DAT240 / DIT596
Assignment 1
Model-Driven Engineering

Group 1

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1. Introduction

This report reflects the meta-model of the Manufacturing System of an Industry. Attempts have been made to reduce the complexity of the system through the design of metamodels.

The complexity of this system is witnessed in the various steps involved in the processing of the workpieces. The steps are broadened into manufacturing, transport and quality assurance and the workpieces by their types and also with the storage facilities for them with people to supervise.

The table below gives an insight into the problem statement:

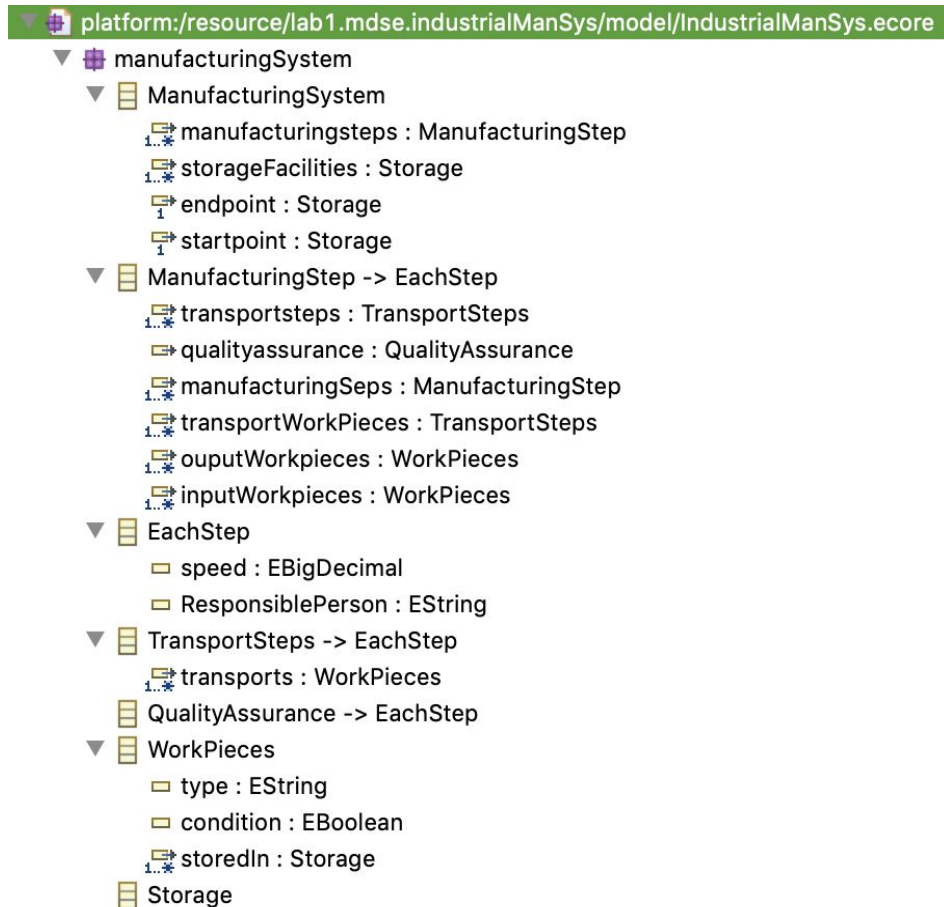|	
Purpose	To model a manufacturing system for the industry
Users	Administrators (to know the workflow and organization and system flow) Constructors(to get an idea before planning to build the manufacturing area)
Concepts	Manufacturing system; manufacturing steps; workpieces; transport steps; storage facilities
Relations	Properties: the difference in the type of input and output workpieces; Boolean conditions on them; quality assurance step non-mandatory and at the end; each step has speed and person; support hierarchy Relations: The key relation is between the Manufacturing System and the steps. The System contains the storage, manufacturing steps and transport and quality assurance as well. All the workpieces are stored and the transport step works on the workpieces.

