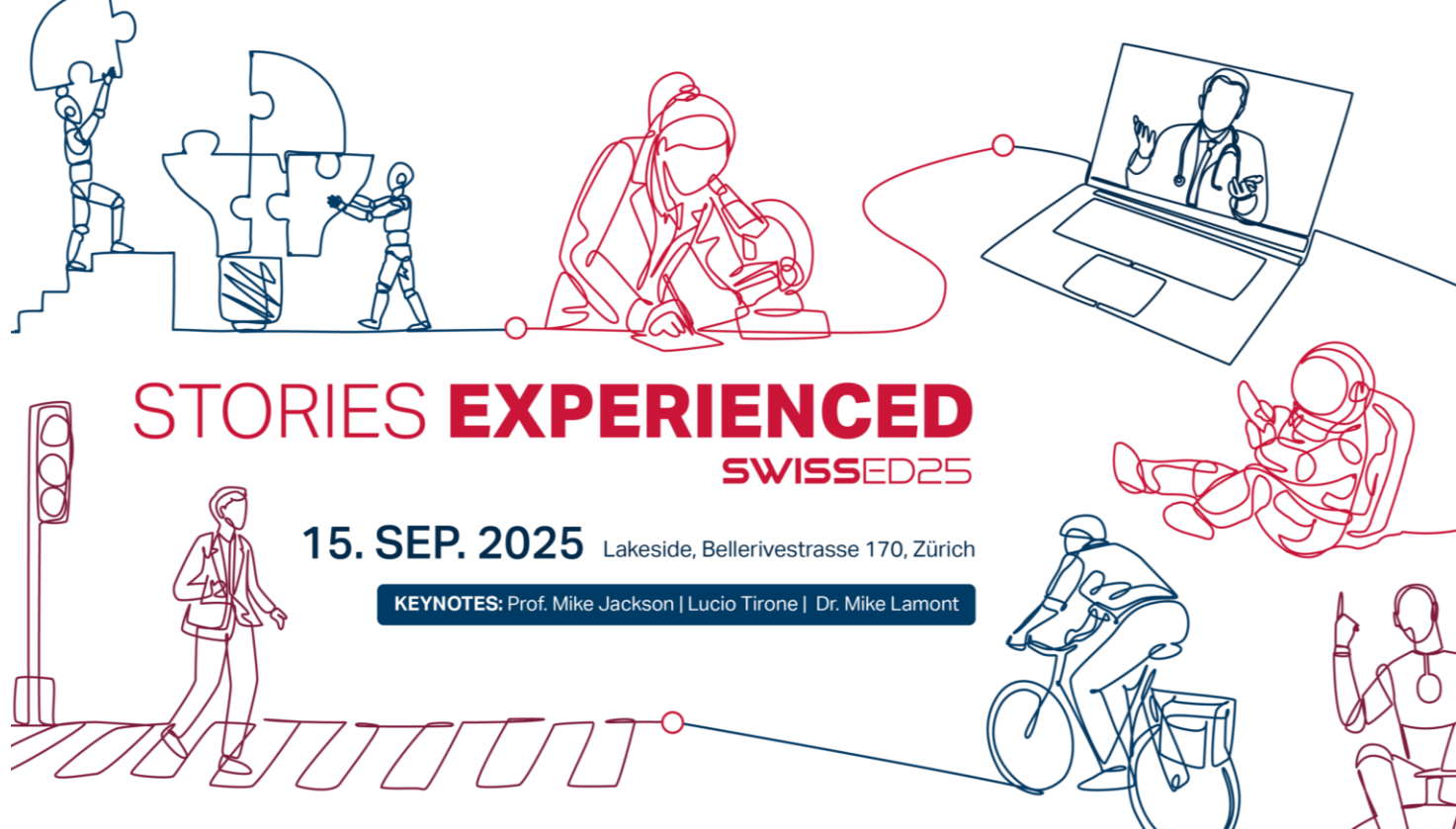




# SysDICE

KNOWLEDGE FOR IMPACT



## STORIES EXPERIENCED SWISSED25

15. SEP. 2025 Lakeside, Bellerivestrasse 170, Zürich

KEYNOTES: Prof. Mike Jackson | Lucio Tirone | Dr. Mike Lamont

## Integrating LLMs into MBSE: SysDICE's Journey toward an AI4MBSE Assistant

*Ibrahim Ghanawi and Mohammad Chami*

*Presented by Ibrahim Ghanawi*

[ibrahim.ghanawi@sysdice.com](mailto:ibrahim.ghanawi@sysdice.com)

