32nd Annual INCOSE international symposium
hybrid event
Detroit, MI, USA
June 25 - 30, 2022

Capt David Burns, Mr. Cecil Tiblin, and Mr. Daniel Hettema

NRO Application of SOW Model

www.incose.org/symp2022

Agenda

- NRO & SED Overview
- BLUF
- Our Design Process
- SOW Model Overview
- Lessons Learned
- Path Forward

About the National Reconnaissance Office (NRO)

Mission

Develop, acquire, launch, and operate the nation's space-based intelligence, surveillance and reconnaissance capabilities to secure and expand the U.S. intelligence advantage.

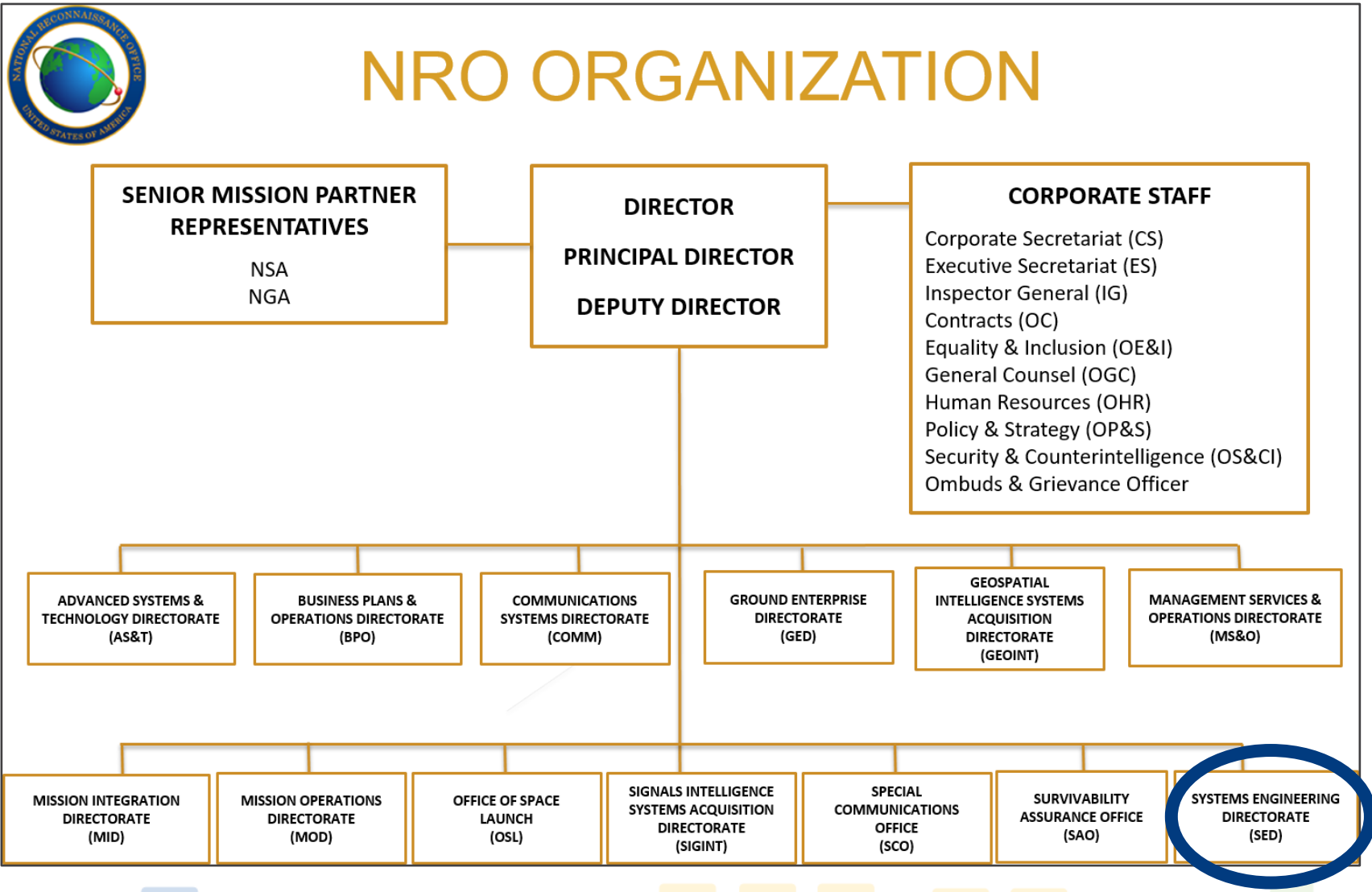
Vision

See it, Hear it, Sense it

Values

Personal Integrity and Accountability, Mission Excellence, Teamwork Built on Respect and Inclusion

About the Systems Engineering Directorate (SED)



Mission

Define, assess, and deliver the Integrated Overhead Mission Enterprise providing assured intelligence capabilities

Vision

Enterprise engineering excellence ahead of the speed of change

Goals

Proactively define and deliver the future NRO mission architecture

Shape NRO investment decisions

Enable and inform enterprise decision making

Ensure enterprise capabilities are fully integrated into the NRO architecture

Attract and develop a world-class SED workforce

Improve the effectiveness and efficiency of NRO System Engineering

BLUF

We built a model to ensure SED has the Systems Engineering and Analysis support required in the future by managing requirements decomposition, traceability, gap analysis, and interface management within a complex acquisition strategy.

Unlocked Acquisition Strategy Feasibility

“The model has enabled us to move out on an acquisition strategy that is significantly different than we have today by allowing us to plan across a diverse set of teams and trace to legacy requirements (ensuring that we don't miss any important scope when setting the new requirements). We have also used the model to specifically plan interfaces, so we can execute without confusing overlap on scope between multiple contracts.”

-SED Acquisition Integration Program Manager

Acquisition Team Needs

- **Reduce risk**
  - With a tight acquisition schedule, how can we reduce the risks to achieve a tight deadline?
- **Improve Statement Of Work (SOW) quality**
  - Too often SOW wording gets out of alignment across sections, how can we reduce the human-in-loop of cross checking?
- **Improve contract scope**
  - In the past generic SOW wording has caused confusion of who does what, how do we better describe the scope of each contract?
- **Demonstrate traceability**
  - As contracts phase in, how do we know which parts of existing contracts do we phase out?

Stakeholder Analysis

Types of Common Questions

- How are we identifying and managing the interfaces between contracts?
- How do we identify gaps in our current structure?
- How do we ensure we don't drop work?
- How do bidders use the model?
- How do you classify a model?
- How do we align contracts to our WBS?
- Can we add FTE? or Cost?

