



**2021**  
Annual **INCOSE**  
international workshop  
Virtual Event  
January 29 - 31, 2021

# ISO 19450 OPM – Object-Process Methodology Update

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January 30, 2021

ISO, "ISO/PAS 19450 Automation systems and integration – Object-Process Methodology,"  
15 Dec. 2015. Available: <https://www.iso.org/obp/ui/#iso:std:iso:pas:19450:ed-1:v1:en>.



# ISO/PAS 19450:2015 – OPM

## Object-Process Methodology Update

- 2009: Work started within ISO TC184/SC5
- 2015: Approved as a PAS (Publicly Available Specification)
- 2018: Approved for a second 3-year term as a PAS
- 2021: Planned to be approved as an IS (International Standard)
- 2021- 2022: Preparation of ISO 19450:2022 – OPM enhanced with new capabilities:
  - Computational objects & processes
  - Stereotypes, Templates...
  - Simulation & Execution; Real-time IoT Operating System

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Search results

ISO/PAS 19450:2015(en)

## ISO/PAS 19450:2015(en) Automation systems and integration — Object-Process Methodology

BUY

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## 3.41

**Object-Process Diagram****OPD**

**Object-Process Methodology** (3.43) graphic representation of an Object-Process Methodology model or part of a model, in which **objects** (3.39) and **processes** (3.58) in the universe of interest appear together with the **structural links** (3.72) and **procedural links** (3.56) among them

## 3.42

**Object-Process Language****OPL**

subset of English natural language that represents textually the **Object-Process Methodology** (3.43) model that the **Object-Process Diagram** (3.42) represents graphically

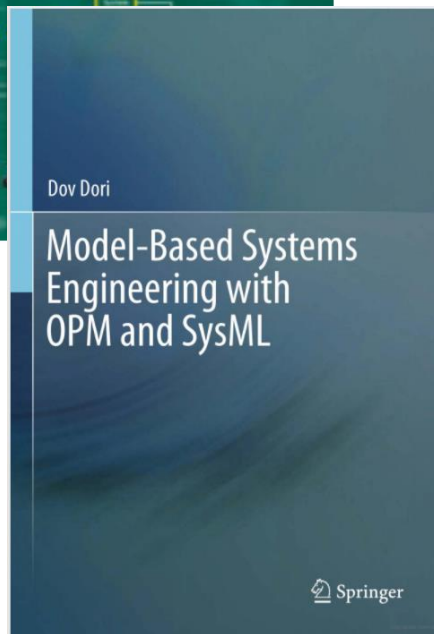
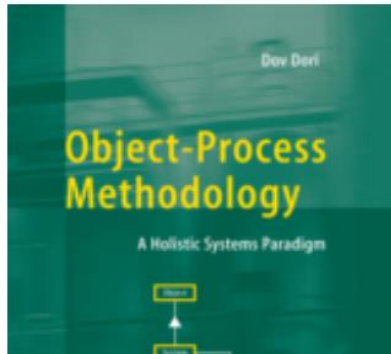
## 3.43