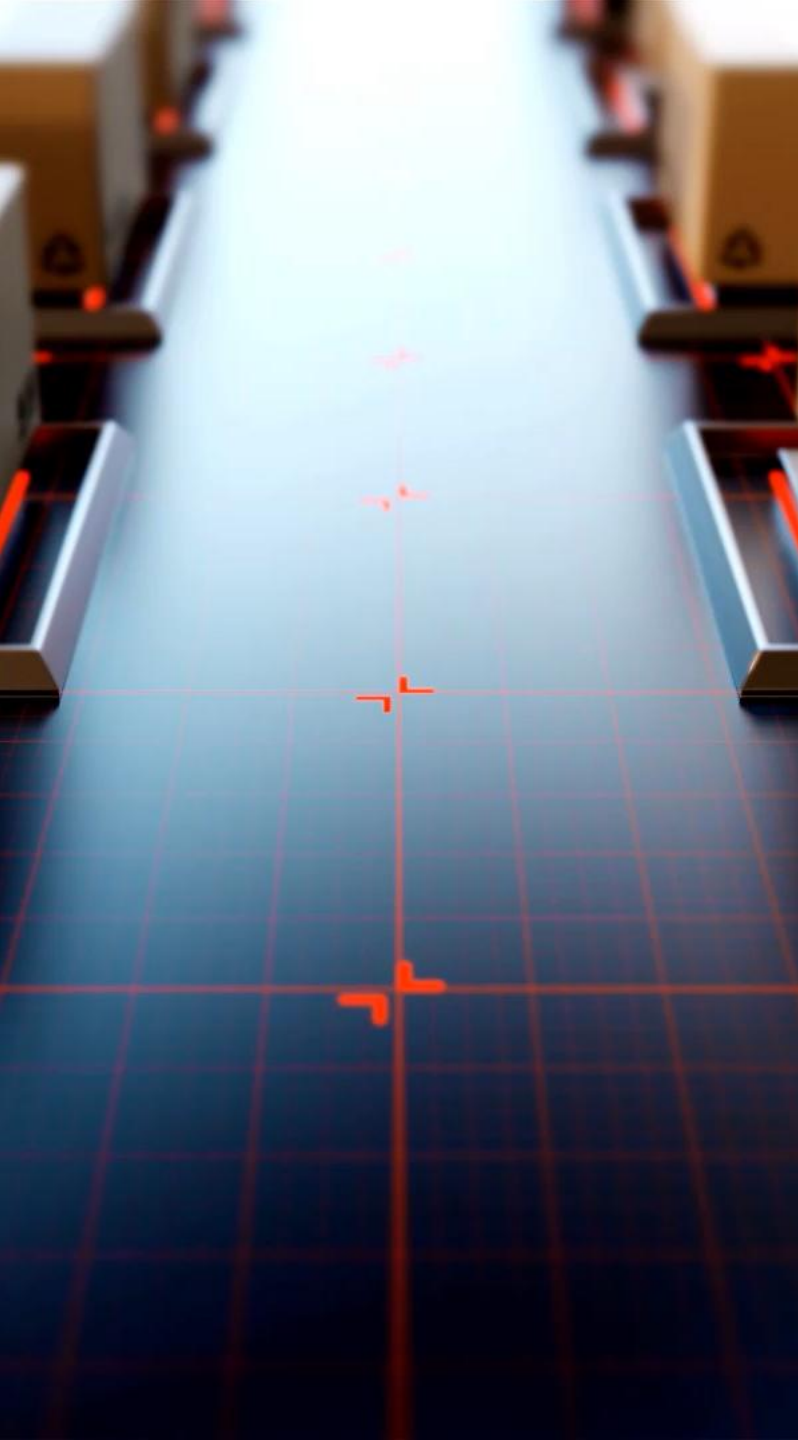
Sep 15<sup>th</sup>, 2025

Zürich, Switzerland



# Agenda

1. Why integration LLMs into MBSE
2. SysDICE's journey towards AI4MBSE assistant
3. Capabilities demo
4. Conclusion



# Why we started?



- Offer system engineers a simple way to interact with complex models.
- Push for adoption of proven AI technologies into the MBSE domain.
- Support different modeling perspectives (e.g., Requirements, Operational, Functional)
- Involve non-modeller stakeholders (SME, PMs) in model review and creation.
- Accelerate onboarding and facilitate knowledge transfer

**Systems Engineering isn't just for engineers, it's for everyone.**

# Using Off-the-shelf LLM Interface

- Good for brainstorming naming ideas or structure