Types of Stakeholders

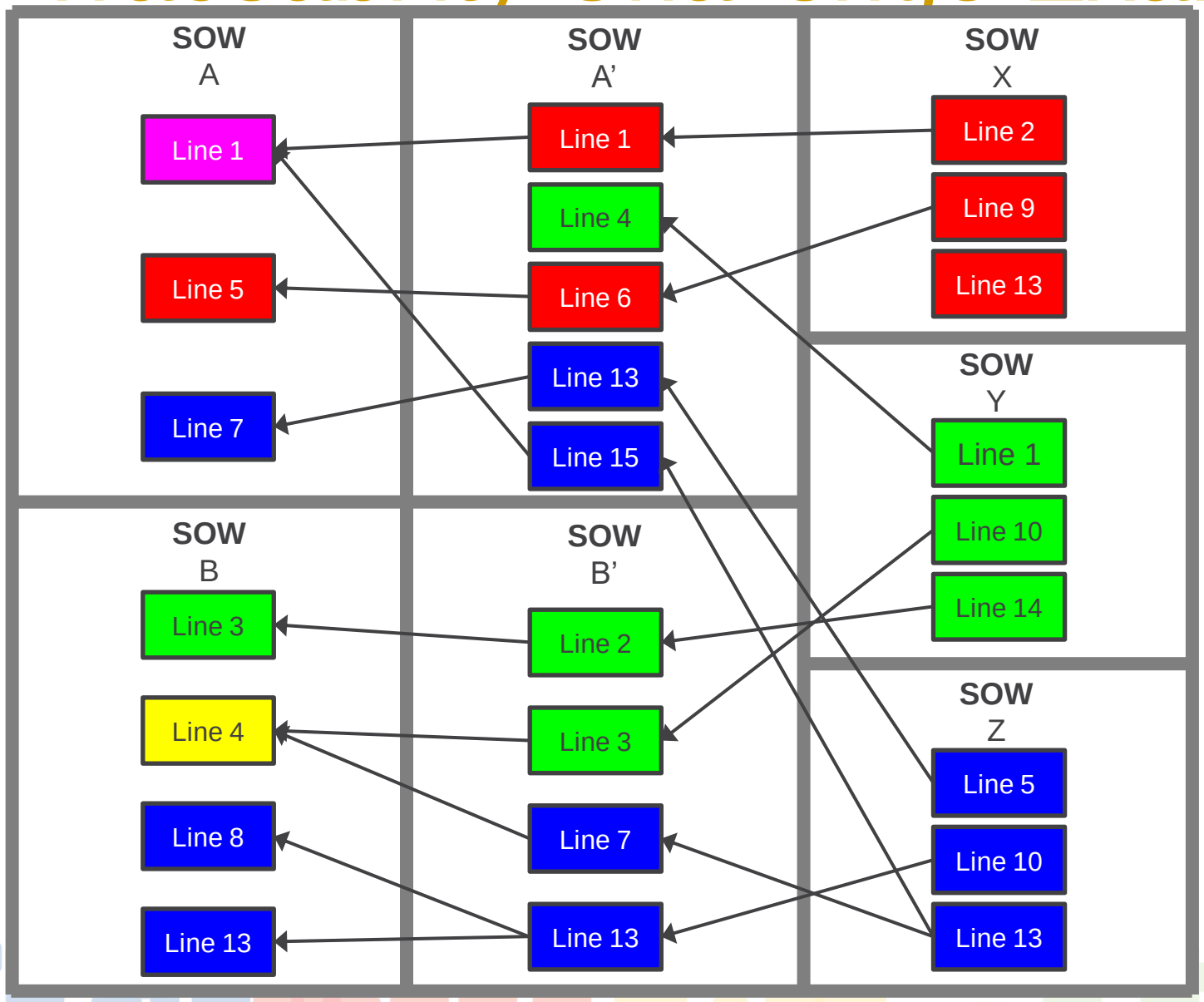
- Source Selection Authority
- Source Selection Evaluation Board
- **Source Selection Program Manager**
- **Technical Contract Leads**
- Technical Advisors
- Contracts
- Contracts Advisors
- Cost Estimation
- Security
- Modeling
- Bidders

***Primary Stakeholder**

Bounding Requirements

- **Minimize impact on Tech Leads' process**
  - Tech leads still have the hard job of writing SOW lines, improve what they do, don't make them do your job.
- **Remove duplication on commonality**
  - Some SOW lines are common across sets of SOWs, need to prevent edits on those common lines unless coordinated.
- **Ensure traceability**
  - Need to capture the complete pedigree of where an individual SOW line is derived from.