2. Meta Modeling

2.1 Class Diagram
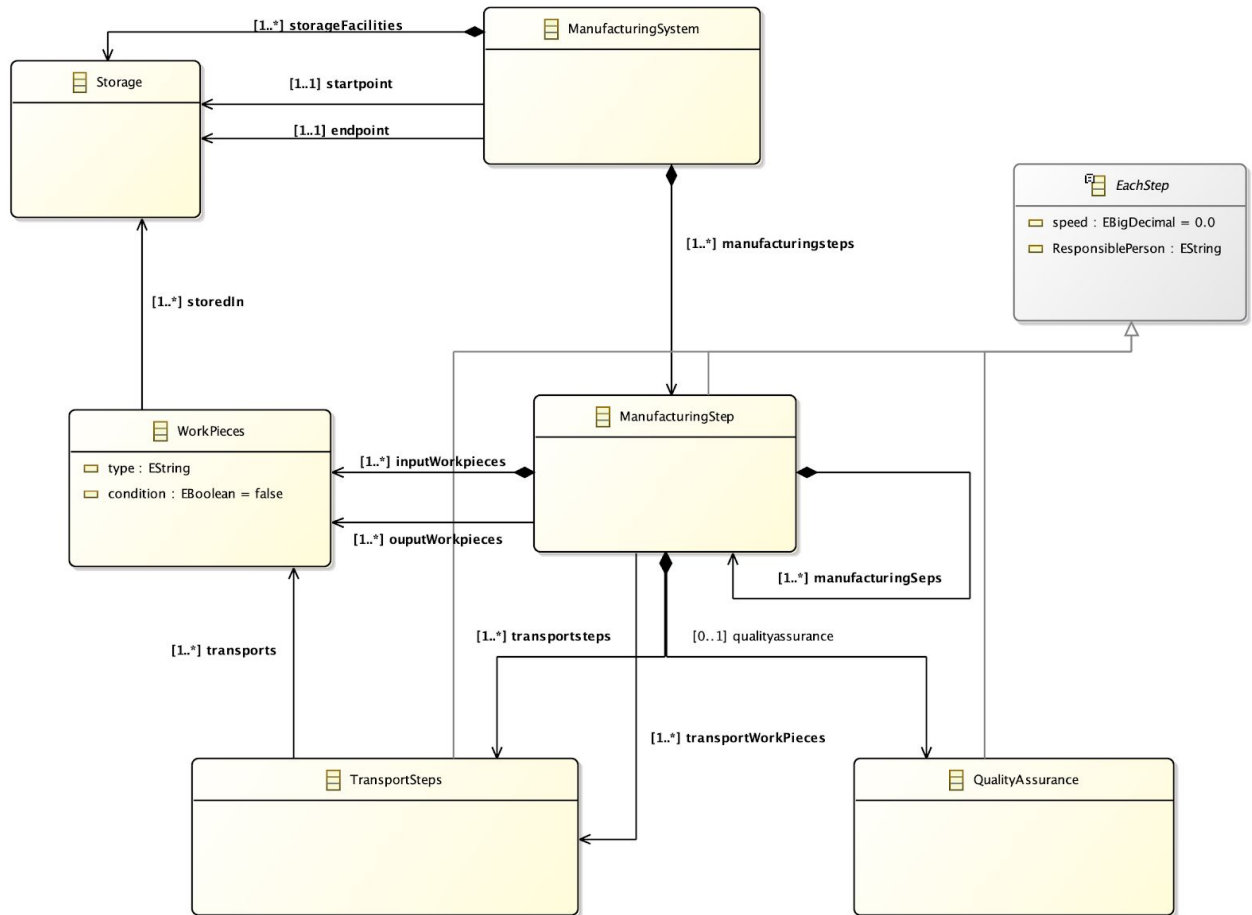
Figure 1: Class diagram for the system

2.2 Relevant classes, Attributes and Associations

```
▼ 🔷 platform:/resource/lab1.mdse.industrialManSys/model/IndustrialManSys.ecore
    ▼ 🔶 manufacturingSystem
        ▼ 🗎 ManufacturingSystem
                manufacturingsteps : ManufacturingStep
                storageFacilities : Storage
                endpoint : Storage
                startpoint : Storage
        ▼ 🗎 ManufacturingStep -> EachStep
                transportsteps : TransportSteps
                qualityassurance : QualityAssurance
                manufacturingSeps : ManufacturingStep
                transportWorkPieces : TransportSteps
                ouputWorkpieces : WorkPieces
                inputWorkpieces : WorkPieces
        ▼ 🗎 EachStep
                speed : EBigDecimal
                ResponsiblePerson : EString
        ▼ 🗎 TransportSteps -> EachStep
                transports : WorkPieces
          🗎 QualityAssurance -> EachStep
        ▼ 🗎 WorkPieces
                type : EString
                condition : EBoolean
                storedIn : Storage
          🗎 Storage
```

2.3 Multiplicities & Description of the Meta-Model

Manufacturing System: The root class of the metamodel. It represents the system that the metamodel is made for. A Manufacturing System can have many ManufacturingSteps and many Storage facilities as there's different storage facilities for different types of Workpieces. A Storage for the workpieces is mandatory as Workpieces are stored there. Additionally, the Storage acts as the start and end point of the system and there can only be 1 of each.
