

Snip-It – An Approach for System of Systems Modeling Reuse

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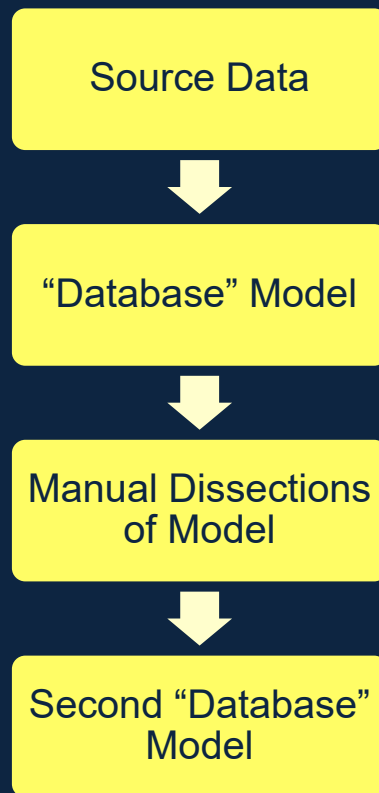
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The Challenge...

- Systems of Systems (SoS) engineering is key to building effective and integrated systems
- Scope and scale of many SoS requires new approaches within DE and MBSE to meet challenges of SoSE modeling
- SoS can be large and complex, and often engineers have an interest in selected aspects of an SoS
- In the past, the approach has been to either address the full complex SoS in on large SoS model or to independently create a model which represents the specific SoS aspects of interest

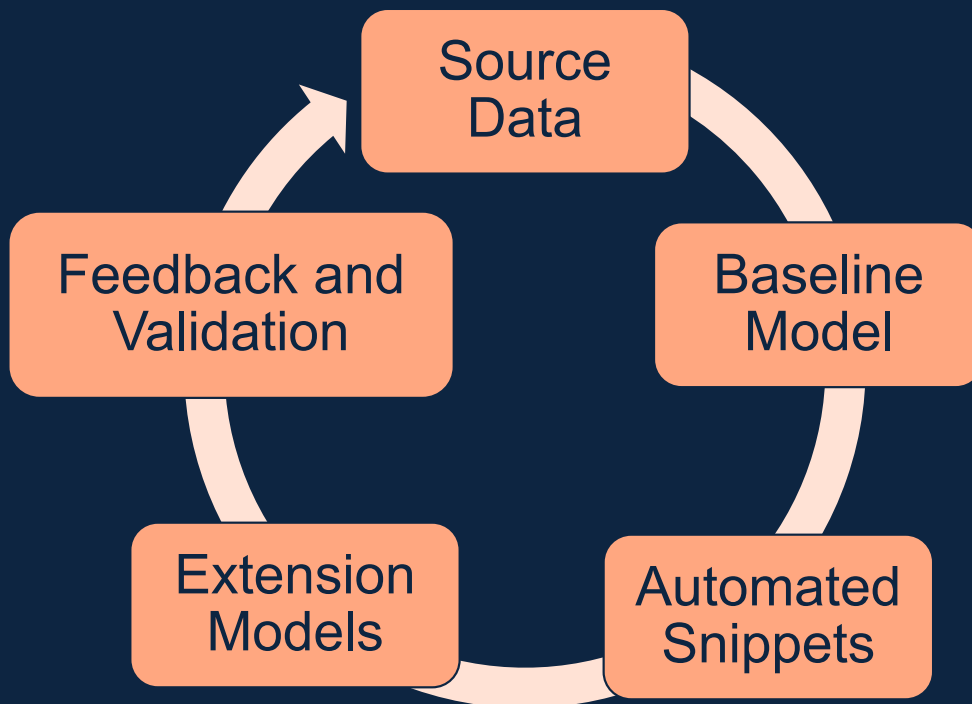


Modeling Today – Large Models are Useful, But...