Traceability Challenge Example

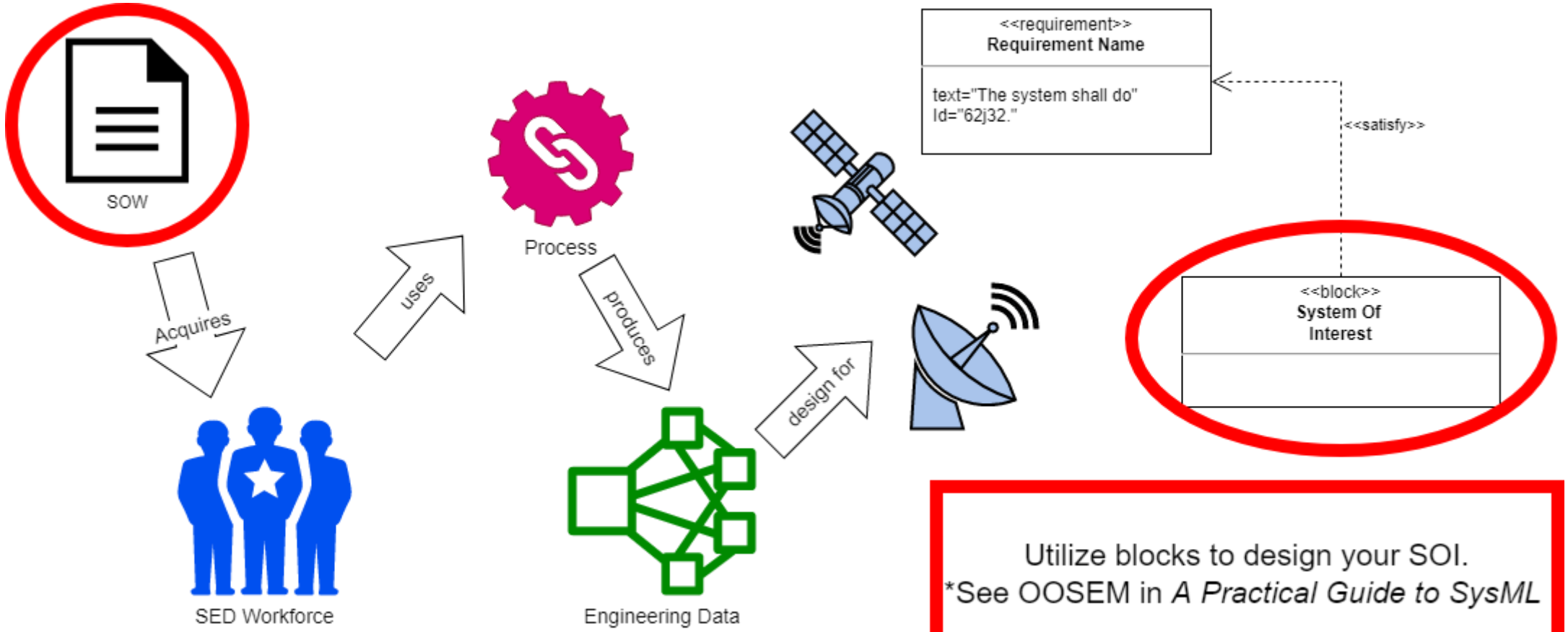


Start with 2 SOWs (A & B)
End with 3 SOWs (X, Y, & Z)

Pink = Red + Blue
Yellow = Green + Blue

*Multiply by hundreds of SOW lines

Realization #1 - What is the SOI



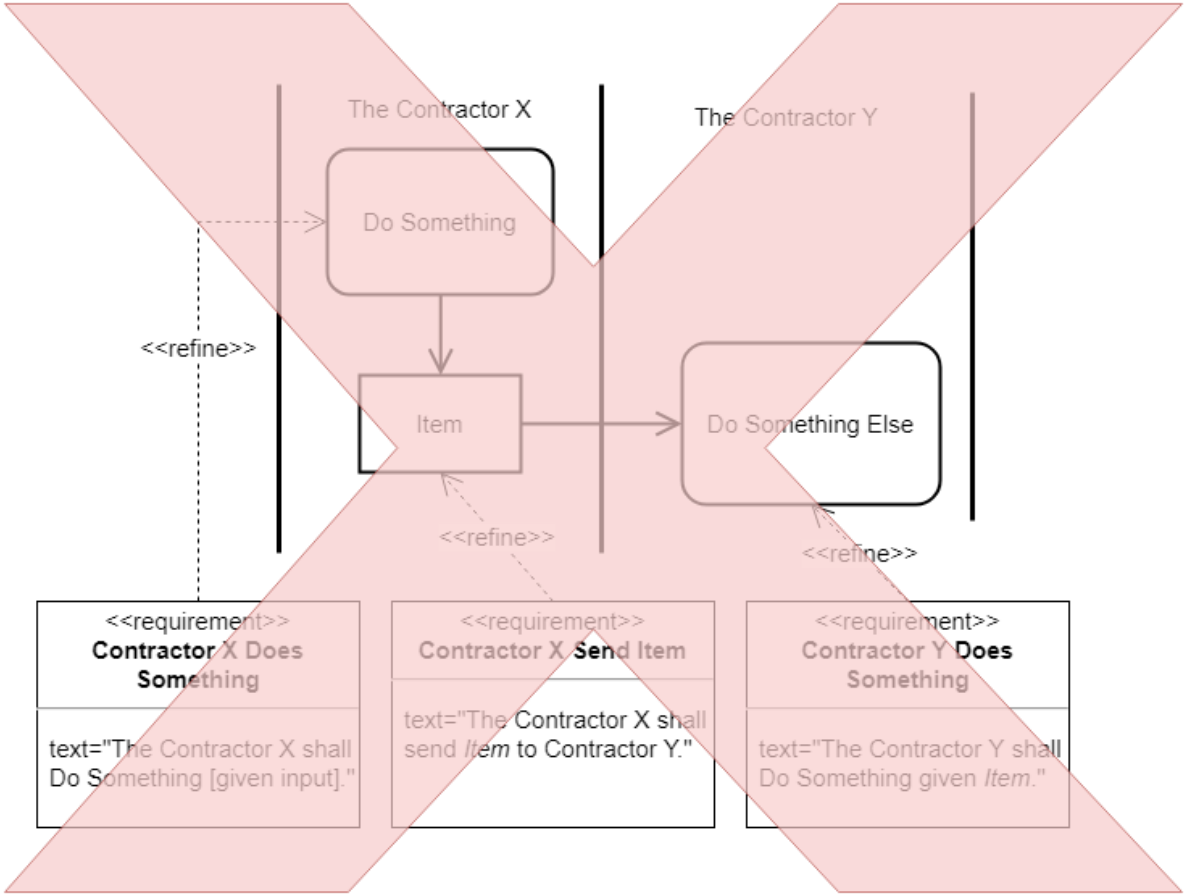
Realization #2 - Solve a "Solveable" Problem