**Object-Process Methodology****OPM**

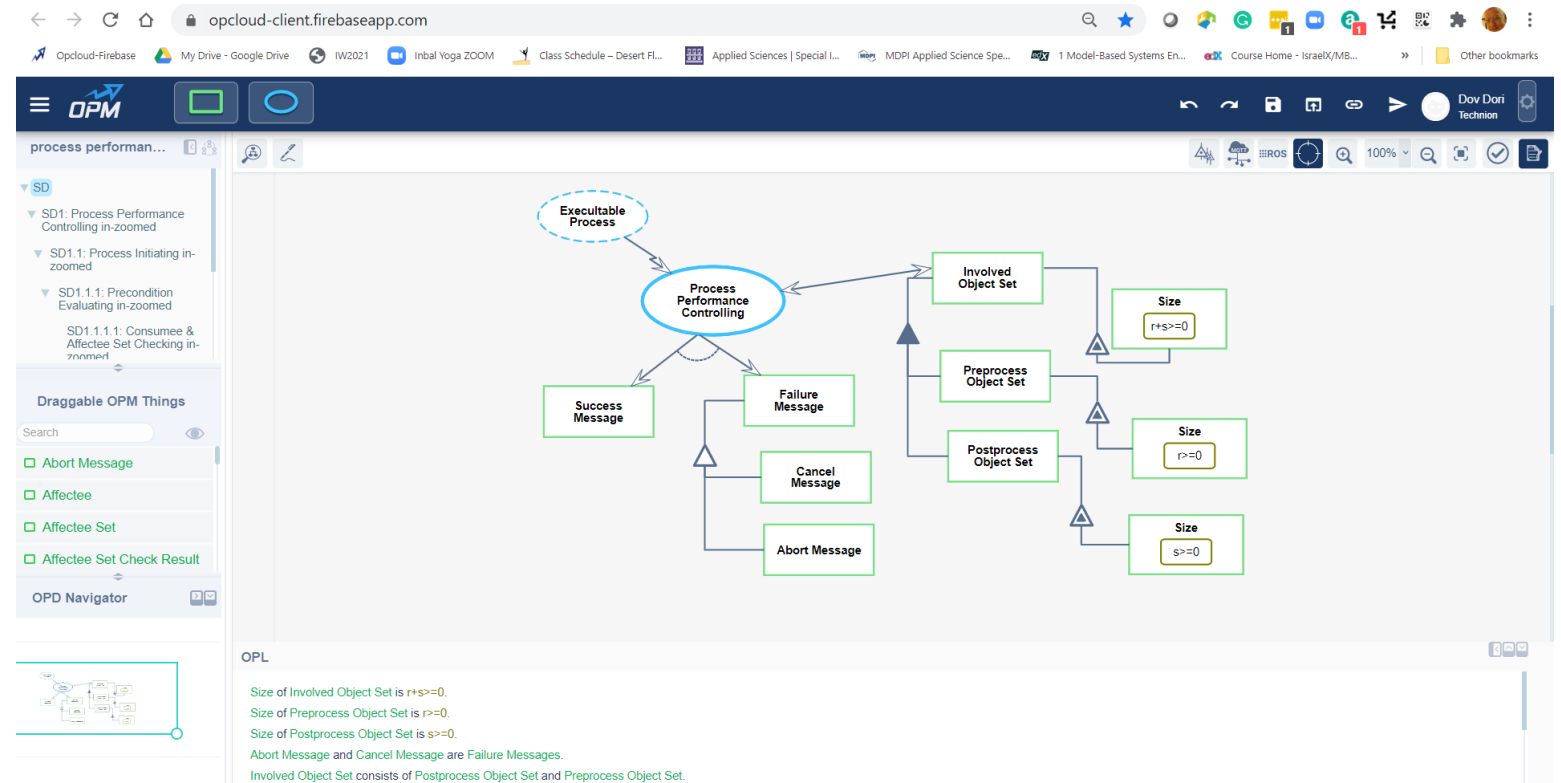
formal language and method for specifying complex, multidisciplinary systems in a single function-structure-behaviour unifying model that uses a bimodal graphic-text representation of **objects** (3.39) in the system and their **transformation** (3.77) or use by **processes** (3.58)



# OPM: Resources



## OPCloud



Details: <https://www.opcloud.tech/>

Try it out: <https://sandbox.opm.technion.ac.il/>

Enterprise Systems Modeling Laboratory: <http://esml.iem.technion.ac.il/>



## **ISO TC184/SC5/SG5: Model-Based Standards Authoring**

- A model-based standard that specifies how to produce a model-based standard
- Applicable to both existing and new standards
- This standard is itself model-based, exemplifying how to do it
- The model is expressed in the Object-Process Methodology (OPM) language ISO 19450



# Rationale

- Standards are based primarily on natural language, often accompanied by graphics.
- Representation through the natural language leads to some challenges:
  - it is a source of ambiguities, omissions, lack of consistency, and possible contradictions both within the text and between the text and the graphics.
- These issues grow with the size of the document and are difficult to track due to the informal nature of natural languages, hindering automated verification and validation.



# SG5 Objective

- Develop a model-based standard for model-based standards authoring
  - Specify how to create standards using an OPM model that is translated automatically to a subset of natural language text.
- Streamline, formalize, and explicate the formation of new and existing standards
  - Standards will be more comprehensive, accessible, usable, and consistent
  - Internally, as well as within and across and across domains.



