



UNCERTAINTY MODELING (UM) - RFI

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UM MOTIVATION

- **Uncertainty is inherent**

- ✓ Complex systems (e.g., CPSs) tend to operate in highly dynamic and highly complex environments
- ✓ It is infeasible to uncover or predict all possible events or circumstances that such systems will encounter.

- **Understanding uncertainty and mitigate the negative impact of uncertainty is possible, as long as:**

- ✓ Uncertainty is explicitly identified and characterized.
- ✓ E.g., testing strategies can be directed to focus on aspects where the level of uncertainty is high.

UM OBJECTIVE

- **Face Uncertainty**
- **Understand Uncertainty**
- **Specify/Model Uncertainty**
 - ✓ Identify, categories and quantify it.
 - ✓ Associate uncertainty with other artefacts such as requirements, etc.
- **Integrate with other OMG specifications**
 - ✓ UML, SysML, MARTE, etc.

BACKGROUND - STANDARDIZATION

- Investigated ISO, IEEE, IEC, JCGM, OMG, ETSI and OASIS and results are:
 - ✓ ISO/IEC 61508, OMG SysML and MARTE all define the concept of **Probability**.
 - ✓ OMG SysML defines the **Distribution** concept.
 - ✓ OMG SACM defines **Evidence**, **Confidence** and **Confidence Level**.
 - ✓ ISO/IEC and JCGM defined few standards on **Uncertainty Measurement**.
 - ✓ ISO 31000 defines the concept of **Uncertainty**.
- Conclusion:
 - ✓ **There does yet not exist an OMG technology recommendation that can characterize uncertainty both subjectively and objectively.**

RFI OBJECTIVES

- Solicit ideas, discussions, comments, recommendations, user needs and experiences about uncertainty modelling
- Particularly focusing on
 - ✓ identifying use cases
 - ✓ integrating with various OMG standards (e.g., SysML, UML, MARTE, UTP, BPMN).

USE CASES - STANDARDIZATION

- **Potential use cases:**

- ✓ Specifying uncertainty requirements as use case models
- ✓ Modelling uncertainties as part of SysML, UML, or BPMN models
- ✓ Exchange model libraries of uncertainty measurement with SysML
- ✓ Modelling uncertainties with an independent modelling notation
- ✓ Uncertainty models could then be used for performing analyses
 - E.g., discovering unanticipated uncertainties
- ✓ Uncertainty models could then be used for generating artifacts
 - E.g., generating test cases

- **This RFI aims to identify more use cases!**

RFI - OBJECTIVE

- This RFI seeks information regarding requirements for uncertainty modelling.

RFI - QUESTIONS

- Are you aware of uncertainties that are relevant to your work?
- To which extent, do you think you understand these uncertainties?
- Is explicit addressing of uncertainties important? If yes, why? If not, why not?

RFI - QUESTIONS

- Do you deal with uncertainties when developing your system/software?
 - ✓ If yes, in which phase of the development lifecycle do you deal with uncertainties?
 - ✓ If yes, do you rely on any existing specification/modelling solution, or is it more or less ad-hoc?
 - ✓ If yes, do you perform any uncertainty related analysis or artefact (e.g., test) generation? Is this automated?

RFI - QUESTIONS

- If there were to be a standard for uncertainty modelling,
 - ✓ What kinds of use cases for this can you envisage?
 - ✓ What kinds of integrations with existing standards would be needed?
 - ✓ What would be the preferred implementation format of uncertainty modelling for your use cases? Possible options include a UML profile, MOF-based metamodel or both.

RFI RESPONSES

- The information of the responses will be ultimately used to:
 - ✓ identify the requirements of the industry in terms of uncertainty modelling,
 - ✓ develop an RFP for an uncertainty modelling specification,
 - ✓ issue the RFP (if possible) in time for the OMG Technical Meeting in December, 2016.

TIMELINE OF STANDARDIZING UNCERTAINTY MODELING

- **Issuing RFI – September 2016**
- **Receive response in January 2017**
- **Issuing RFP – March 2016**
- Initial submission
- Revised submission
- Finalization