Things We Looked At Doing

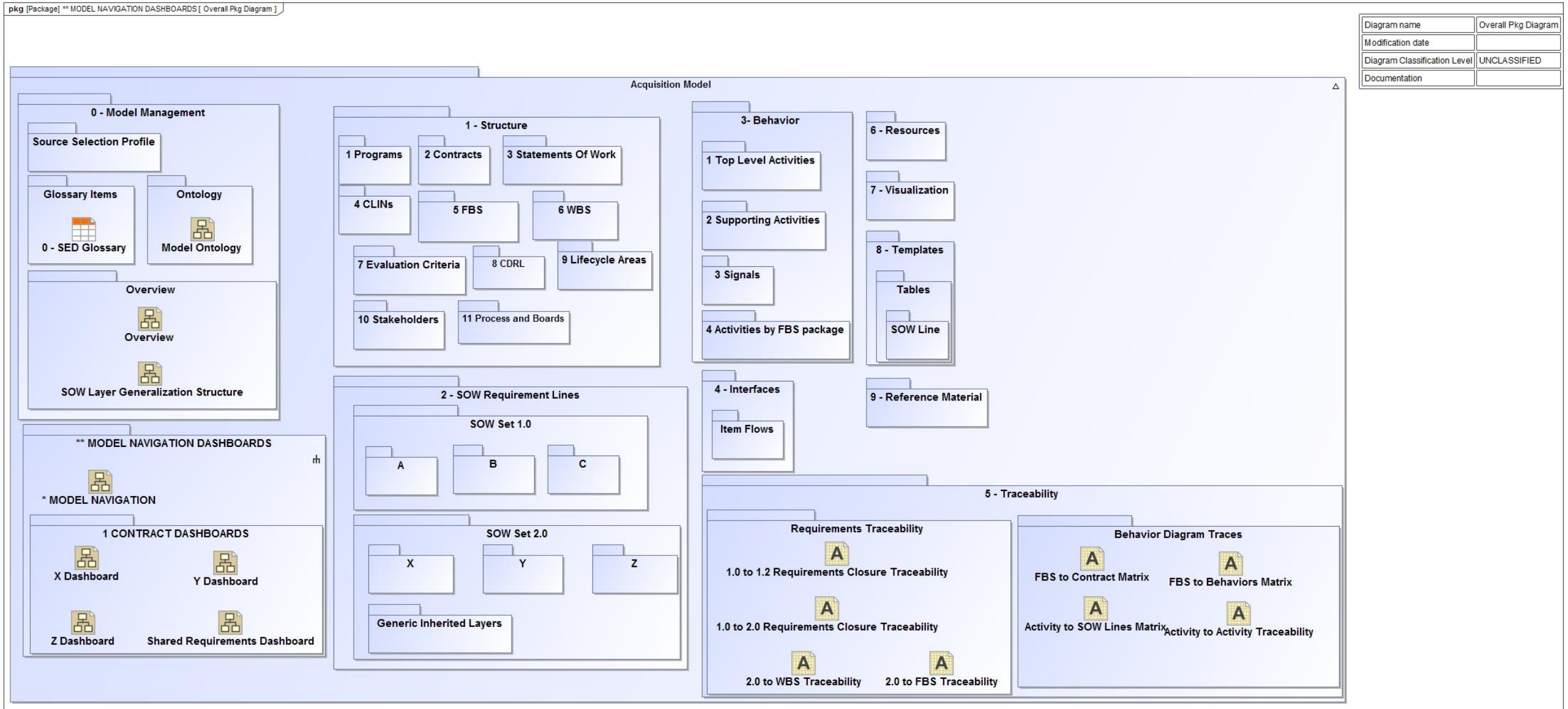
- Creating behaviors for every requirements
- Auto generating every SOW
- Adding in cost data
- Adding in FTE data
- No documents just models
- Requiring a model as a deliverable

What We Decided To Do

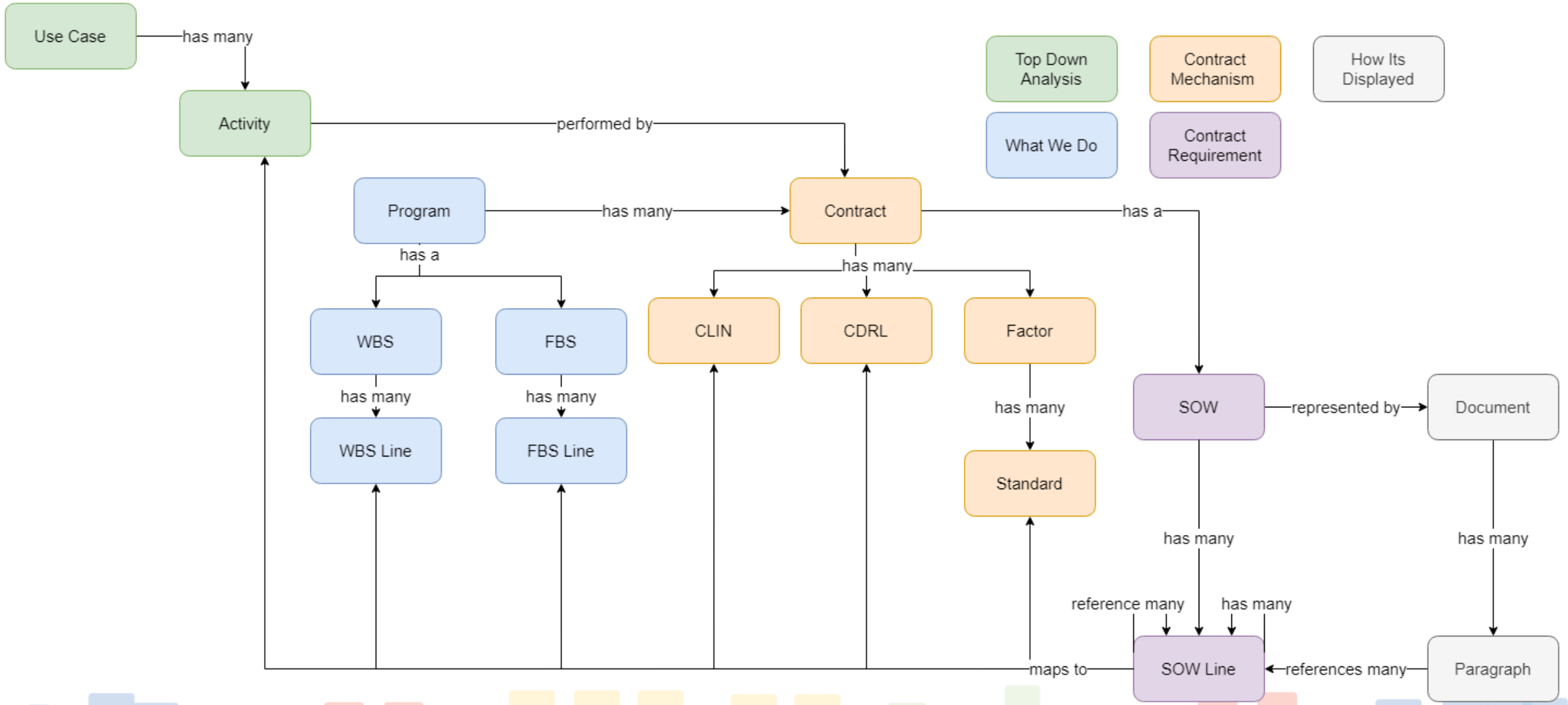
- Go back to our needs
- Focus on improving quality
- Use models to drive conversations



