INGENIA SE | YEAR 2022-2023

Modeling Tool Selection

Hell-ix Group

4th November 2022

Contents

1. Definition

The purpose of this document is to analyze and select the systems modeling tool that will be employed during the project. The tool shall pride support for the construction of system models for MBSE. Different alternatives are proposed and one of them is selected according to the selection criteria by using a decision matrix.

2. Alternatives proposal

Five different alternatives are proposed as potential system modeling tools for the project:

2.1 MATLAB System Composer

Matlab is a programming and numeric computing platform used to analyze data, develop algorithms, and create models. It has thousands of official and user-created add-ons that facilitate its use in a variety of areas while making the interaction between them easy by forcing them to share the same development environment. System Composer is one such add-on that enables the specification and analysis of model-based systems engineering.

2.2 Capella

Capella is an open-source solution for model-based systems engineering (MBSE). Hosted at `https://projects.eclipse.org/projects/polarsys`, this solution provides a process and tooling for graphical modeling of systems, hardware or software architectures, in accordance with the principles and recommendations defined by the Arcadia method.

2.3 Eclipse Papyrus

Eclipse Papyrus is an industrial-grade open source Model-Based Engineering tool. Eclipse Papyrus has notably been used successfully in industrial projects and is the base platform for several industrial modeling tools.

2.4 Cameo Systems Modeler

Cameo Systems Modeler is an industry leading cross-platform collaborative Model-Based Systems Engineering (MBSE) environment, which provides

smart, robust, and intuitive tools to define, track, and visualize all aspects of systems in the most standard-compliant SysML models and diagrams.

2.5 Modelio

Modelio is an open source modeling environment. Based on a 20-year track record of high end commercial products, Modelio delivers a broad focused range of standards-based functionalities for software developers, analysts, designers, business architects and system architects.

3. Selection criteria and alternative analysis

In the present section, the criteria used for performing the decision matrix are defined, as well as their relative weight which defines the overall importance of each criterion when compared with the rest on a 0–10 scale.

3.1 Accessibility

The software should preferably be open-source, so that all the Hell-ix Group members can access to it freely. This criterion is given a relative importance of **20%**.

- **MATLAB System Composer: 10/10.** Most members of the team have used Matlab and have it installed in their PCs with a student license (that includes this add-on) already enabled. Matlab allows for easy installation of add-ons. It might be necessary for some to update it, which is a little bit more cumbersome.
- **Capella: 8/10.** It is open-source software.
- **Eclipse Papyrus: 8/10.** It is open-source software.
- **Cameo Systems modeler: 0/10.** It is not open-source and its trial version is very limited in functionality.
- **Modelio: 4/10.** It was an open-source software up to version 4.

3.2 Integration of SysML

This integration will ensure that the MBSE software is up-to-date, enabling the users to access to newly-created diagrams and be more effective during the project. This criterion is given a relative importance of **20%**.

- **MATLAB System Composer: 9/10.** It is up-to-date with the latest versions of MATLAB and receiving support. It uses SysML and can even translate its models into Simulink models. Claims to have cross-platform compatibility.
- **Capella: 3/10.** Utilizes its own standard called "Arcadia". This is mostly equivalent to SysML, compliant with IEEE 1220 standard and covering parts of ISO/IEC/IEEE 15288.
- **Eclipse Papyrus: 5/10.** The currently implemented version of SysML is 1.4, but this can be updated by installing additional packages. It is currently receiving support.
- **Cameo Systems modeler: 8/10.** Up-to-date and receiving support.
- **Modelio: 4/10.** Requires the installation of additional modules which may not be up-to-date.

3.3 Usability

The MBSE software should be easy-to-learn, so that all the members of the group can get to know how to use it without any previous knowledge. Tutorials and community activity would increase the usability of the software. It is given a relative importance of **40%**.

- **MATLAB System Composer: 9/10.** The previous experience with MATLAB of the team members is the most relevant factor at play here. There is also ample documentation and numerous tutorials online.
- **Capella: 9/10.** It has a very complete collection of official video-courses, as well as other online tutorials. It is well documented. It has add-ons for collaborative work.
- **Eclipse Papyrus: 6/10.** It is well documented and has some tutorials online.
- **Cameo Systems modeler: 6/10.** It is well documented and has some tutorials online.
- **Modelio: 5/10.** Working with an older version that is currently unsupported would mean having to check what tutorials and forum threads are valid for this version. Other than that, there is plenty of learning material online.

3.4 Community

An active community will enhance the learning process of the users by means of forums, customer support, etc. This criterion is given a relative importance of **20%**.

- **MATLAB System Composer: 7/10.** MATLAB Answers (its official forum) is very active, however it is dedicated to questions about MATLAB and Simulink in general.
- **Capella: 9/10.** Has very active forums and is receiving support.
- **Eclipse Papyrus: 7/10.** Has active forums and is receiving support.
- **Cameo Systems modeler: 5/10.** Has somewhat active forums and is receiving support.
- **Modelio: 3/10.** Version 4 has official forums which are still somewhat active, but it stopped receiving support in 2020.

4. Decision

In the present section it is shown the decision matrix implementing the marks for each criterion for each of the alternatives. It can be observed that, according to the selection criteria, **MATLAB System Composer** is the best option to be the chosen as MBSE tool.

Criteria	MATLAB System Composer	Capella	Eclipse Papyrus	Cameo Systems Modeler	Modelio
Accesibility (20%)	10	8	8	0	4
Integration of SysML (20%)	9	3	5	8	4
Usability (40%)	9	9	6	6	5
Community (20%)	7	9	7	5	3
Weighted Total	**8.8**	7.6	6.4	5	4.2

Table 4.1: Decision matrix with weighted results of the alternative analysis.