ISE&PPOOA White paper

ISE&PPOOA and ISO 15288:2023

3 September 2025

Introduction

As you may know, ISO 15288:2023 is an international standard that establishes a common framework for delineating the life cycle processes of human-made systems. The standard focuses on Systems Engineering, outlining a set of processes that organizations may employ to manage the complete life cycle of a system, spanning from conceptualization to retirement.

These processes are categorized into four principal groups**: Agreement Processes, Organizational Project-Enabling Processes, Technical Management Processes, and Technical Processes.**

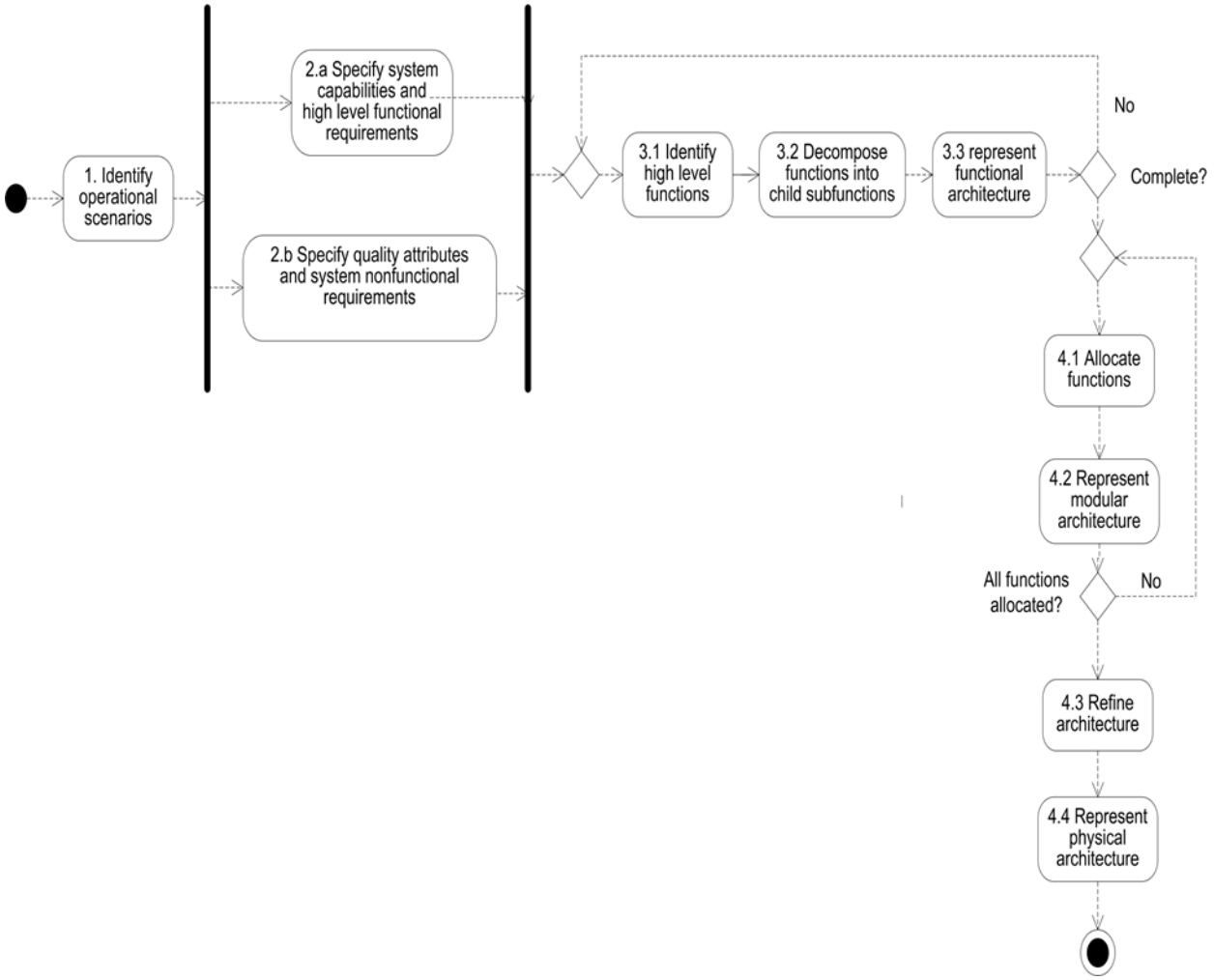
This white paper shows the alignment of the ISE&PPOOA MBSE methodology and the well-known ISO 15288:2023 standard.

The following table provides some hints on which activities (and their outcomes) from the ISE&PPOOA methodology cover the different Technical Processes defined in ISO 15288:2023.