- Moderate data handling via copy-paste
- Limited integration with MBSE tools
- Gaps with company's frameworks and practices

Good start... But we want more.



ChatGPT  
(OpenAI)



Perplexity  
(Perplexity AI)



Claude  
(Anthropic)

# Learning from Coding Assistants in Software Engineering



- Widely adopted among developers and companies
- Quickly utilize proven LLM techniques
- Directly integrated into developer workflows (IDEs)
- Significantly speed up prototyping and implementation
- Ability to use the tool with self-hosted LLMs



Cursor  
(Anysphere)



Codex  
(OpenAI)



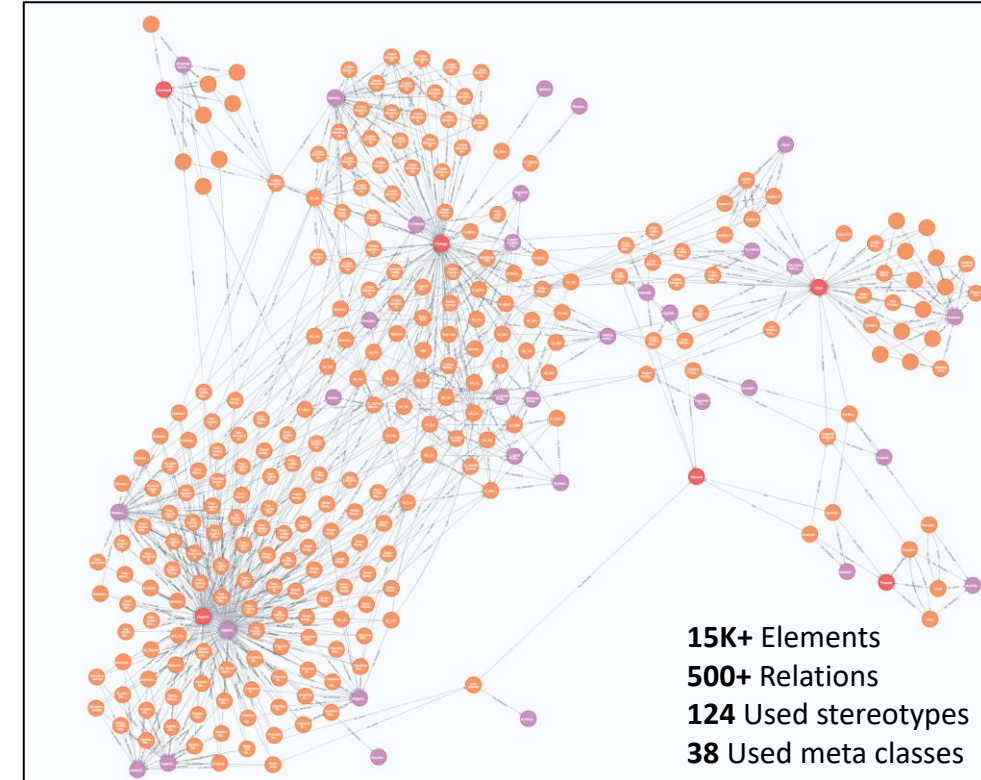
GitHub Copilot  
(GitHub)

Why did the magic not reach MBSE?