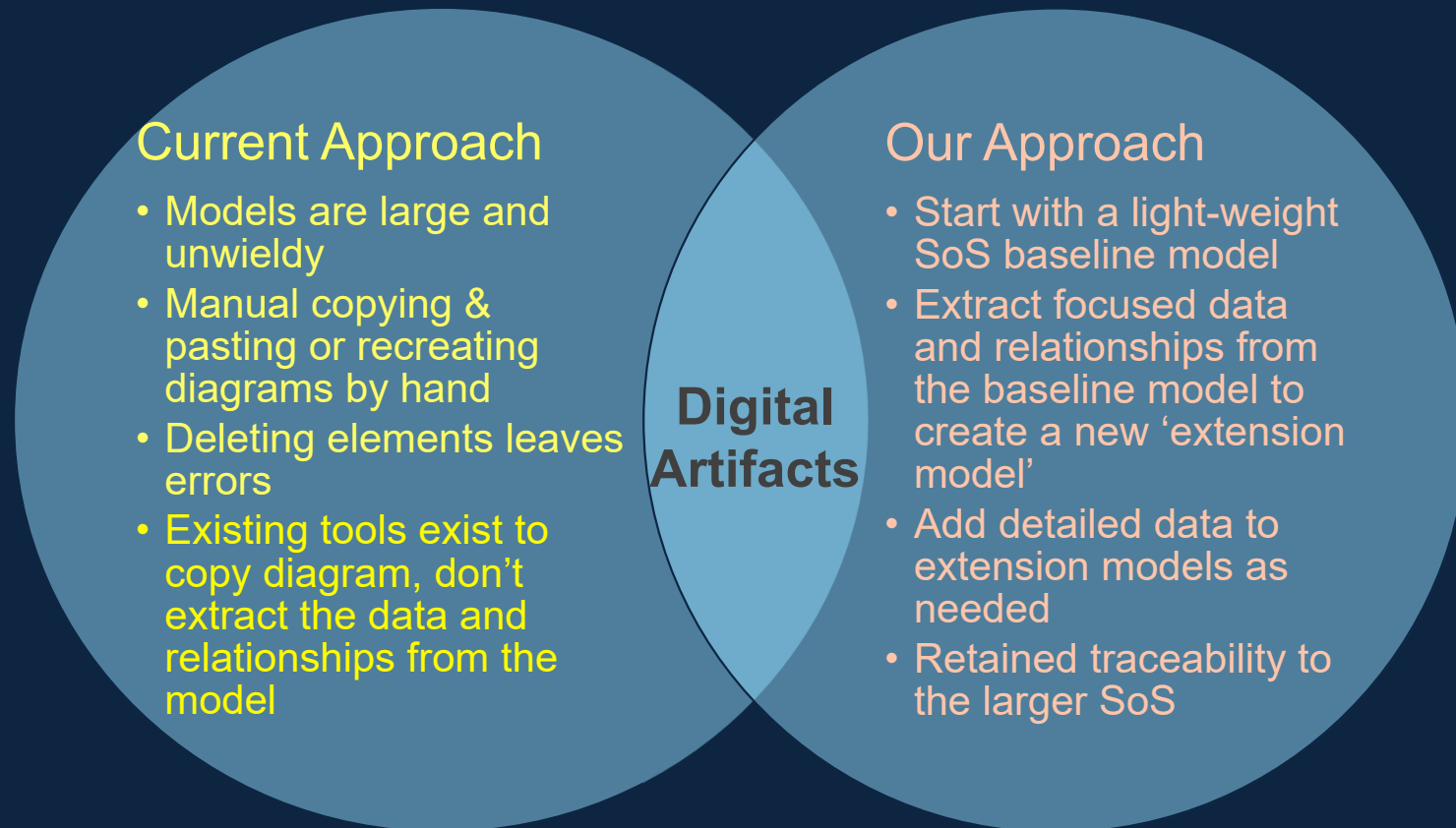
- Large systems of systems models often grow overtime as they are applied to a broader set of purposes
- They often hold data that is never used for analysis, morphing models into large databases
- Large models have an unwieldy loading time; Some take hours to open
- Extracting the data needed for an analysis from these large models can be a manual, error prone, and unwieldy process

Snip-It Approach



- An approach to create models with just the right amount of information
- Reuse existing large light-weight models for a focused and deliberate analysis
- Support the “just in time vs just in case” methodology within extension models

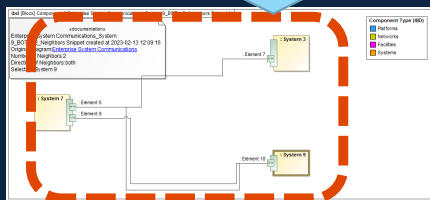
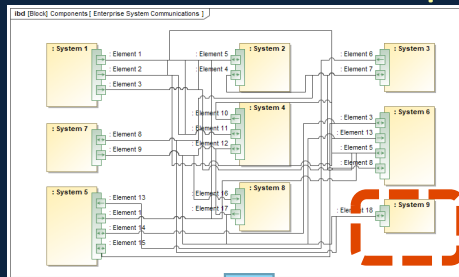
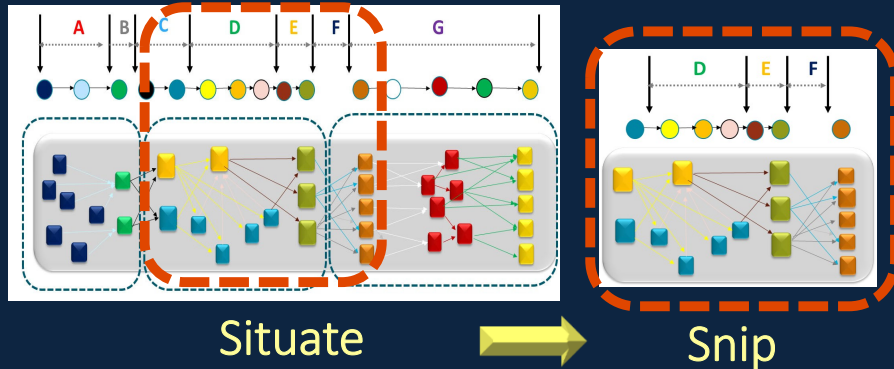
Current Approach vs. Our Approach



