INCOSE

New Standards for System of Systems Engineering (SoS)

Why standardization for SoS engineering?

Common concerns across SoS domains and types:

- SoS engineering practices build on proven processes of systems engineering, other disciplines and domains, for the individual system-of-interest (SoI)
- Account for considerations that a system-of-interest needs to address for interactions in anticipated SoS
- Provide constituent systems with knowledge of the SoS in which they will interoperate in order to meet the primary SoS purposes

From a practitioner point of view:

- Treat the SoS with the same engineering discipline as is used for a single system-of-interest
- Avoid the risks from the lack of understanding of how the constituent systems and the SoS operate as a whole

Definitions from the Standards
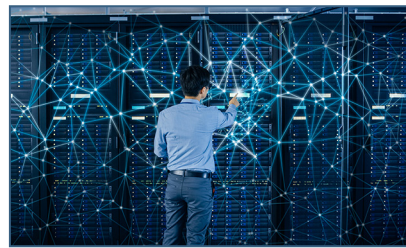
System of Systems—set of systems and system elements that interact to provide a unique capability that none of the constituent systems can accomplish on its own

Note: System elements can be necessary to for interaction of constituent systems in SoS.

[Source: ISO/IEC/IEEE 21839:2019, 3.1.4]

System—combination of interacting elements organized to achieve one or more stated purposes [Source: ISO/IEC/IEEE 15288:2015, 4.1.46]

Constituent System—independent system that forms part of a system of systems

Note: Constituent systems can be part of one or more SoS. Each constituent system is a useful system by itself, having its own development, management, utilization, goals, and resources, but interacts within the SoS to provide the unique capability of the SoS.

[Source: ISO/IEC/IEEE 21839:2019, 3.1.1]

To access these standards
https://www.iso.org/store.html

For more information on SoS
INCOSE SoS Working Group:
https://www.incose.org/incose-member-resources/working-groups/analytic/system-of-systems

New Standards for Systems of Systems Engineering

ISO/IEC/IEEE 15288
System Life Cycle Processes
Primary Standard For Systems Engineering, Underpins Other Standards

- Establishes a common framework of process descriptions for the life cycle of systems created by humans.
- Defines a set of processes and associated terminology from an engineering viewpoint.
  - These processes can be applied at any level of a system's structure.
  - Selected sets of these processes can be applied throughout the life cycle for managing and performing the stages of a system's life cycle.
  - This is accomplished through the involvement of all stakeholders, to achieve customer satisfaction.
- Provides processes that support the definition, control and improvement of the system life cycle processes used within an organization or a project.
  - Organizations and projects can use these processes when acquiring and supplying systems.

ISO/IEC/IEEE 21839
System of Systems Considerations in Life Cycle Stages of a System

- Provides critical SoS considerations to be addressed at key points in the life cycle of the System of Interest (SoI).
  - Considerations that apply to an SoI that is a constituent system that interacts in an SoS.
  - Considerations and life cycle model align with those which are already defined in ISO/IEC/IEEE 15288:2015 and ISO/IEC/IEEE 24748-1:2018.
  - Selected subsets of these considerations may be applied throughout the life of systems through the involvement of stakeholders.
- Emphasizes that the goal is to achieve customer satisfaction—when delivered, the SoI will operate effectively in the operational or business environment which is typically characterized as one or more systems of systems.
- Useful as an augmentation to 15288 when developing an individual system such as the SoI.

ISO/IEC/IEEE 21840
Guidelines for the use of ISO/IEC/IEEE 15288 in the context of system of systems

- Provides guidance on the application of processes in ISO/IEC/IEEE 15288 to the special case of SoS, including considerations for how constituent systems relate within the SoS.
- Explores the similarities and differences between systems and SoS and, by extension, the similarities and differences between engineering of systems and SoS.
- Applies when the system of interest is an SoS.

ISO/IEC/IEEE 21841
Taxonomy of systems of systems

- Explains what taxonomy is and how it applies to the SoS to aid in understanding and communication.
- Defines a normalized taxonomy for SoS to facilitate communications among stakeholders.
- Applies when describing comparing SoS.