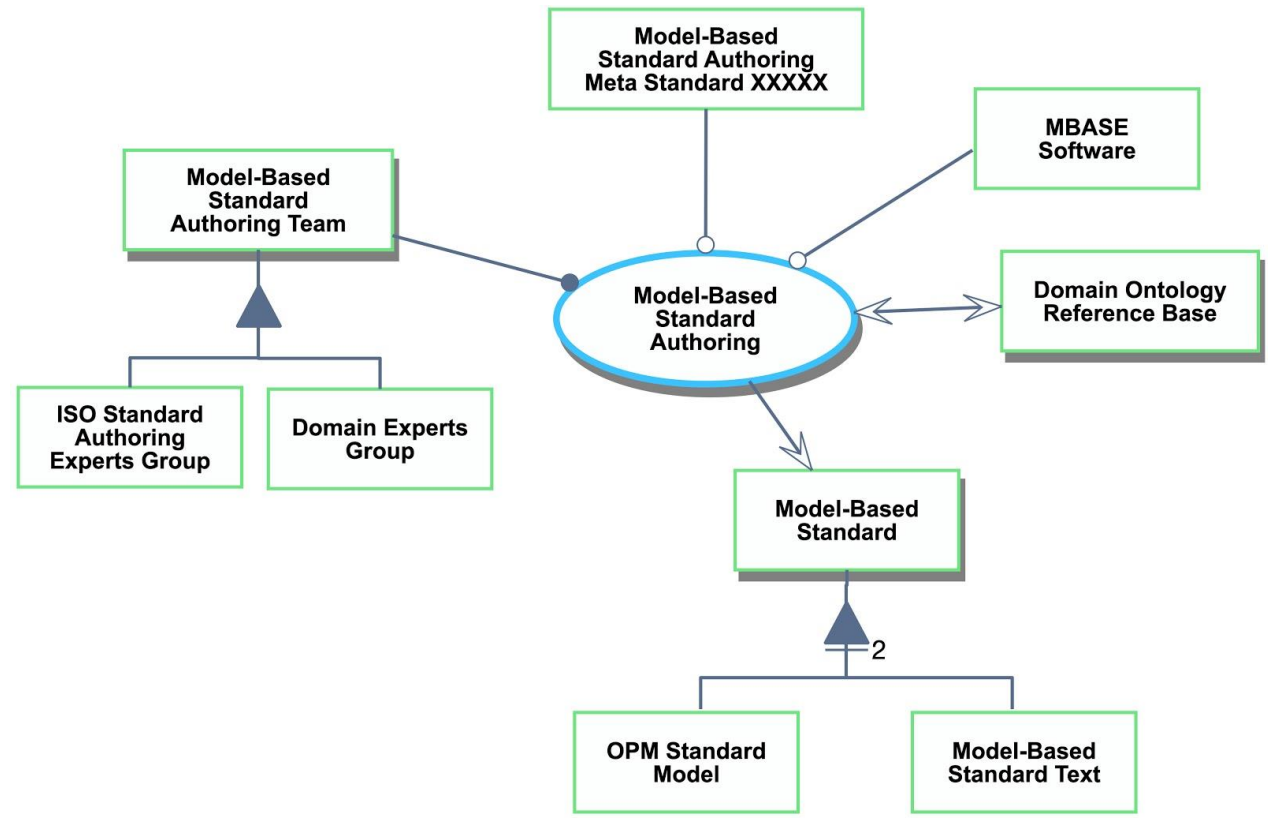
# SG15 Committee Draft and Participants

- We have prepared the Committee Draft “Meta-model for model-based standards authoring”.
- ISO SG5 members:
  - Dov Dori [dori@technion.ac.il](mailto:dori@technion.ac.il) Co-convenor
  - Richard Martin [richardm@tinwisle.com](mailto:richardm@tinwisle.com) Co-convenor
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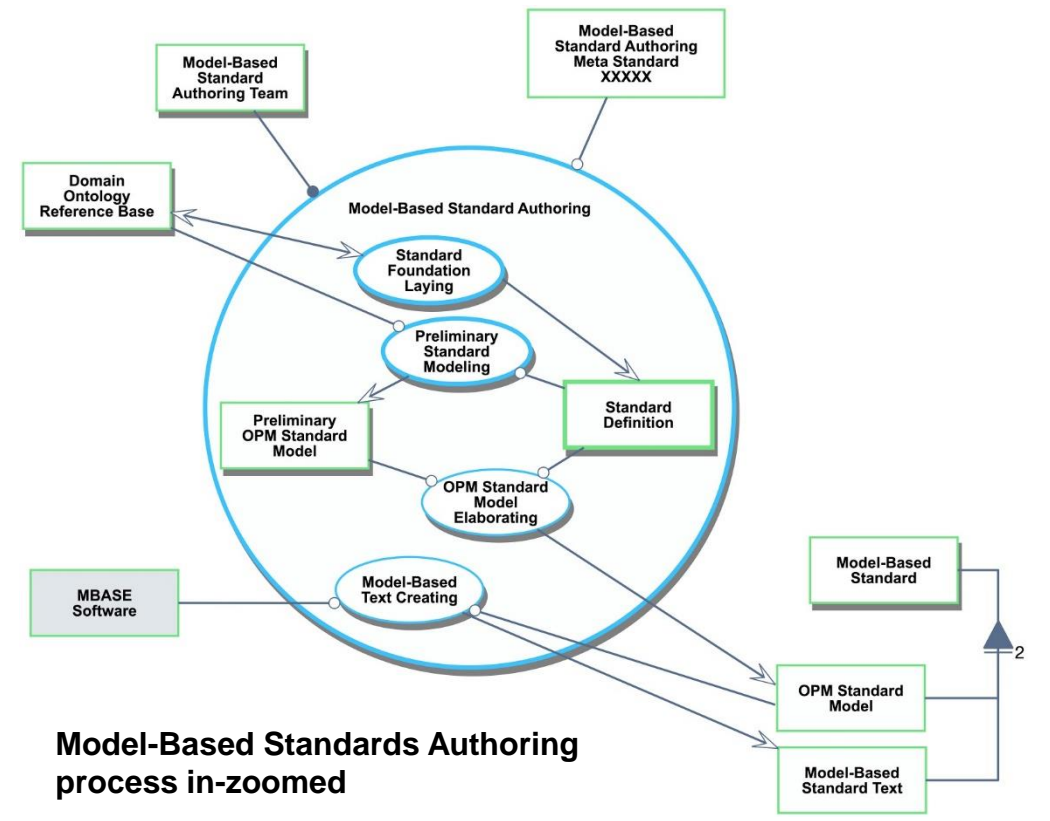