Automation, ease of reuse, and framework to facilitate analysis deep dive

Snip-It (Patent Pending)

What is a 'Snippet'



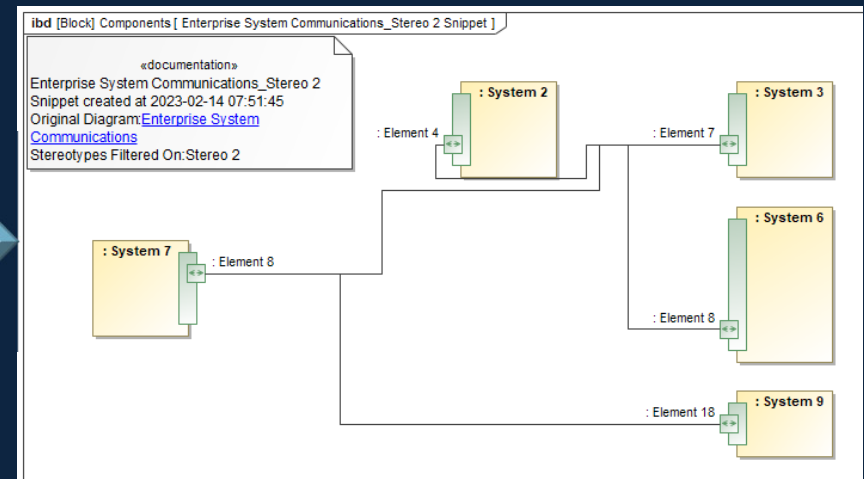
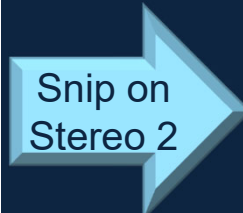
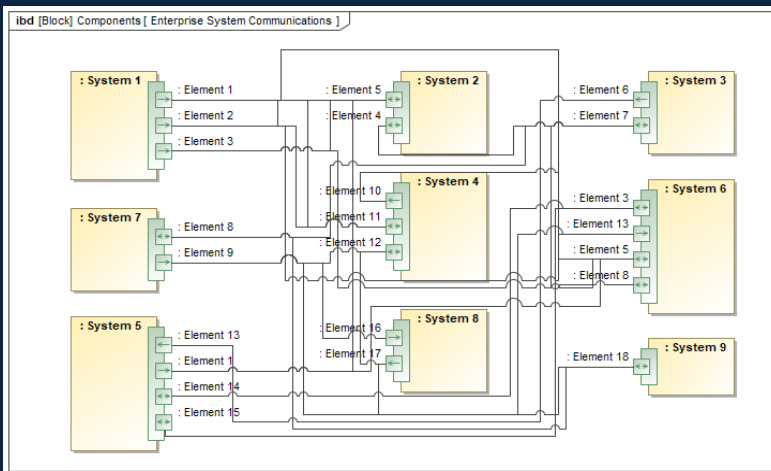
- Large System of Systems model provides a common enterprise context for addressing a range of different issues affecting different parts of the enterprise
- Using this construct, those parts of the SoS relevant to the issue under consideration are identified and are extracted from the model to create a "snippet"
- Snippets are currently generated either manually or by use of Cameo 'diagram aspects'
- Snippets then provide the frame for development of enhanced extension models to address the specific 'deep dive' issue

Types of Snippets

- Stereotype Snippet
 - This snippet allows to see all the **elements with a certain stereotype applied**. The stereotype snippets can be executed on structural elements and behaviors.
- Neighbor Snippet
 - This snippet allows **to see neighbors from 1-3 hops** of the selected structural elements.
- Containment Tree Snippet
 - This snippet allows **to create an extension model** directly from **the model containment tree**.
- Item Flow Snippet
 - This snippet allows the generation of a **Snippet of an IBD** by filtering the nodes based on the Conveyed Information or Item Flows of its connectors.