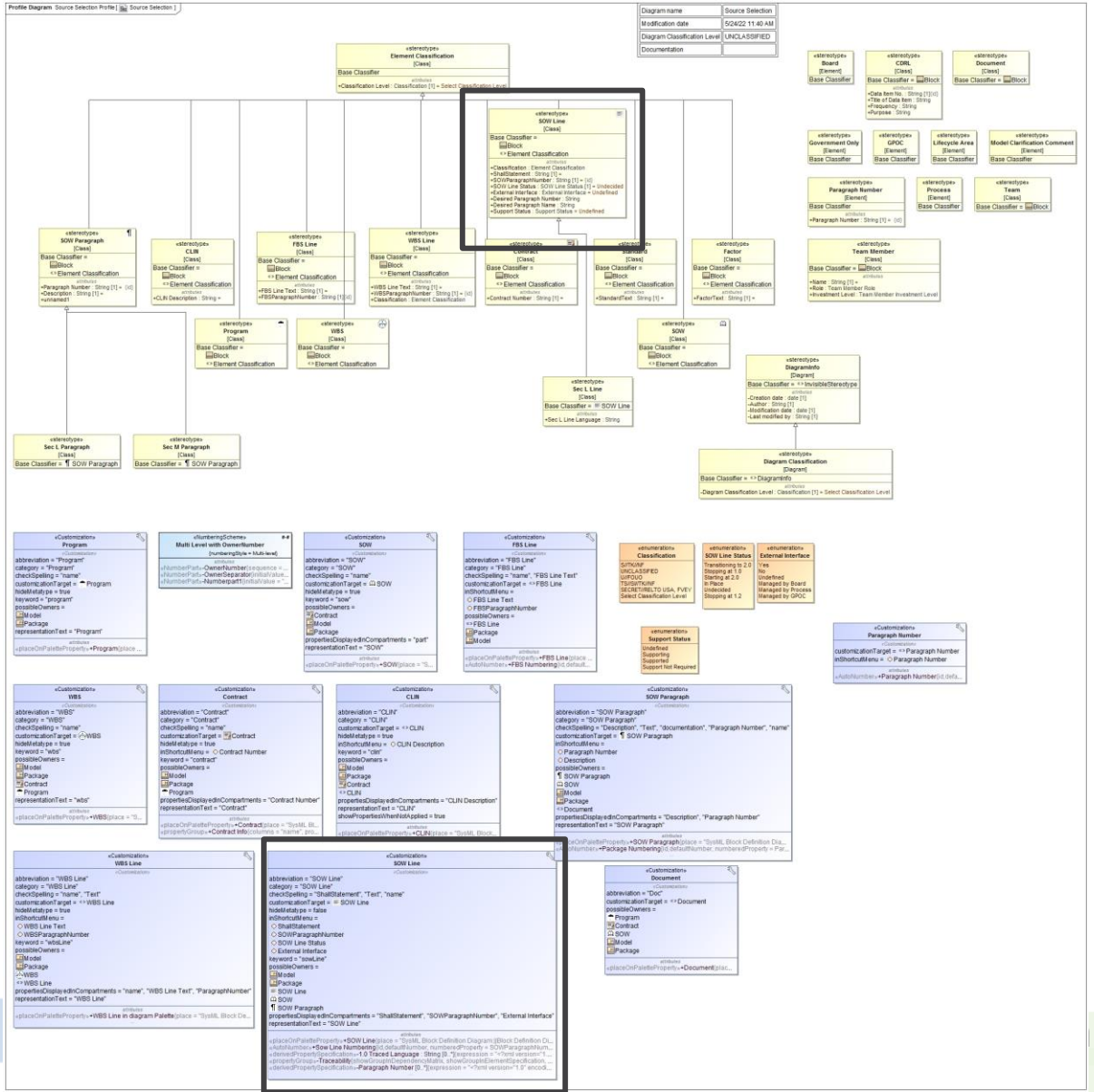
SOW Model Structure



SOW Profile Ontology



SOW Profile Excerpt



«stereotype»
SOW Line
[Class]

Base Classifier =
Block
«» Element Classification

attributes
+Classification : Element Classification
+ShallStatement : String [1] =
+SOWParagraphNumber : String [1] = {id}
+SOW Line Status : SOW Line Status [1] = Undecided
+External Interface : External Interface = Undefined
+Desired Paragraph Number : String
+Desired Paragraph Name : String
+Support Status : Support Status = Undefined

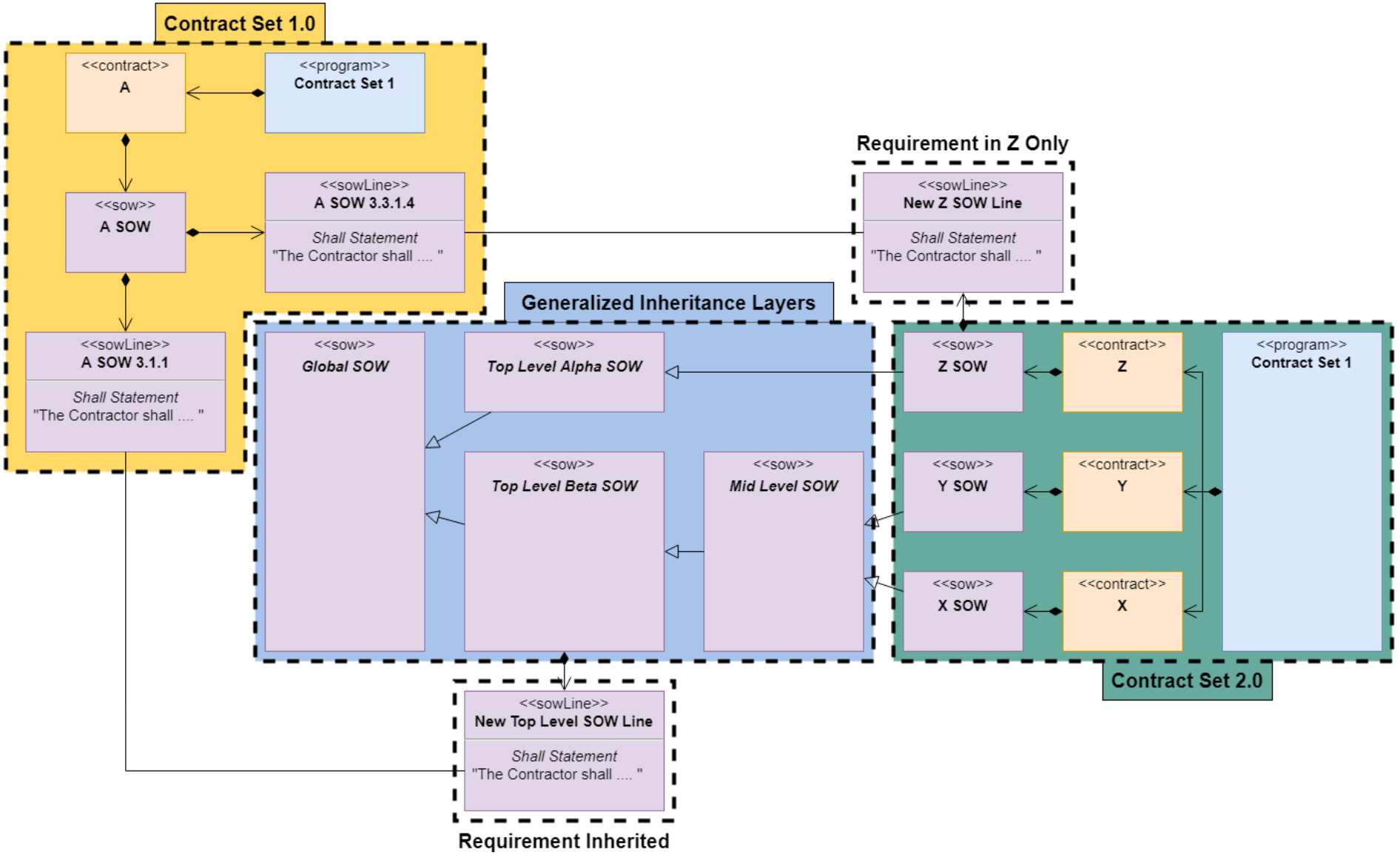
«Customization»
SOW Line
«Customization»