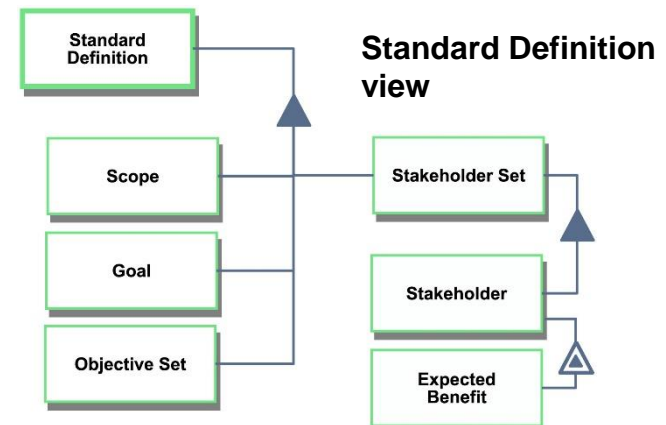
# sg5 Model-Based Standards Authoring Diagrams



Model-Based Standards Authoring System Diagram (SD)



Model-Based Standards Authoring process in-zoomed





# ISO TC184/SC5 Resolutions: January 27, 2021 (Virtual Meeting)

1. SG5 is converted to WG15 and WG15 is established.
2. Working Draft SC5\_N1112-v3 is adopted and moved to the next stage of IS development.

## System lifecycle processes and objects in ISO 15288: Benefiting from a formal OPM model

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***Abstract***—ISO/IEC/IEEE FDIS 15288:2014(E) is one of the most fundamental systems engineering international standards. In this work, the major system lifecycle processes specified in 15288 and, equally importantly, the objects interacting through them, are modeled meticulously using OPM ISO 19450. The conceptual model, based on this standard's text, reflects the implied authors' intent, bringing up ambiguities that arise from the informality of natural language text and reference to related figures. The resulting OPM model is an exact, formal, and detailed expression of the processes and related objects in the first part of 15288, making it machine-interpretable. The gaps discovered during the modeling process are testimony to the value of the model-based standards authoring and the centrality of a formal yet humanly accessible model as the underlying backbone of international standards.

***Keywords***—ISO/IEC/IEEE FDIS 15288, model-based systems engineering, conceptual modeling, OPM ISO 19450, model-based standards authoring

In the context of semiconductor fabrication environment, capturing and transferring information throughout the product development cycle is critical. To solve the problem of information standards in this domain, which are incomplete, cumbersome, or unworkable, Simmon et al. [11] have proposed UML class diagram as a means to reduce redundant efforts of standards development teams, who can avoid revisiting due to missing or conflicting data and ensure that the of all necessary data is captured.

Anda et al. [12] reported empirical evaluation of UML-based development of large software projects by examining a case study in ABB in which a new version of a safety-critical process control system was developed to enable certification of embedded software according to the IEC 61508 safety standard. Interviewees experienced improvements with traceability, communication and documentation, but the positive effects were reduced due to reasons including lack of training and inadequate modelling tools.

# 15288 Clause 5.2.2 contains Figure 1 and reference to it in the text, which reads:

*“The system life cycle processes in this International Standard are described in relation to a system (see Figure 1) that is composed of a set of interacting system elements, each of which can be implemented to fulfill its respective specified requirements.”*