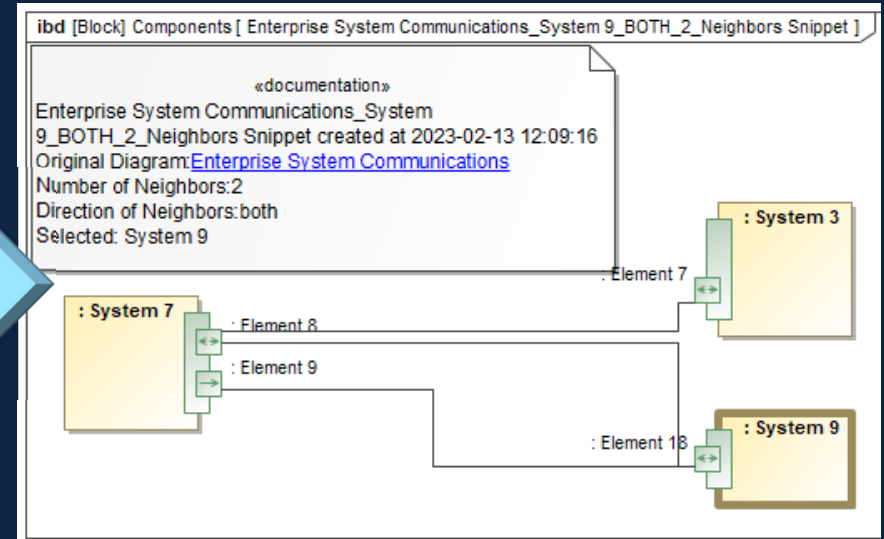
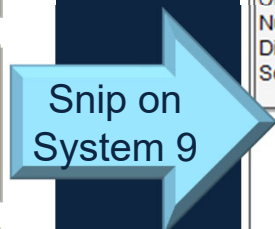
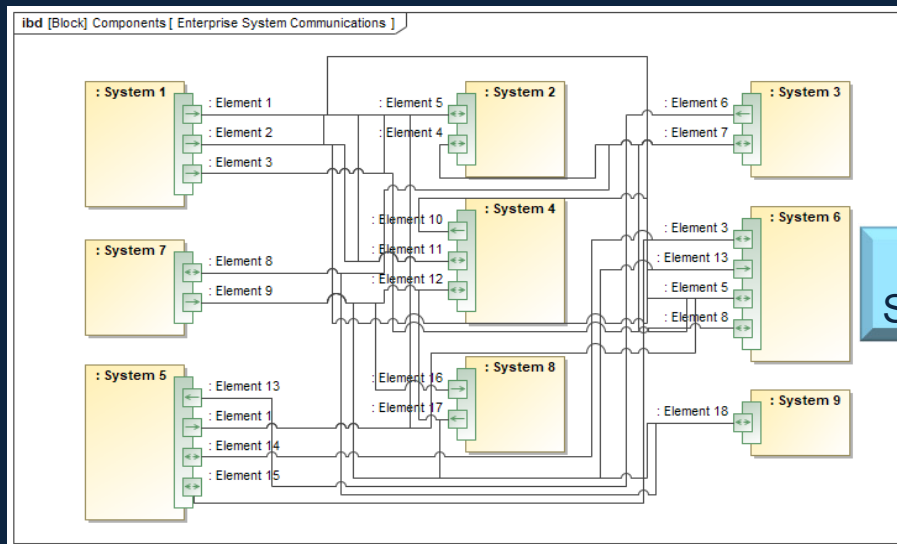
Stereotype Snippet

The stereotype snippet looks for all elements on the current diagram that have the specified stereotype