# Facing MBSE Reality

- Proprietary model formats; complex text representation
- Thousands of elements and relations
- Diverse elements, relations types
- Slow AI adoption in regulated industries
- Less agreed-on modeling practices

## Coffee Machine Example Project



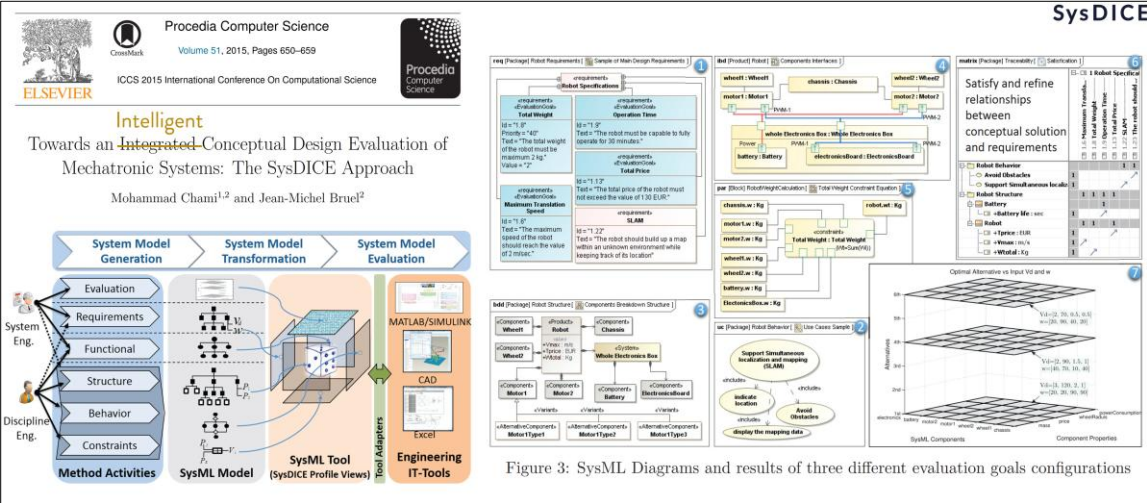


# SysDICE's AI4MBSE Journey

More than a Decade, continuous exploration from early research to implementation



2013  
PUBLISHED  
FIRST  
RESEARCH  
RESULTS



2019  
A FIRST  
STEP

A First Step  
towards AI  
for MBSE:  
Generating a  
Part of SysML  
Models from  
Text Using AI

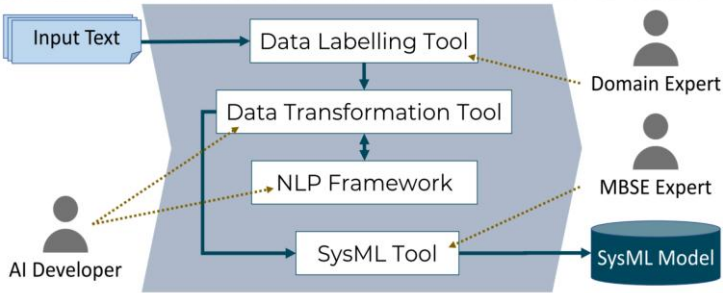
Mohammad Chami – Chami Consulting  
Christophe Zoghbi – ZAKA SAL  
Jean-Michel Bruel – University of Toulouse