abbreviation = "SOW Line"
category = "SOW Line"
checkSpelling = "ShallStatement", "Text", "name"
customizationTarget = SOW Line
hideMetatype = false
inShortcutMenu =
- ShallStatement
- SOWParagraphNumber
- SOW Line Status
- External Interface

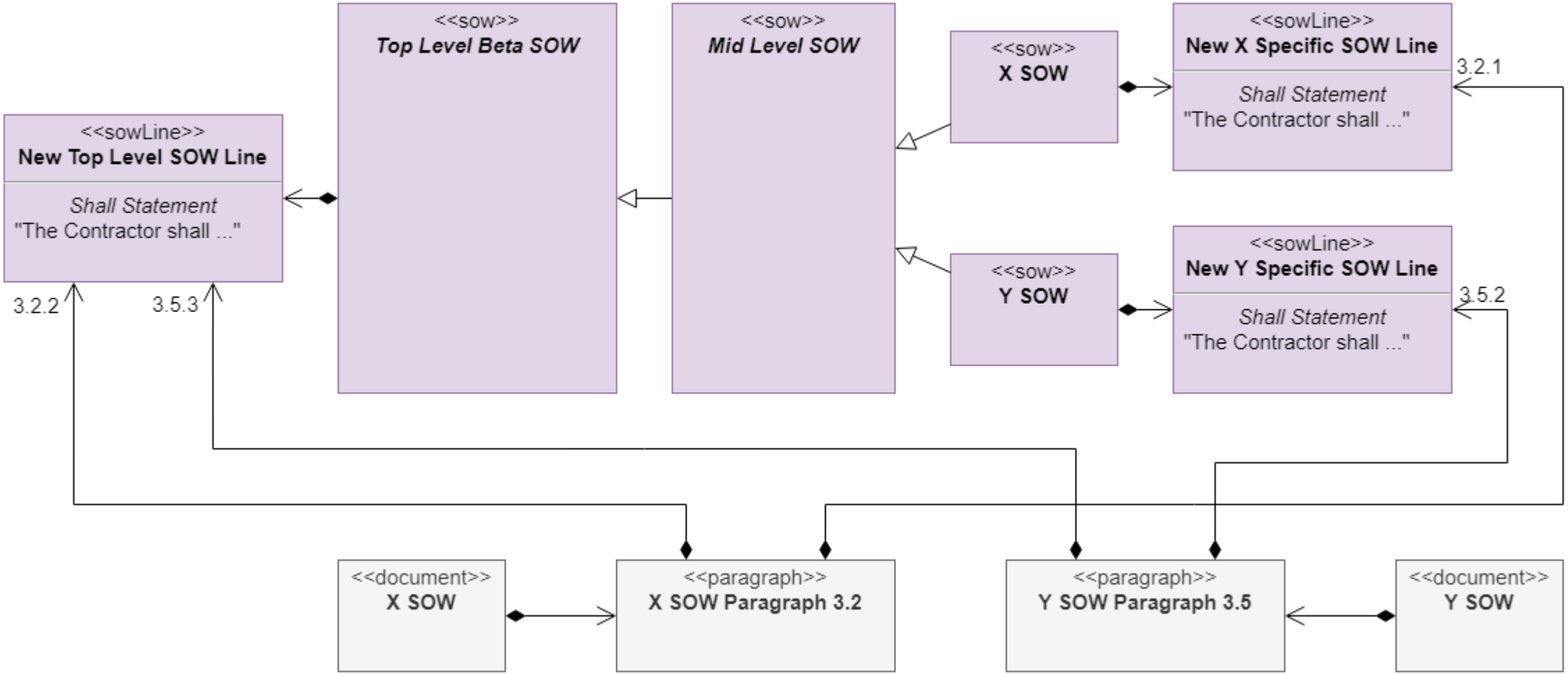
keyword = "sowLine"
possibleOwners =
Model
Package
SOW Line
SOW
SOW Paragraph
propertiesDisplayedInCompartments = "ShallStatement", "SOWParagraphNumber", "External Interface"
representationText = "SOW Line"

attributes
«placeOnPaletteProperty»+SOW Line{place = "SysML Block Definition Diagram:||Block Definition Di...
«AutoNumber»+Sow Line Numbering{id,defaultNumber, numberedProperty = SOWParagraphNum...
«derivedPropertySpecification»-1.0 Traced Language : String [0..*]{expression = "<?xml version="1....
«propertyGroup»-Traceability{showGroupInDependencyMatrix, showGroupInElementSpecification, ...
«derivedPropertySpecification»-Paragraph Number [0..*]{expression = "<?xml version="1.0" encodi...
...