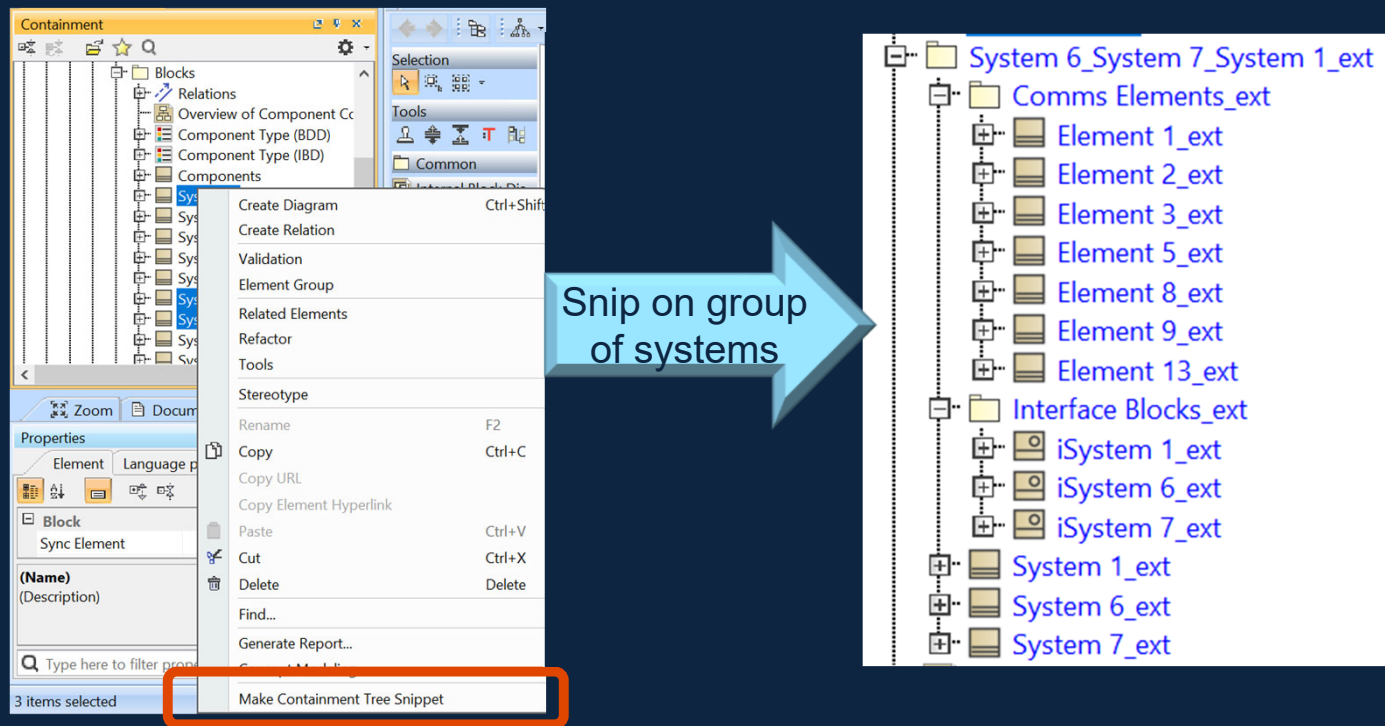
Neighbor Snippet

The neighbor snippet looks at one step, two steps, or three steps from the system of interest. The user must first select the element or elements of interest and right click to access the Snip-It capability.



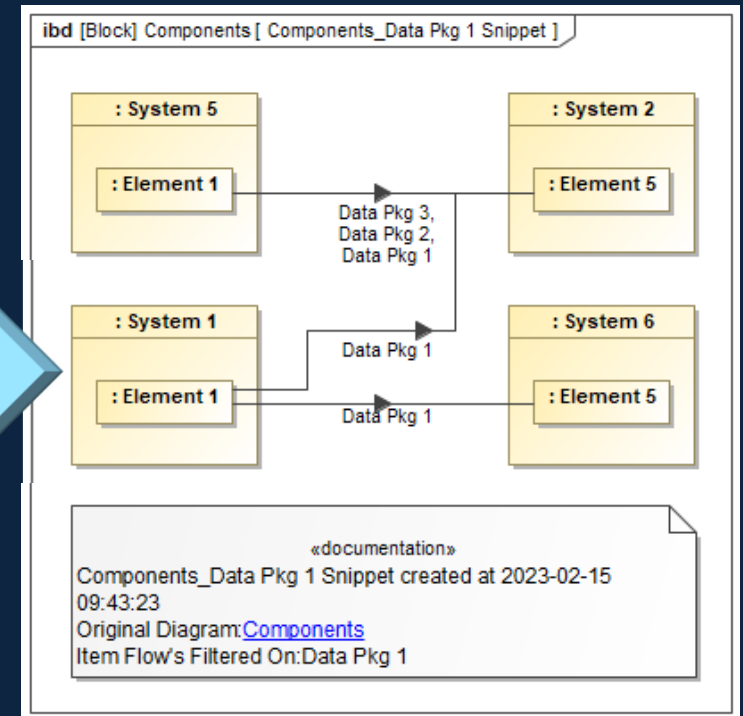
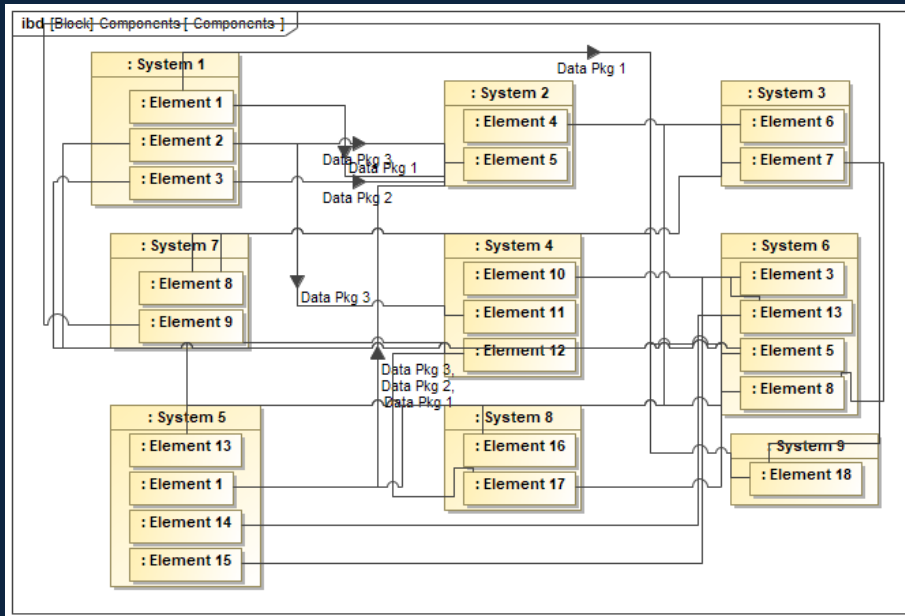
Containment Tree Snippet

The containment tree snippet pulls the selected element(s) and all underlying data into an extension model so that the user retains traceability to the baseline model. The user selects the element(s) and right click to access the Snip-It options menu.