<http://www.krinfuc3m.es/ai4se/>

## Text-to-Model Modules and Roles

The What and Who

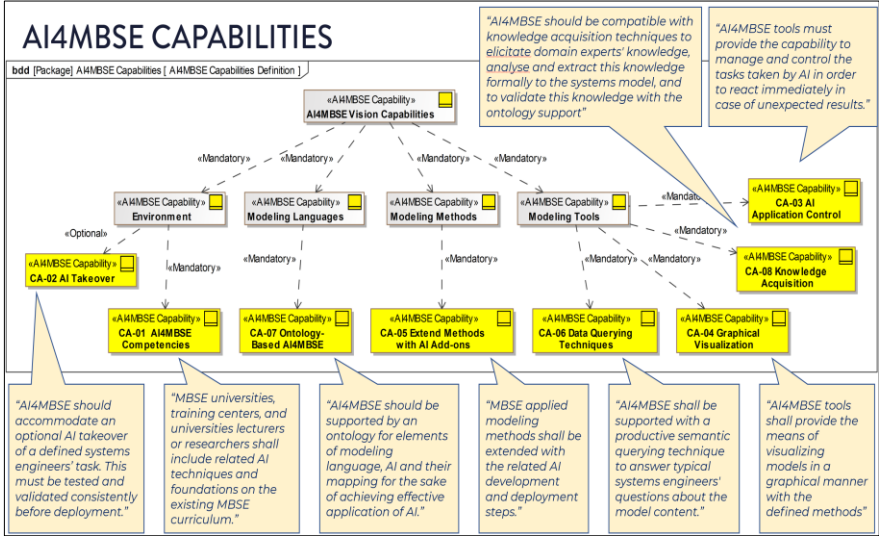


A First Step towards AI for MBSE  
M. Chami, C. Zoghbi, and J.M. Bruel  
AI4SE Workshop 2019, Madrid, Spain

15/25

# SysDICE's AI4MBSE Journey

More than a Decade, continuous exploration from early research to implementation



2022  
PUBLISHED  
IN INCOSE IS

## Automatic Norm Compliance (CyberTech Project)

BS EN 61010-1:2010  
61010-1 © IEC:2010

Requirement text

Requirement title

Location in PDF

Requirements Titles

Identify Compliance

Criteria	System Element	Compliance Status	Approval Status	Norm Element
1	HEM002 cutting by releasing kinetic energy by moving parts	Compliant	Not Checked Yet	RE 7.3 Moving parts
2	HEM004 cutting by touchable sharp edges	Compliant	Not Checked Yet	RE 7.3.1 Handbook sharp workpiece
3	TS 60601-1 6.2.3 Determination of ACCESSIBLE parts - Examination	Compliant	Not Checked Yet	RE 6.001 1.6.2.3 Determination of ACCESSIBLE parts - General
4	TS 60601-1 6.2.2 Determination of ACCESSIBLE parts - Examination	Compliant	Not Checked Yet	RE 6.2 ENCLOSURE rigidity tests
5	TS 60601-1 6.2.3 Determination of ACCESSIBLE parts - Examination	Compliant	Not Checked Yet	RE 6.2.3 Examination

2024  
PUBLISHED  
IN INCOSE IS



# Latest Stop: AI4MBSE Assistant

*More than a Decade, continuous exploration from early research to implementation*

## **2025 AI4MBSE ASSISTANT**

- Unified tool leveraging our accumulated expertise
- Direct LLM capabilities within the modeling environment
- Integration with multiple MBSE tools
- Web-based interface for interactive model exploration

# Capability One: Enforcing Modeling Rules

## *Custom Rule Enforcement for Model Quality*

- Automatically check naming conventions, descriptions, and stereotypes
  - *“Use case and activity names must start with a verb”*
  - *“Function blocks must include at least two port.”*
  - *“Requirements must have relationships to uses cases, functional blocks, or Logical blocks”*
- Organization-specific frameworks and methods encoded as rules
- Immediate feedback to modelers
- Consistent modelling and better collaboration

: Coffee Machine

Ask Attach Element

SysDICE EVA

Explain what is this project about?

