNEALING, GENETIC, PARTICLE SWARM, EVOLUTION STRATEGY	HYBRID, FAST, pilOPT, SANGEA	POWELL, SIMPLEX	CLASSICAL SQP METHODS, AFilterSQP, Bounded BFGS

ACCURACY

ROBUSTNESS

= HIGH CONVERGENCE RATE



Thank you for your attention

Questions?

EXPLORE DESIGN PERFECTION

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