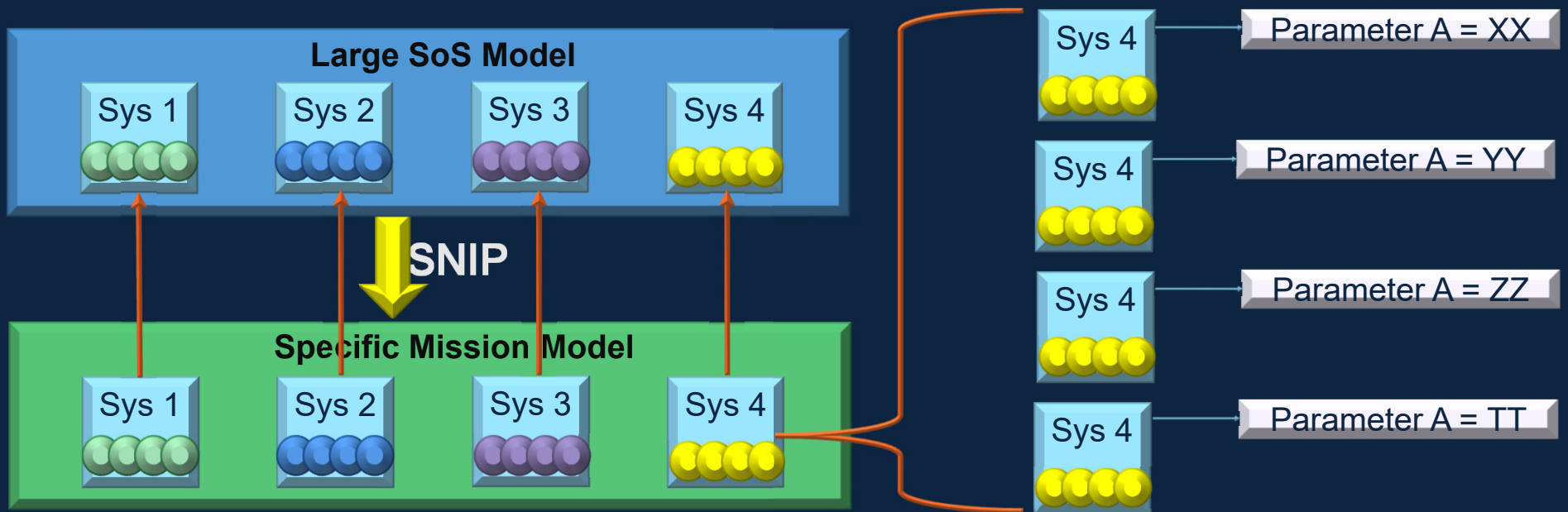
Item Flow Snippet

The Item Flow snippet looks for all item flows between elements on the current diagram that have the specified stereotype.