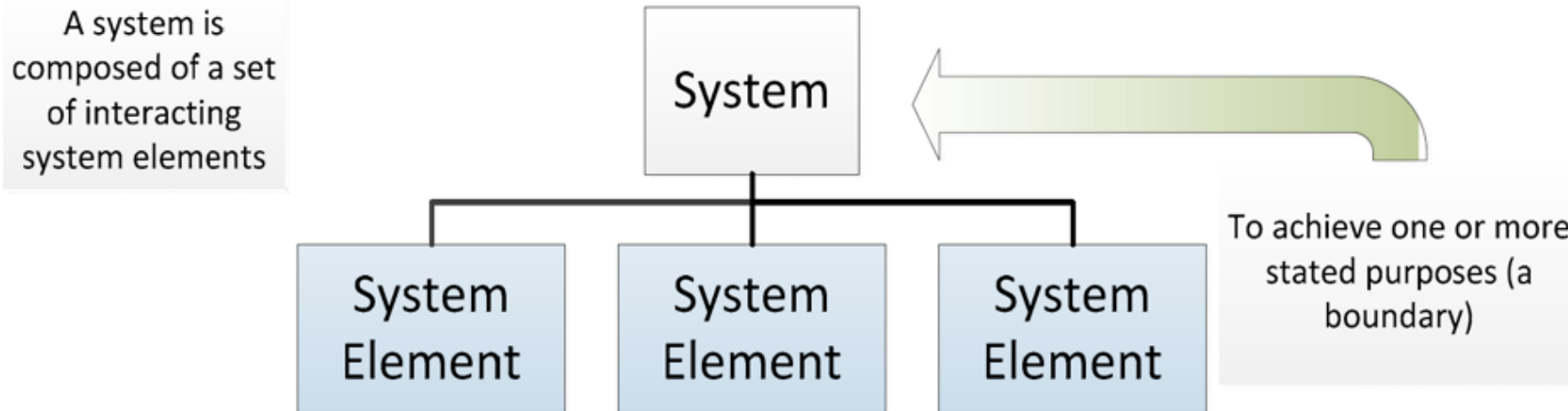
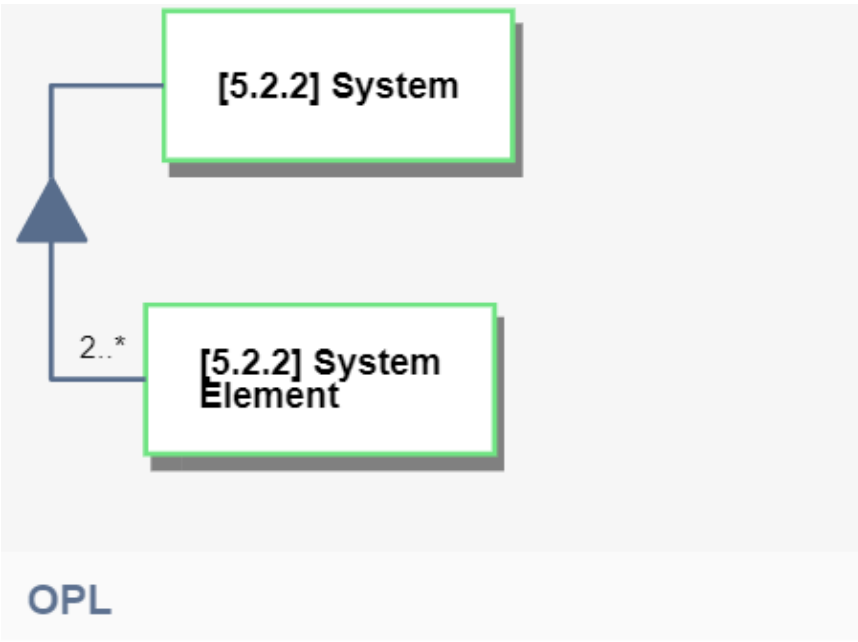
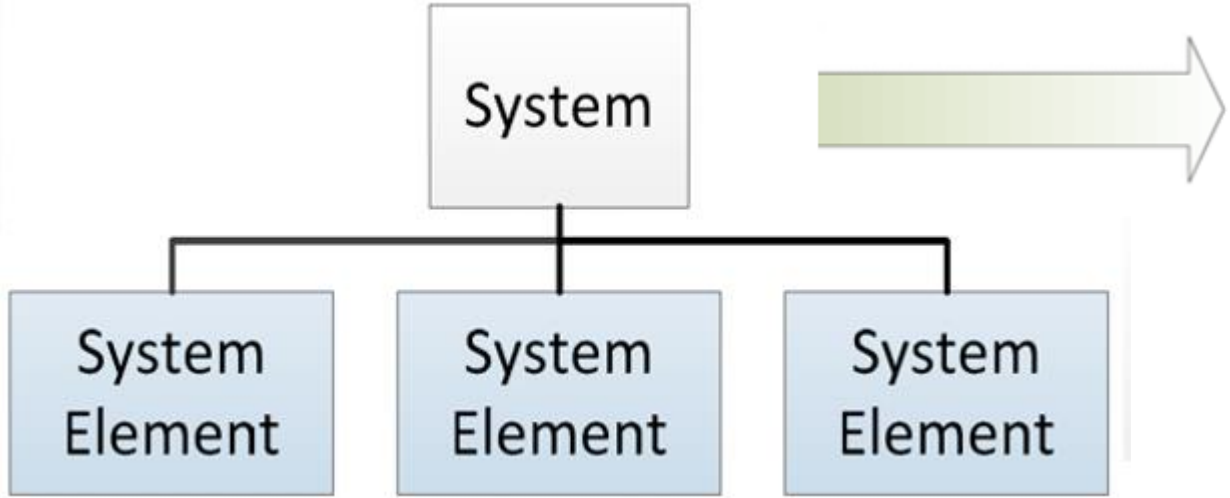


Fig. 5. Figure 1 of 15288, titled “System and system element relationship”