ManufacturingStep - In the ManufacturingStep class the Workpieces are taken as an input and can throw different types of Workpiece as an output. Each manufacturing step can contain other manufacturing steps as indicated by the self-containment loop reference and there must be at least one manufacturing step as indicated by the multiplicity. Each manufacturing step may contain one QualityAssurance step and one or more TransportSteps. ManufacturingSteps, QualityAssurance and TransportSteps have a duration (speed) and a responsible person (ResponsiblePerson). The speed and ResponsiblePerson are inherited by the

EachStep abstract class as they are common variables in ManufacturingSteps, QualityAssurance and TransportSteps.

QualityAssurance: This step can be added to the ManufacturingStep but is not mandatory as can be seen by the multiplicity "0..1".

TransportSteps: the TransportSteps transport several Workpieces between the ManufacturingSteps.

Workpieces - These have a type, because they can be made out of wood, metal, paper, etc., and a condition. The condition is there as workpieces are meant to be transported to the manufacturing steps but only if they fulfill a condition (what kind of condition is not specified).

Hierarchy is supported as ManufacturingStep contain QualityAssurance and TransportSteps. Once a new ManufacturingStep is made, a QualityAssurance step and several TransportSteps can be made under it. Each new subsequent ManufacturingStep can have its own QualityAssurance and TransportSteps and will be under the old ManufacturingStep.

3. Example of a Manufacturing System Model

Dynamic creation of ManufacturingSystem Model, ManufacturingSystem.xmi of the metamodel tree.

3.1 Running Eclipse Application

Model using ManufacturingSystem metamodel as a new Eclipse Application by choosing Manufacturing System from project's context menu.
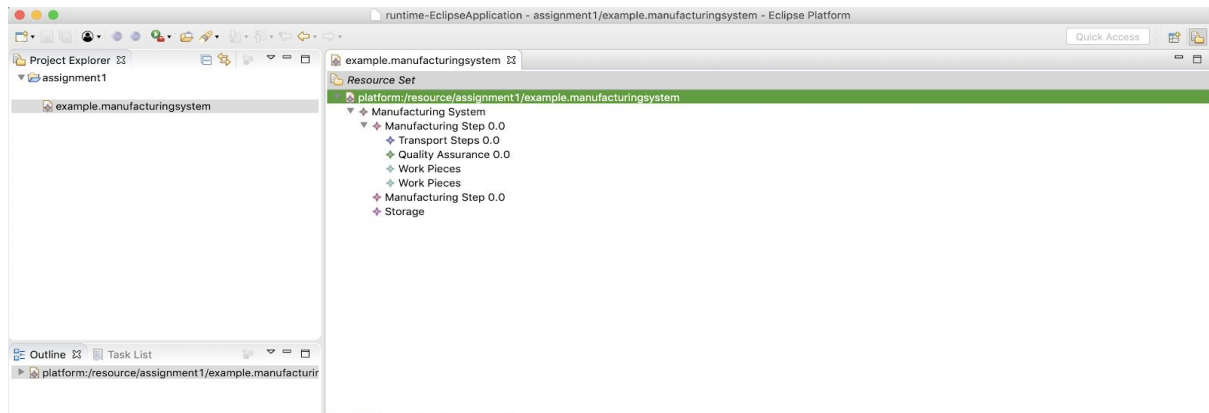