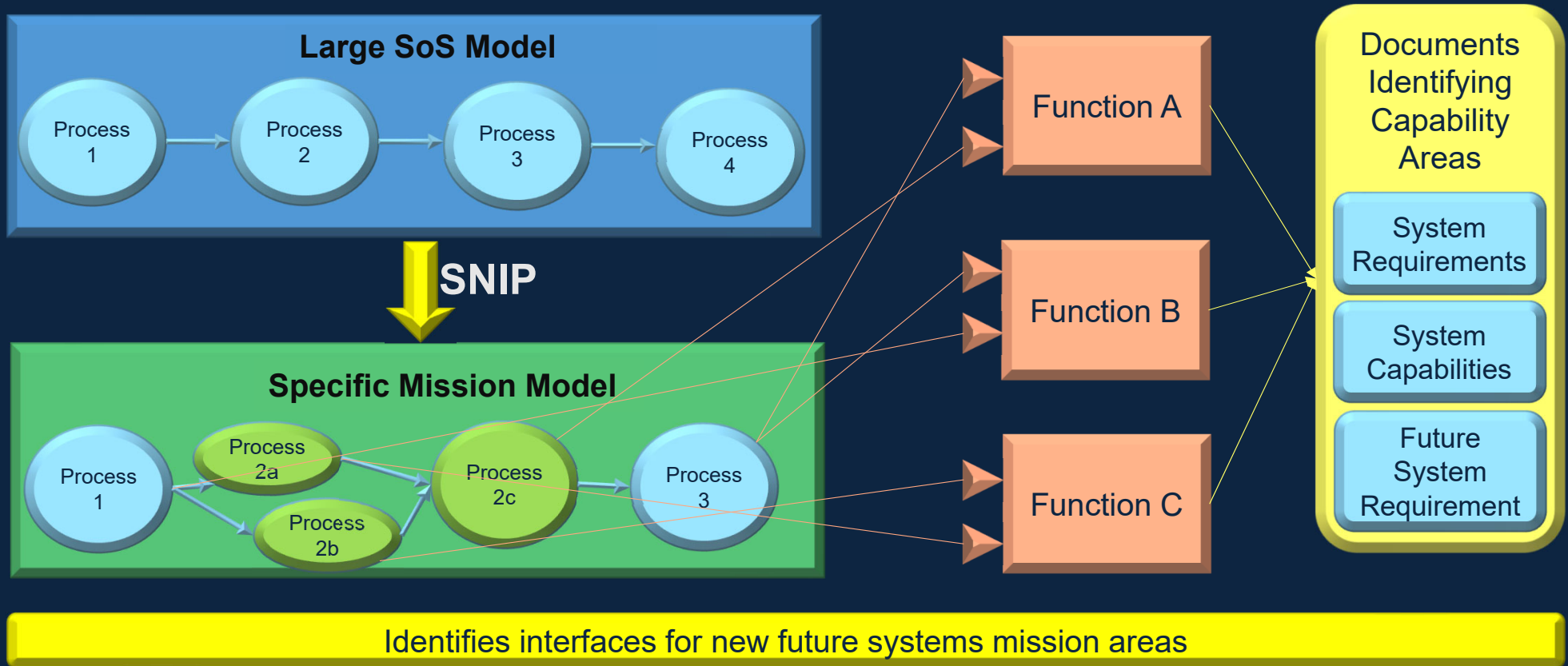
Practical Applications

Extension Models to Enhance Data Parameters

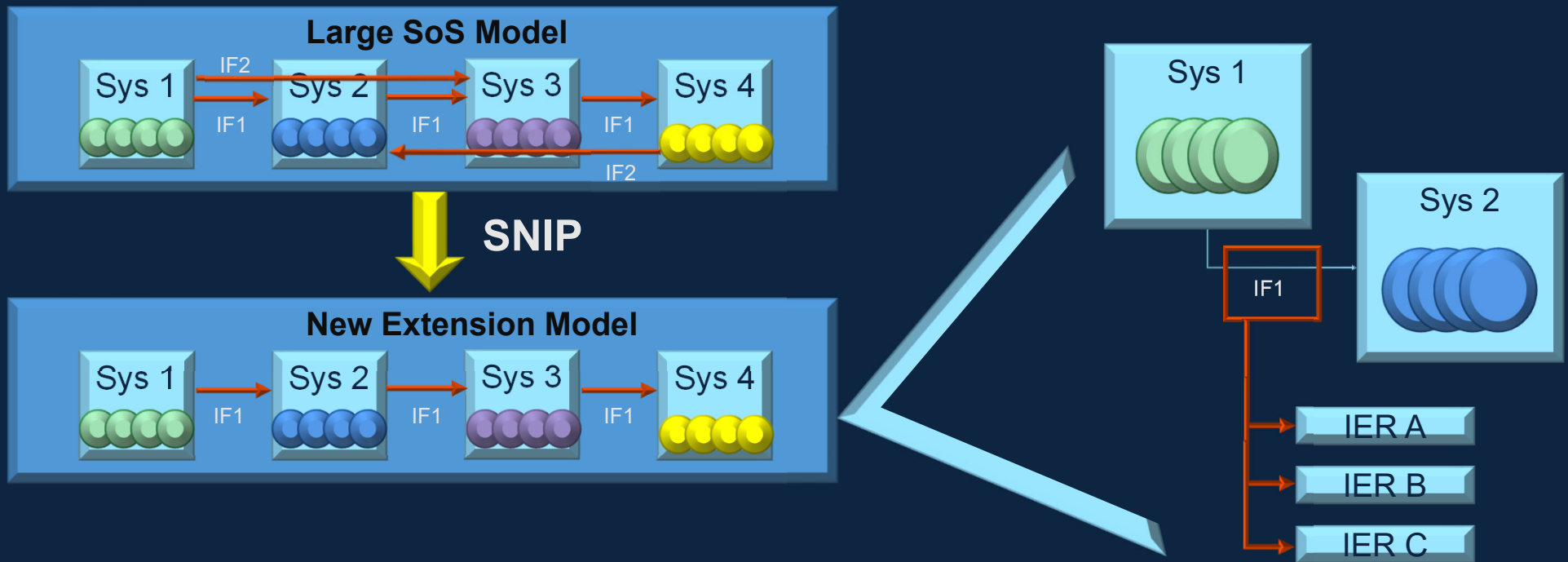


Identifies visual discrepancies within the model and allows for iteration

Extension Models to Drive Requirements

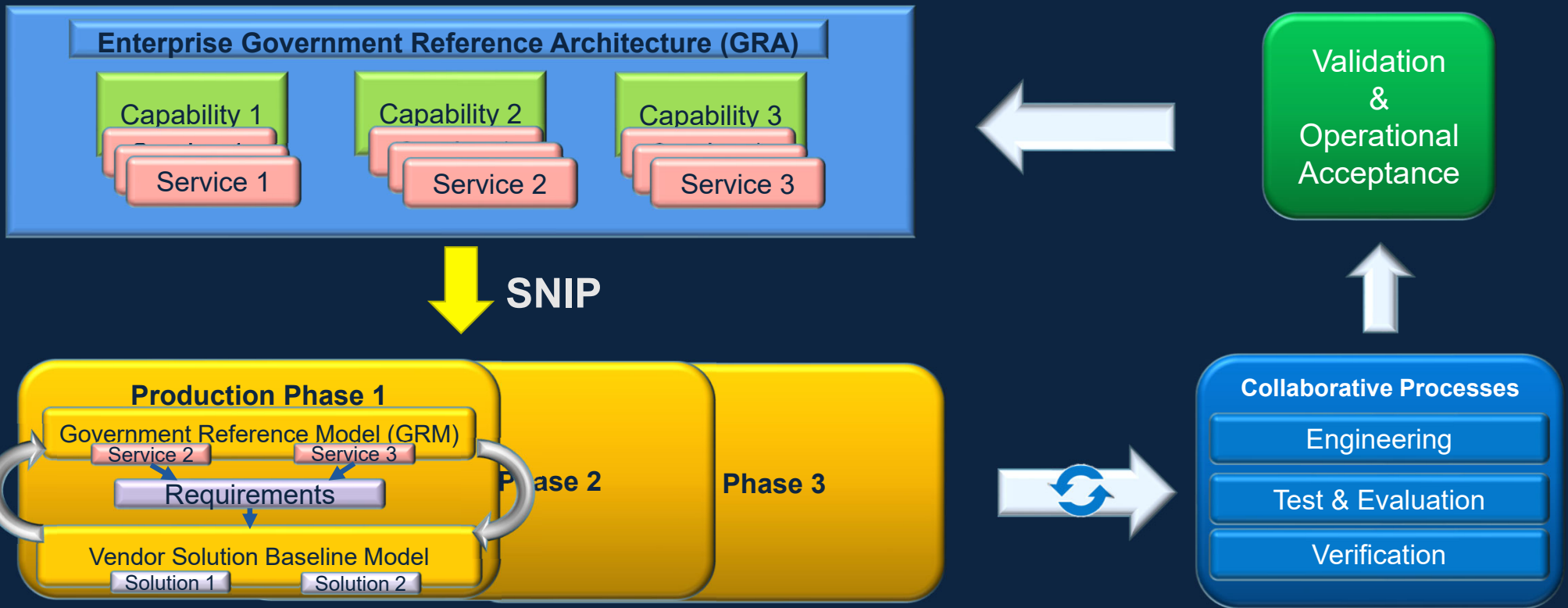


Extension Models to Refine Data Interfaces



Allows modelers to create new models in a short amount of time

Extension Models to Validate Vendor Solution



Enhanced data and collaboration to reduce time, cost, and risk

Conclusion

- Large high-level SoS models have many benefits
 - SoS can be large and complex, and often engineers have an interest in selected aspects of an SoS
 - In the past, the approach has been to either address the full complex SoS in the SoS model or to independently create a model which represents the specific SoS aspects of interest
- Snip-it approach decreases manual development of diagrams, models, etc.
 - Supports effective data reuse for analysis
 - Adds traceability to original high-level model
 - Creates copies of elements to allow for enhancement of data
 - Creates focused diagrams of interest
 - Applicable across various languages and frameworks (SysML, UAF, etc.)
- Scoped extension models facilitate focused analysis on specific issues with the right amount of information

Back up

Abstract

- Systems Engineering (SE) prioritizes systems and their subsystems for detailed analysis. Digital engineering (DE) and model-based systems engineering (MBSE) approaches were developed and have supported traditional SE applications. However, the recognition that Systems of Systems (SoS) engineering is necessary to build effective and integrated systems in today's world of resource constraints and legacy systems is requiring new approaches within DE and MBSE. These SoS can be large and complex, and often engineers have an interest in selected aspects of an SoS. In the past, the approach has been to either address the full complex SoS or to independently create a model which represents the aspects of interest.
- To address this need, the Snip-It application allows for the constituent systems of interest and their neighbors or related systems and connectivity to be isolated and extracted from a larger Systems of Systems model to develop an extension model which can be used to address issues related to these elements of the larger SoS. The extension model can be tailored with new details and added fidelity, as these “snippets” are then further detailed and enhanced to enable deep dive analyses of proposed SoS investments or issues, within the context of an overall mission. This presentation will detail the work of extending MBSE and DE-relevant capabilities and will share examples of how these extensions have enabled analyses of a complex, operational SoS.