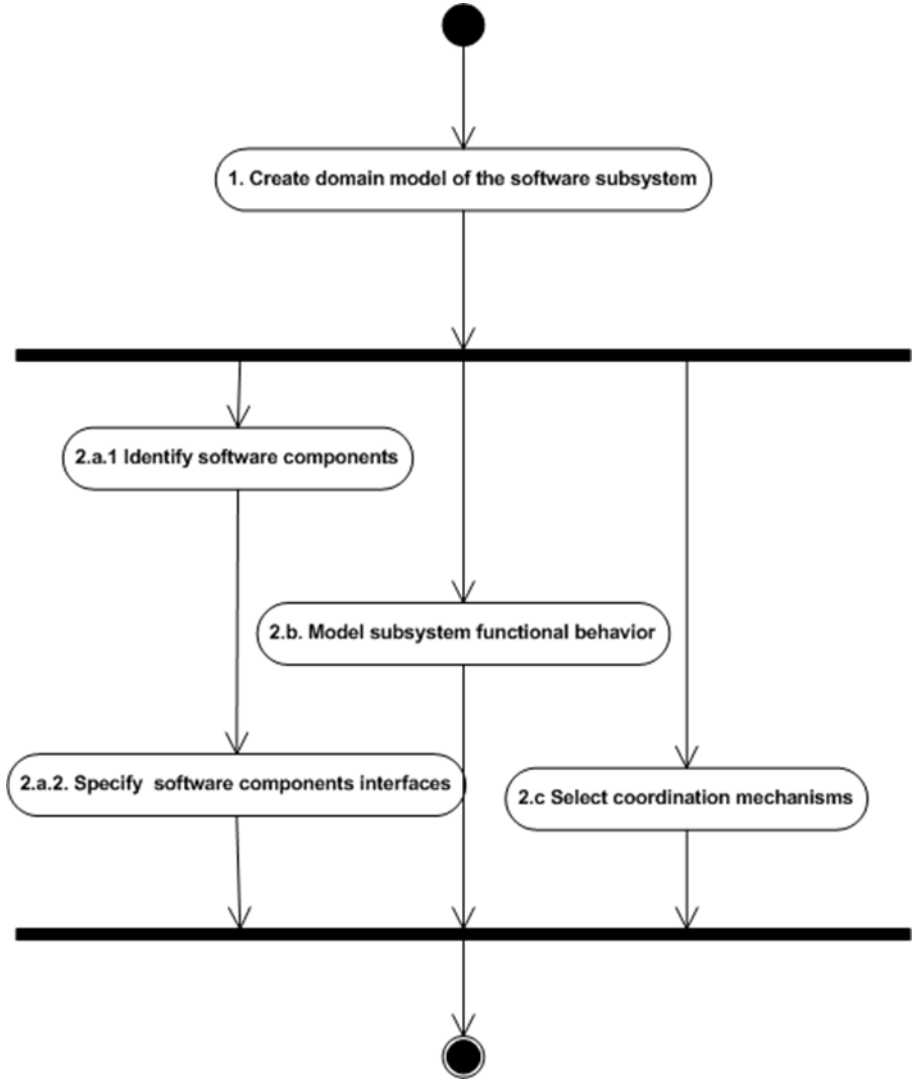
Note: references appearing in the table are from ISE&PPOOA book titled "Practical Model-Based Systems Engineering" and published by Artech House in 2019 (https://us.artechhouse.com/Practical-Model-Based-Systems-Engineering-P2032.aspx).

Additional information can be found at the ISE&PPOOA website: https://ppooa.com.es/

The ISE&PPOOA methodological process-System architecting subprocess (To be applied to the System of Interest)



The ISE&PPOOA methodological process-Software architecting subprocess (optional when using PPOOA software architectural framework to a software intensive subsystem)



How does ISE&PPOOA MBSE methodology align to ISO 15288:2023?

ISO15288 Process	Description	ISE&PPOOA Alignment/Steps
Business or Mission Analysis Process	Identifies and analyzes business or mission problems/opportunities of the organization and bound the solution space.	Even though there are no explicit steps in the methodology to deal with the analysis of the business/mission of the organization, we can use the outputs from Step 1 (Identify Operational Scenarios) of the methodology as feedback.
Stakeholder Needs and Requirements Definition Process	Defines stakeholder needs, transforms them into requirements, and ensures they reflect the intended use.	Step 1 (Identify Operational Scenarios) proposes to identify the context/s of the system and define its use cases and operational scenarios. Stakeholder needs can be extracted from the operational scenarios steps, writing them from the stakeholder's point of view, ensuring that the needs are consistent with the intended use of the system reflected by the operational scenarios. Additionally, Step 2a (Specify System Capabilities and High-level Functional Requirements) will be used to identify the system capabilities based on the outputs from Step 1, and Step 2b (Specify Quality Attributes and System NFRs) will help us define critical performance measures and quality characteristics of the system. Sections 8.1 and 9.1 provide some examples.
System Requirements Definition Process	Transforms stakeholder requirements into system requirements, including functional and non-functional aspects, changing perspectives of what is needed from the stakeholder´s view to the system developer´s view, i.e. his design input.	Step 2a (Specify System Capabilities and High-level Functional Requirements) will be used to identify the system functional requirements and Step 2b (Specify Quality Attributes and System NFRs) will be used to define the non-functional requirements based on the quality tree. Sections 8.2 and 9.2 provide some examples. Additionally, Steps 3 and 4 (related to the creation of the system architecture) will help us perform the (functional and non-functional) requirements flow down to the lower layers of the system decomposition. This is a disciplined iterative process that