Figure 3: The Model structure
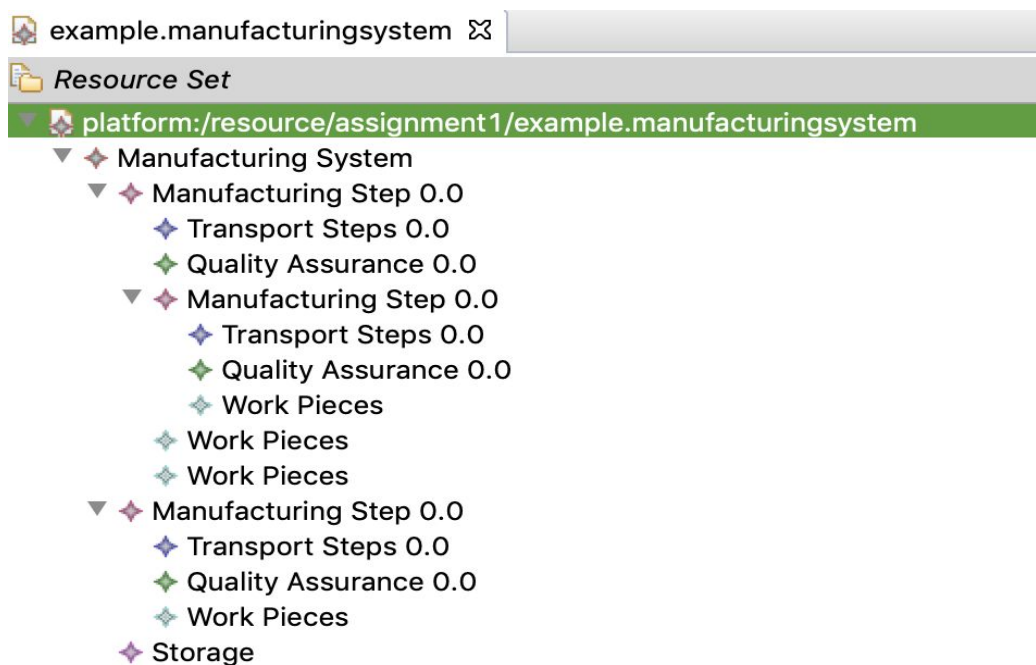
4. Description of the Model

Figure 4: Example Model

In the example Model(Fig 4), it can be seen that a Manufacturing System has a Storage and Manufacturing Steps. The Manufacturing steps contain Workpieces, Transport Steps and a Quality Assurance Step. Additionally as can be seen under the first Manufacturing Step, there is another Manufacturing Step which can contain a Transport Step, Quality Assurance and Workpieces. A Manufacturing Step can be made under any other Manufacturing Step, which once again may contain a Transport Step, Workpieces and possibly, but not necessarily, a Quality Assurance Step. There is no where on the model a second Quality Assurance step as only one can be made per Manufacturing Step.

References

1. https://help.eclipse.org/luna/index.jsp?topic=%2Forg.eclipse.emf.doc%2Freferences%2Foverview%2FEMF.html