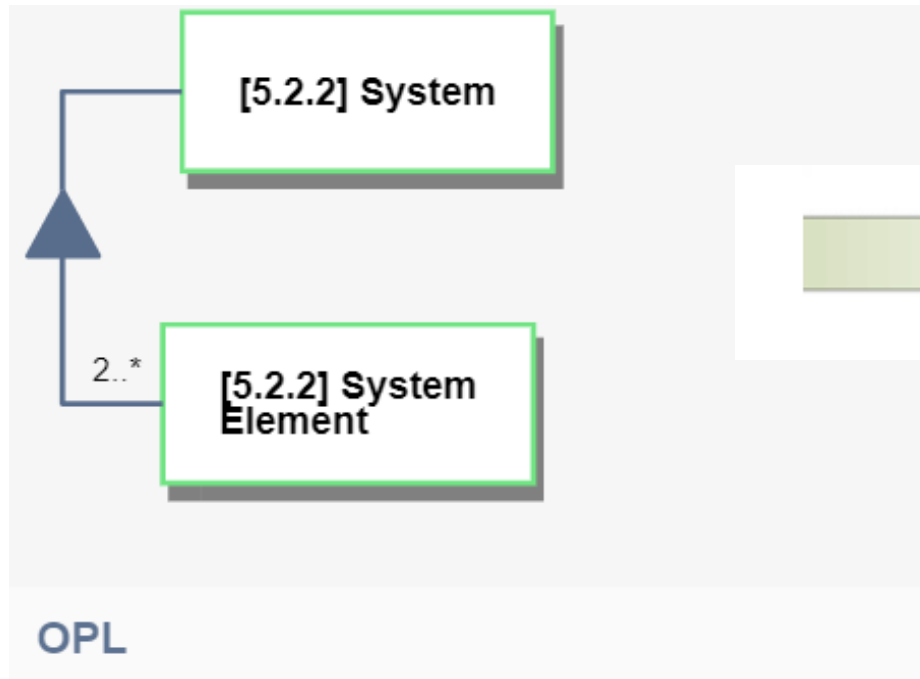
# Translation of 15288 Figure 1 Into an OPM Model



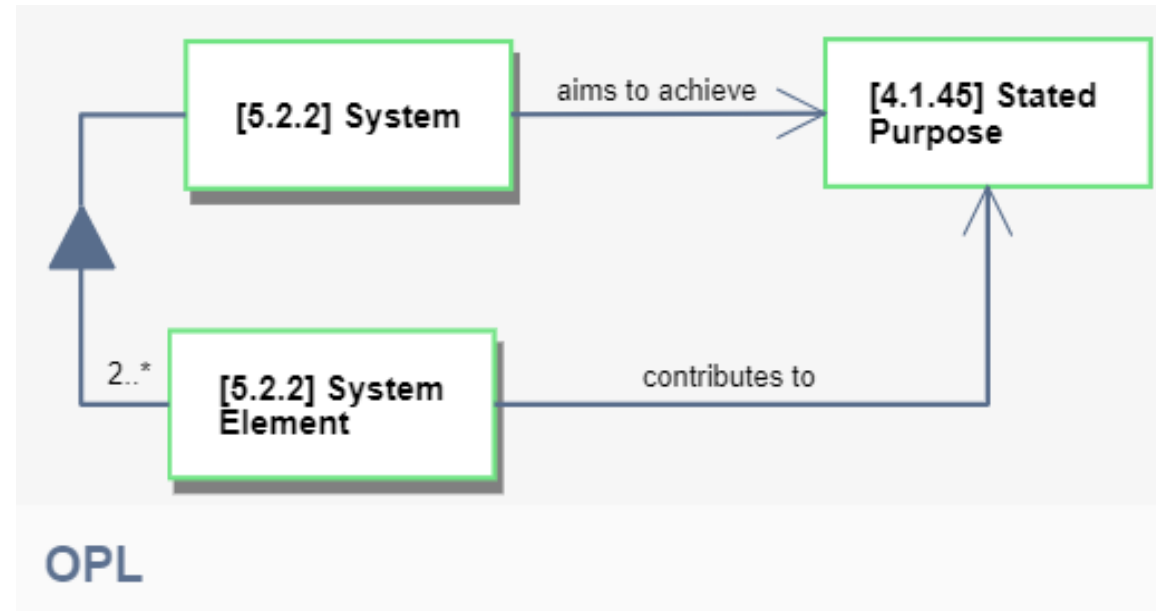
OPL

- System is physical.
- System Element is physical.
- System consists of 2 to many System Elements.