		produces progressively more solution-oriented or detailed requirements (see Section B.3).
ISO15288 Process	**Description**	**ISE&PPOOA Alignment/Steps**
Architecture Definition Process	Defines the system architecture, including logical and physical views, ensuring it meets requirements.	Iterative Steps 3.1 (Identify High Level Functions), 3.2 (Decompose Functions into Child Subfunctions) and 3.3 (Represent Functional Architecture) are used to create the complete functional architecture of the system independent of the possible solutions, where considering functions as transformations, using the out-in approach, and the use of the N^2 chart are key elements to make the functional architecture consistent with the operational view of the system from the previous steps, and to facilitate identification of system elements with clear interfaces in Step 4. (See Chapter 5 for more details) Steps 4.1 (Allocate Functions), 4.2 (Represent Modular Architecture), 4.3 (Refine Architecture) and 4.4 (Represent Physical Architecture) focus on defining the solution consistent with the functional architecture and the quality tree, and where modularity and heuristics play a key role to meet the functional and non-functional requirements. (See Chapter 6 and 7)
Design Definition Process	Provides detailed design data for implementation, refining architecture into realizable elements.	For software-intensive subsystems, PPOOA recommends Domain Analysis as the bridge between the system architecture and software architecture. Domain Analysis is independent of the software architecture framework to be used. (See Section 4.4.2).
System Analysis Process	Performs analyses to support decision-making, such as trade-offs, risks, and performance.	Step 4.3 (Refine Architecture) recommends using trade-offs to select the physical building elements and to use heuristics and patterns to implement non-functional requirements. (See Chapter 11)
Implementation Process	Realizes system elements through fabrication, coding, or adaptation.	ISE&PPOOA focuses on architecture and design, not detailed implementation, but the outcomes produced during the application of its steps facilitate the implementation process, e.g. a refined architecture which its comprising elements have clear

		responsibilities, properties and interfaces, consistent with the system needs, and which can be implemented and evolved with a low degree of interdependency with teams responsible for other system elements.
ISO15288 Process	**Description**	**ISE&PPOOA Alignment/Steps**
Integration Process	Assembles system elements into a cohesive whole that functions as intended, ensuring interfaces work.	Outcomes produced by the application of the ISE&PPOOA methodology, explicitly stating the interfaces between system elements in different views (i.e. internal block diagrams for physical interfaces, n-squared charts for functional interfaces) together with the allocated functional flows, the promotion of having a modular architecture, and clear requirements traceability help plan integration sequences and verify interface consistency during assembly.
Verification Process	Confirms that the system meets specified requirements.	ISE&PPOOA proposes a requirement-driven process in which requirements are specified during the architecting process and the resulting architecture drives the requirements flow-down (see Section B.3). The methodology recommends employing requirements templates and the INCOSE Guide for Writing Requirements to ensure well-formed requirements that serve as a verifiable baseline for the Verification process.
Transition Process	Establishes the system in its operational environment.	Outcomes produced by the application of the ISE&PPOOA methodology, like the context diagram, the operational scenarios and the system architecture support deployment planning, facilitating transition tasks like installation and configuration of systems.
Validation Process	Confirms the system meets stakeholder needs in its intended environment.	Outcomes produced by the application of the ISE&PPOOA methodology, like the use cases, operational scenarios, and an explicit set of stakeholder needs provide the validation artifacts that can be used to demonstrate system behavior in user environments.
Operation Process	Uses the system to deliver services/products	By consistently applying the ISE&PPOOA methodology (which prioritizes understanding and defining the problem before exploring potential solutions), we can produce reliable outcomes

		to create a system which, when operated in its intended environment, performs as expected to fulfill stakeholders' functional and non-functional expectations (e.g. resilience, safety, human factors...).
ISO15288 Process	**Description**	**ISE&PPOOA Alignment/Steps**
Maintenance Process	Sustains the system through repairs, upgrades, and support	Outcomes produced by the application of the ISE&PPOOA methodology, like use cases and operational scenarios to perform maintenance, quality models covering reliability and maintainability aspects and their related heuristics, together with a physical architecture based on modularity (Section 7.2) will facilitate that the produced system is maintained as expected by its stakeholders.
Disposal Process	Ends the system's life responsibly, including decommissioning and waste management.	The outcomes generated by applying the ISE&PPOOA methodology (such as use cases and operational scenarios for system decommissioning) ensure that stakeholders execute the disposal process as intended.