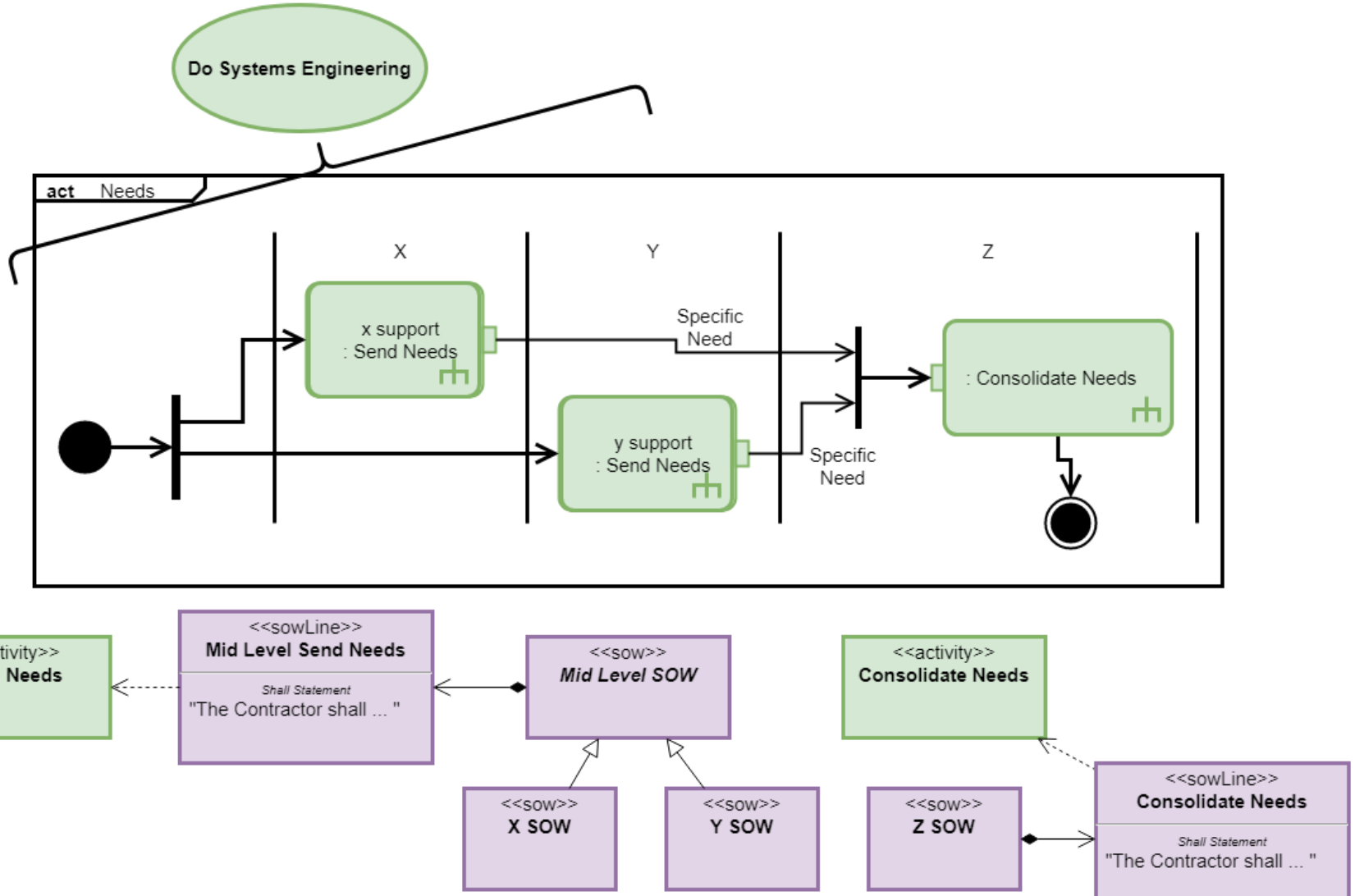
Example Traceability



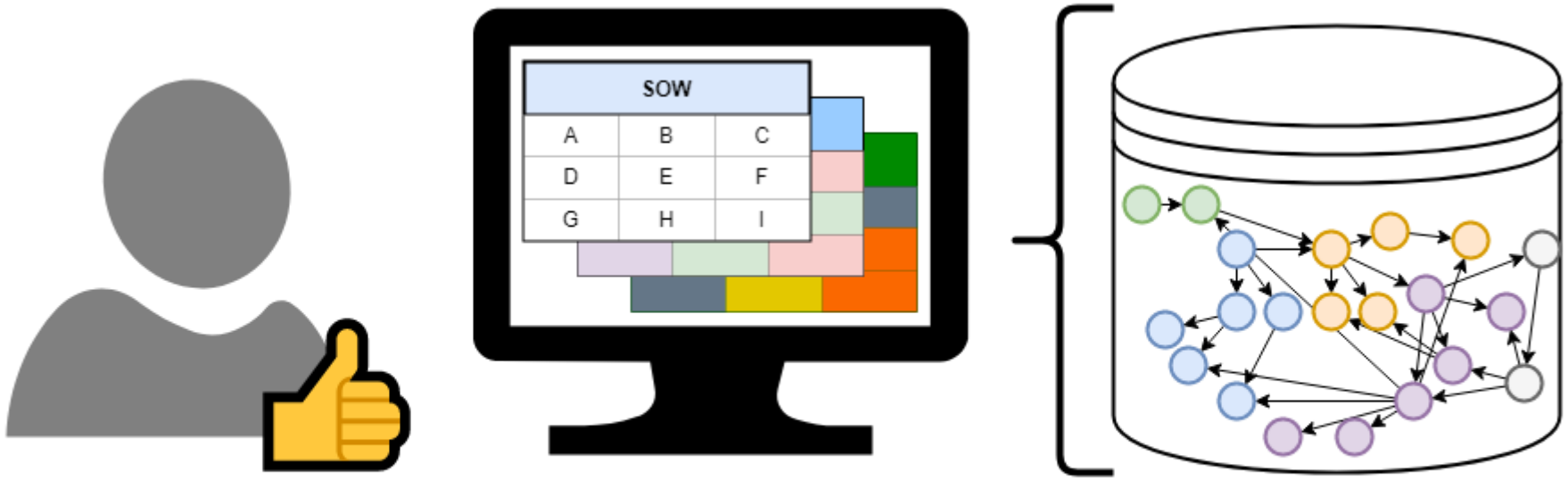
Example Visualization



Example Top Down Analysis

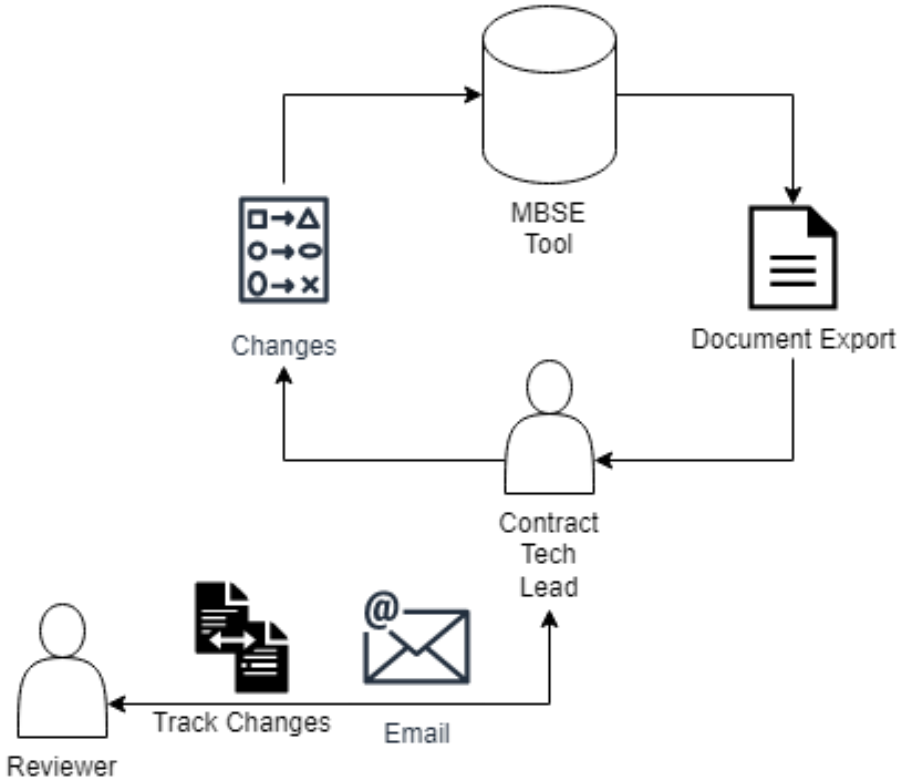


Power of Tables



*via metachains

Model Integration Workflow



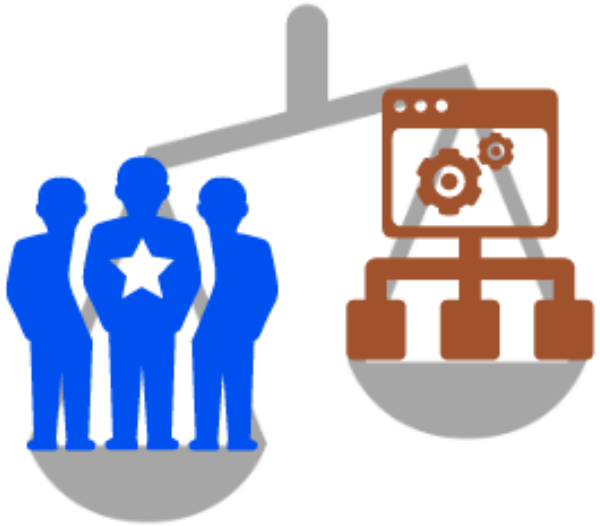
Steps

1. Export a table view in the model
2. Modeler converts content into Word
3. Modeler sends doc to contract technical lead
4. Contract technical lead coordinates with reviewers
5. Contract technical lead determines final updates
6. Coordinates with modeler to get loaded into the model

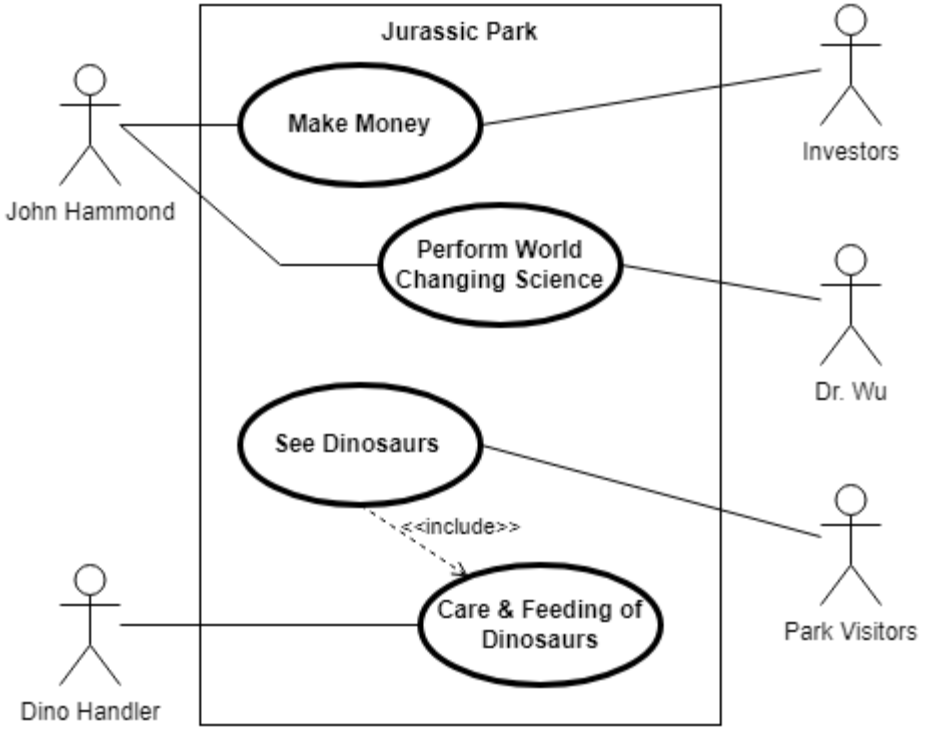
Limitations

- Look at document export capabilities, but needed a good enough solution so moved out with csv export
- Couldn't change the whole process and reviewers would likely never be in the model
- Some leads were more active in the model others needed a bit of help to get going

Lessons Learned from Modeling



People over technology



Just because you can, doesn't mean you should

Show value, Not your design

Resultant Impacts to Our Acquisition

- Enabled an execution of a difficult acquisition strategy
- Improved requirements consistency across SOWs and managed interfaces
- Ensured gap closure across SOWs for SED needs
- Provided Technical Leads a robust draft to start from
- Captured supporting rationale and engineering rigor for requirements development
- Served as a communication tool to uncover assumptions and build more complete requirements
- Provided bidders the model for contextual depth

Path Forward

Model Structure & Profile

- Expand profile to support directorate business operations
  - FTE, Costs, Business Process, etc
- Further refine profile
- Extract profile
- Leverage better visualization & integration tools
- Move to model organization as the SOI for a more digital acquisition approach (e.g. the model is the RFP)

SOW Development Approach

- Other directorates are interested in doing a similar approach
- Explore standardizing approach with Contracting Office
- Facilitate as future approach with our system developers

Questions?

Contact Us

Capt David Burns
burnsdav@nro.mil

Mr. Cecil Tiblin
tiblince@nro.mil

Mr. Daniel Hettema
hettemad@nro.mil

32nd Annual INCOSE international symposium

hybrid event

Detroit, MI, USA
June 25 - 30, 2022

www.incose.org/symp2022