# Adding the Text from 15288 Figure 1 into the OPM Model

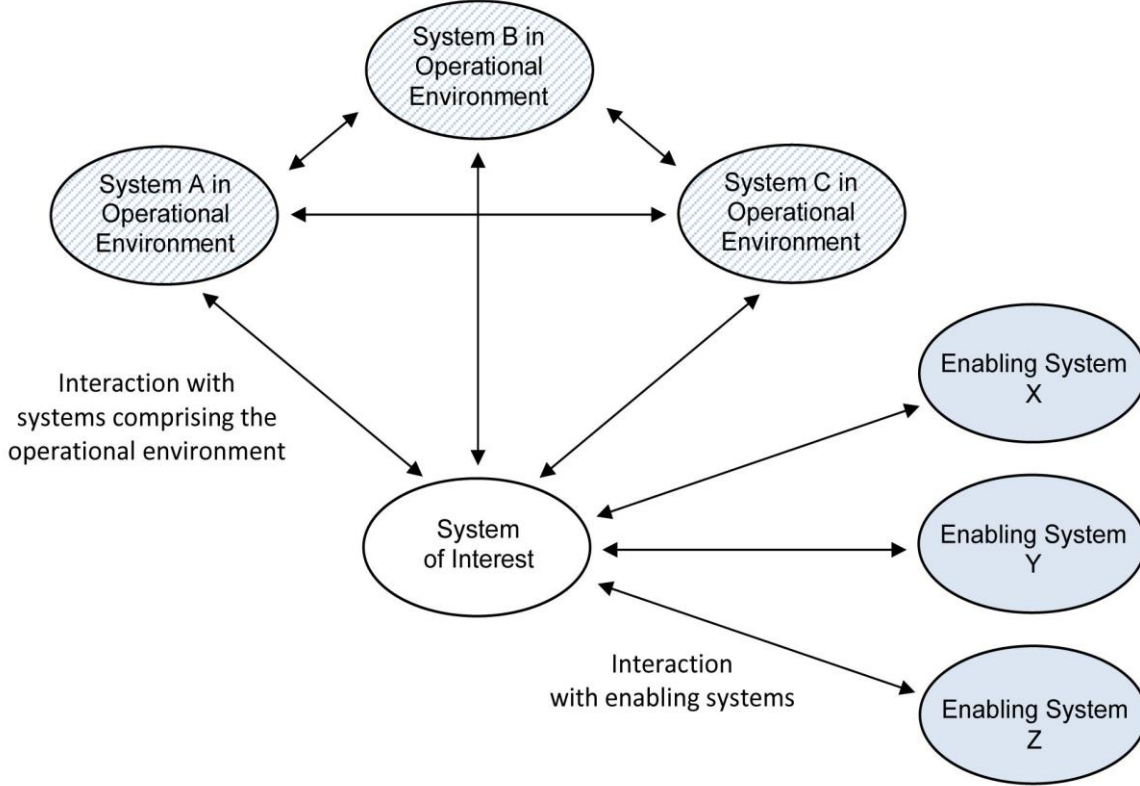
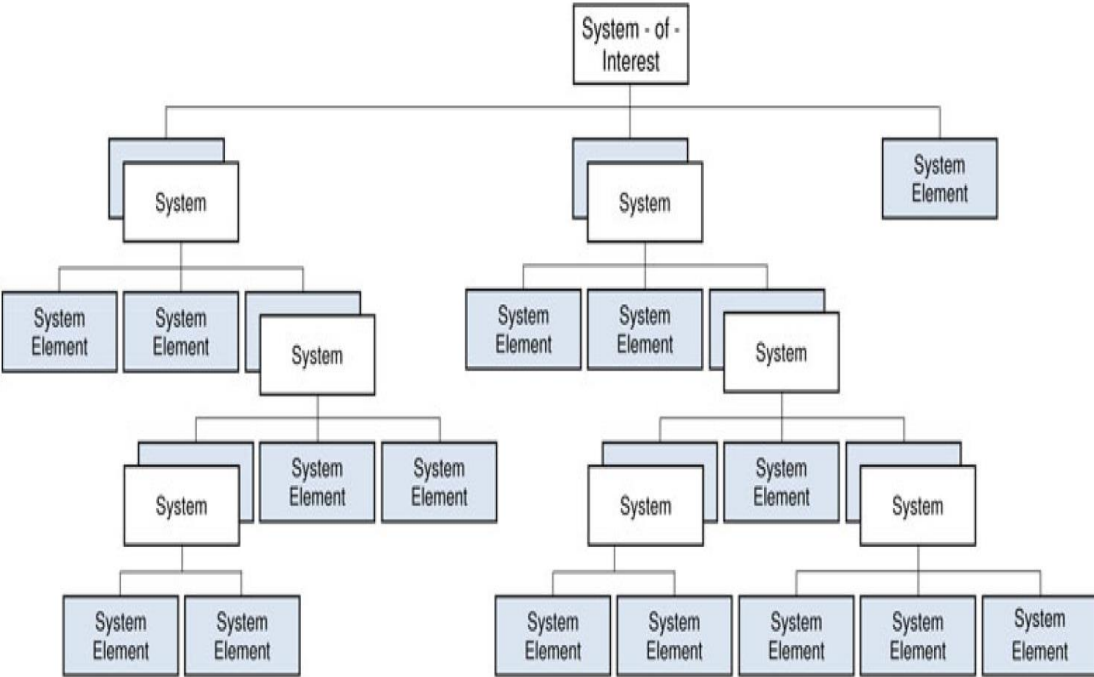


System is physical.  
 System Element is physical.  
 System consists of 2 to many System Elements.



System consists of 2 to many System Elements.  
 System aims to achieve Stated Purpose.  
 System Element contributes to Stated Purpose.