Response:

This project is about modeling a coffee machine system using SysML. The core system, 'Coffee Machine', is represented by a Functional Context Block (FCB - Coffee Machine - Brew Coffee) that is composed of several Functional Blocks: 'Provide Coffee', 'Process Coffee', and 'Cost Generation'. The system interacts with external elements like 'Provide Water' and 'Provide the water requested' through External Function Blocks. The coffee machine also involves payment processing, as indicated by the 'Process Payment' Use Case Activity and

Send Query Send Feedback Refresh Window Cancel

Search Results

Found in loaded diagrams (0 symbols)

Found in model (20 elements)

Activity (4 matches)

External Function Block (3 matches)

Functional Block (5 matches)

Functional Context Block (2 matches)

Proxy Port (3 matches)

Technical Block (3 matches)

Delonghi Coffee Machine

Delonghi Coffee Machine New Gen C

SIEMENS HMI

: Coffee Machine

Ask Attach Element

SysDICE EVA

Explain what is this project about? Tell me what kind elements are modeled in the project and give me examples.

Response:

This project is about modeling a coffee machine system using SysML. The main elements modeled in the project include:

1. Functional Context Blocks (FCB): These represent the functional context of the system. In this project, there are two FCBs:  
- FCB-2: 'Coffee Machine - Order Coffee Drink' (elementnumber: FC-2)  
- FCB-3: 'FCB - Microcontroller - ' (elementnumber: FC-3)

Send Query Send Feedback Refresh Window Cancel

Search Results

Found in loaded diagrams (0 symbols)

Found in model (20 elements)

External Function Block (5 matches)

External Logical Block (1 match)

Functional Block (6 matches)

Functional Context Block (2 matches)

Logical Block (3 matches)

Operational Context Block (2 matches)

Technical Block (1 match)

Delonghi Coffee Machine

200\_Stakeholder Requirements

Definition - Stakeholder Requirements

6 Brewing Options

8 Brewing Time

9 Ease of Use

10 Variation

11 User Profile

12 Coffee Tem

13 Brew Intens

14 Failure Mod

14.1

SysDICE EVA

Create Diagram Ctrl+Shift+D

Create Relation

Lock

Validation

Element Group

Refactor

Related Elements

Tools

Stereotype

Rename F2

Copy Ctrl+C

Copy URL

Conv Element Hyperlink

Find Similar Elements

Open Chat Window

Run Custom Validation

Validation Rules

Please enter the list of rules you would like to validate the elements against.

The requirement should have a name.

Ok

Search Results

Found in loaded diagrams (0 symbols)

Found in model (11 elements)

Stakeholder Requirement (11 matches)

6.2

6.3

6.4

8.1

8.2

9.1

9.2

9.3

10.1

12.1

14.1

6 Brewing Options

6.2

6.3

6.4

8.1

8.2

8.3

9.1

9.2

9.3

The item is missing a name for the requirement, breaking Rule 1.

6.2

6.3

6.4

8.2

8.1

9.1

9.2

9.3

10.1

11 User Profiles

Validation Rules

Please enter the list of rules you would like to validate the elements against.

A requirement shall have a name.

The name of the requirement shall be at least 8 words long.

Ok

Search Results

Found in loaded diagrams (0 symbols)

Found in model (19 elements)

Stakeholder Requirement (19 matches)

6 Brewing Options

6.2

6.3

6.4

8.1

8.2

9.1

9.2

9.3

10.1

11 User Profiles

12 Coffee Temperature

12.1

13 Brew Intensity

14 Failure Mode

14.1

8 Brewing Time

8.2

8.1

9.1

Name 'Brewing Time' is too short (2 words), does not meet the minimum requirement of 8 words.

Flow Property

Constraint Parameter

# Capability Two: Questions and Answers

## *Natural Language Interaction with MBSE Models*

- Ask model-specific questions like:
  - *“What are the elements of the coffee machine?”*
  - *“Which components interact with the braking system?”*
  - *“Summarize use cases involving safety related constraints”*
- Extract model insights without direct interaction with the MBSE tool
- Answers grounded in your SysML models, not generic knowledge
- Supports engineers and non-modellers during reviews, audits, or onboarding

The screenshot displays the SysDICE Chat Web Interface. The top navigation bar includes the SysDICE logo, a hamburger menu, a project selector set to 'Coffee Machine Example', and buttons for 'Select Project' and 'Delete Chat'. The left sidebar shows the active AI model 'Mistral-Nemo', a 'New Chat' button, a search bar, and a 'Recent' list with two items: 'Delonghi Coffee Machine Architect...' and 'Drone Delivery System Overview'. The main chat area shows a conversation with a system response detailing technical blocks and use cases. At the bottom, there is a user profile for 'Demo User', a 'User Settings' button, a 'Conversation Feedback' button, and a chat input field with a 'How can I help you?' placeholder and a send button.

**SysDICE**  
KNOWLEDGE FOR IMPACT

Project  
Coffee Machine Example

Active AI Model  
**Mistral-Nemo**

New Chat

Search

Recent

- Delonghi Coffee Machine Architect...
- Drone Delivery System Overview

**System A1.1** (Block, composed of 'System B' and 'System C')

- (LB-61, LB-62, LB-64) - These could represent additional components or systems not yet defined in the model.

**Technical Blocks (Physical Components):**

- 'Delonghi Coffee Machine' (SN-COFF12345ABC-2024, LB-18)
- 'Samsung Galaxy S23 Ultra Mobile' (referenced by 'Delonghi Coffee Machine')
- 'SIEMENS HMI' (referenced by 'Delonghi Coffee Machine')
- 'STMicroelectronics Microcontroller' (referenced by 'Delonghi Coffee Machine')
- 'User Manual' (LB-31)
- 'References' (LB-32) - This could represent external references or data used by the system.

The model appears to be a systems architecture for a smart coffee machine, incorporating both hardware (technical blocks) and software (logical blocks) components, as well as external interactions (use cases).

Sources

Ok, what use cases are related to processing payments?

The use cases related to processing payments are:

- 'Process Payment' (CUC-173, stereotyped as Continuous Usecase)
- 'Make money transfer easily' (TUc-175, stereotyped as Triggered Usecase)

Sources

How can I help you?