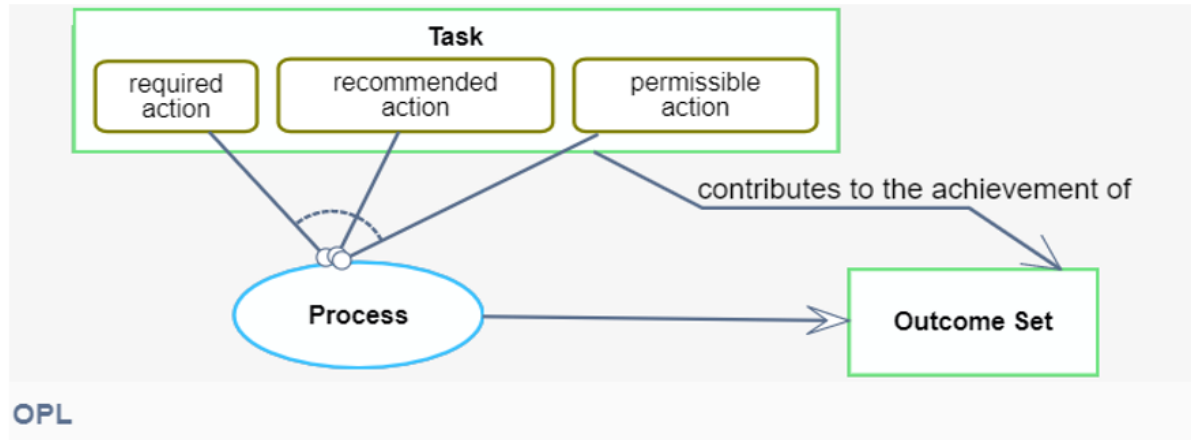
# 15288 Figure 1 vs. Figure 2: Why Different Symbols??





# 15288 – Two 15288 task definitions?

In Clause 4.1.49, a task is defined as “required, recommended, or permissible action, intended to contribute to the achievement of one or more outcomes of a process”.

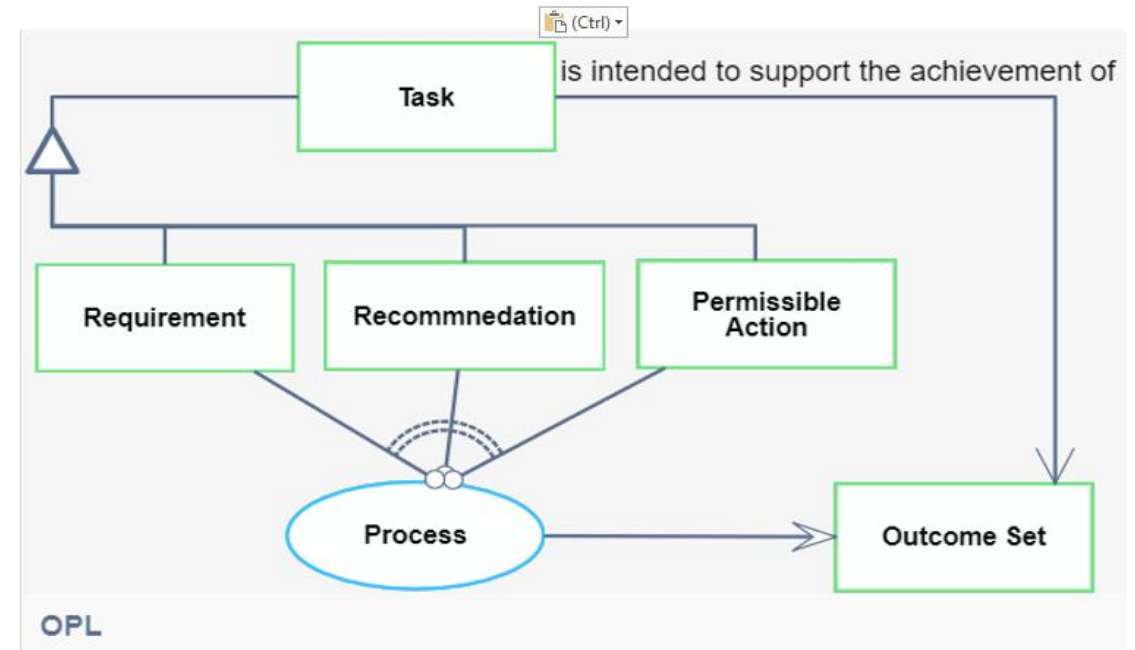


OPL

- Task can be required action, recommended action or permissible action.
- Task contributes to the achievement of Outcome Set.
- Process yields Outcome Set.
- Process requires Task at one of the states required action, recommended action or permissible action.

Fig. 12. OPM model of **Task** according to 15288 Clause 4.1.49

Yet, in 5.5.2 we read: “The tasks are requirements, recommendations, or permissible actions intended to support the achievement of the outcomes.”



OPL

- Permissible Action, Recommendation, and Requirement are Task.
- Task is intended to support the achievement of Outcome Set.
- Process yields Outcome Set.
- Process requires at least one of Permissible Action, Recommendation, and Requirement.

Fig. 13. OPM model of **Task** according to 15288 Clause 5.5.2