DU Demo User  
demo.user@sysdice.com

User Settings

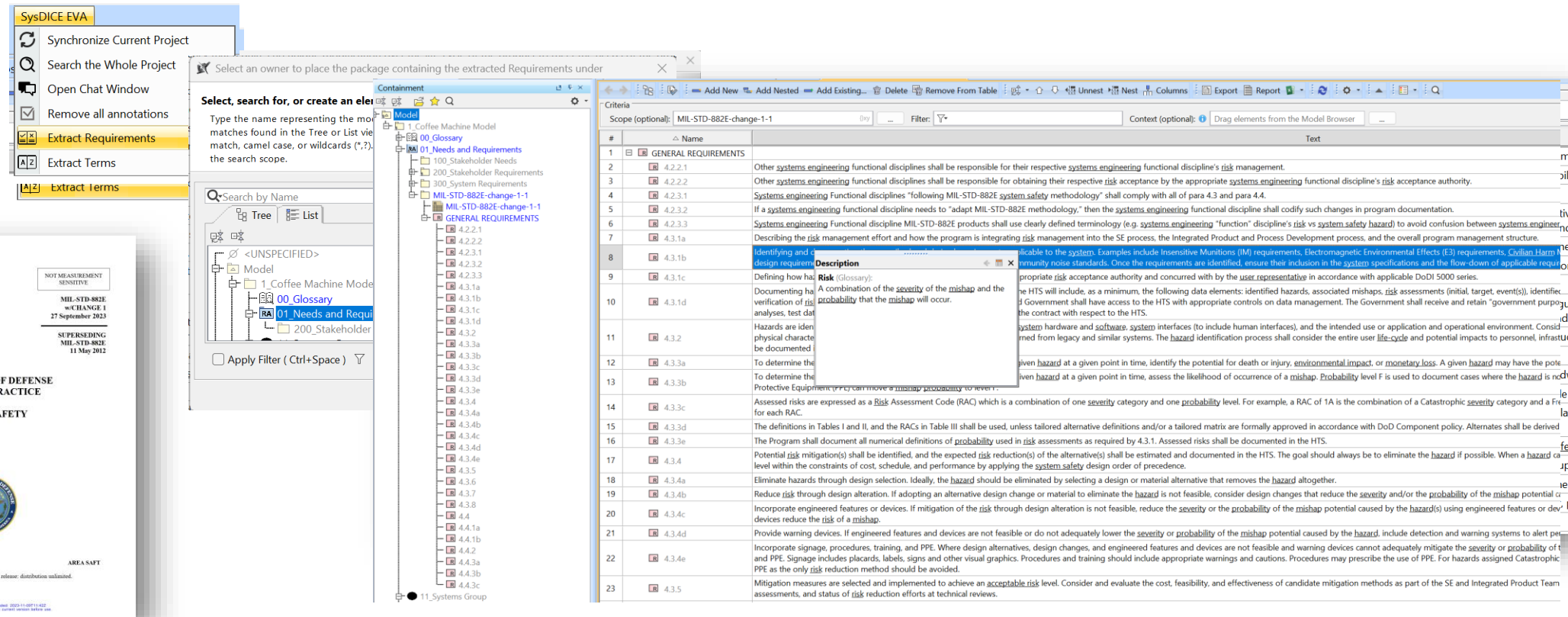
Conversation Feedback



# Capability Three: PDF Data Extraction

## Extract SysML elements from PDF files

- Extract glossary terms
- Extract Requirements



The screenshot displays the SysDICE EVA interface, which is used for extracting SysML elements from PDF files. The interface is divided into several panes:

- Left Pane:** Contains a menu with options like "Synchronize Current Project", "Search the Whole Project", "Open Chat Window", "Remove all annotations", "Extract Requirements", "Extract Terms", and "Extract terms". Below the menu is a search bar and a tree view showing the project structure, including "1 Coffee Machine Model", "00 Glossary", and "01 Needs and Requirements".
- Top Pane:** Displays the selected PDF document, "MIL-STD-882E-change-1-1", with a search bar and a list of extracted elements.
- Right Pane:** Shows a table of extracted requirements, with columns for "Criteria", "Scope (optional)", "Context (optional)", and "Text". The table lists various requirements, including "GENERAL REQUIREMENTS", "Identifying and design requirements", and "Risk Assessment Code (RAC)".

The extracted requirements are listed in a table with columns for Criteria, Scope (optional), Context (optional), and Text. The table contains 23 rows of requirements, including "GENERAL REQUIREMENTS", "Identifying and design requirements", and "Risk Assessment Code (RAC)".



# Future Capabilities



- Add and modify model elements
- Combine insights from multiple MBSE models
- Integrate an organization's knowledge sources
- Accommodate different element versions

# Conclusion

*LLMs + MBSE = New Possibilities When Done Right*

- Of-the-shelf tools aren't enough; we can get more with specialized and well integrated tools.
- Integrating LLMs with MBSE comes with complexity and higher constraints.
- We're building an assistant that's:
  - ✓ Secure
  - ✓ Domain-specific
  - ✓ Fully integrated with MBSE workflows
- Are you interested in following along?
- Do you have any questions or comments?
  - We'd be happy to hear from you.

# Contact Us

## Address

SysDICE GmbH  
CUBEX ONE  
Franz-Volhard-Str. 5  
68167 Mannheim  
Germany

## Schedule an Appointment

<https://calendly.com/sysdice>

## Website

[www.sysdice.com](http://www.sysdice.com)

## Email

[support@sysdice.com](mailto:support@sysdice.com)

## Phone

+ 49 1511 7679 156





QUESTIONS?  
THOUGHTS?