

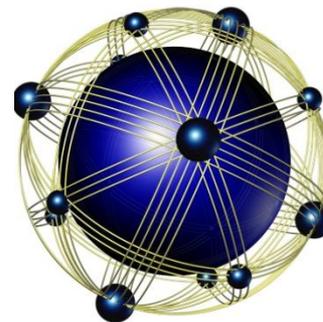


# ***Using Model Based Systems Engineering to improve requirements communication and shared understanding***

**Tim Tritsch**

**NDIA T&E Conference**

**14 March 2012**





# ***Problem Statements***

- *We don't really do Systems Engineering, we just write Requirements*
  
- *What did you really mean by that?*
  - Sometimes there is no opportunity to ask this question
  
- Requirements Creep is a matter of perspective
  - They were always there, we just discovered them late

- Typical Requirements Development Environment
- Definition of MBSE
- Generic, High-Level Walk Through of Process
- Summary

# ***Current State of Practice***

- Requirements are captured in database applications as stand alone textual statements (there are often hundreds, even thousands of them)
- They are used to create “Specifications” in document form without supporting Rational and Source information
  - Even when it does exist somewhere
- There may be system/component pictures, diagrams, tables, graphs that add understanding
  - Independently managed.
- Verification Methods are also written as textual statements organized just like the requirements are.
- Piles of text and documentation makes it difficult to achieve common understanding

# ***MBSE – General Definition***

Building and using a singular abstract representation to record and analyze aspects of a system relevant to understanding a problem and its solution.

Tim Tritsch

The formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases

INCOSE Vision 2020



# MBSE – General Definition

- It is about System Modeling
  - System Model is a cohesive, unambiguous representation of what the System is and does.
- It provides a description of
  - Requirements and
  - Technical Solution and
    - ❖ Operational Scenarios
    - ❖ System Behavior (including I/O)
    - ❖ Physical Architecture (Structure, interfaces)
    - ❖ Dynamic Simulation (requires “executable” models)
  - Verification Procedures
- MBSE is used to produce SE products

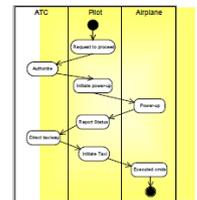
Past



Document centric



Future



Model centric

Minimum  
Required to  
Define System

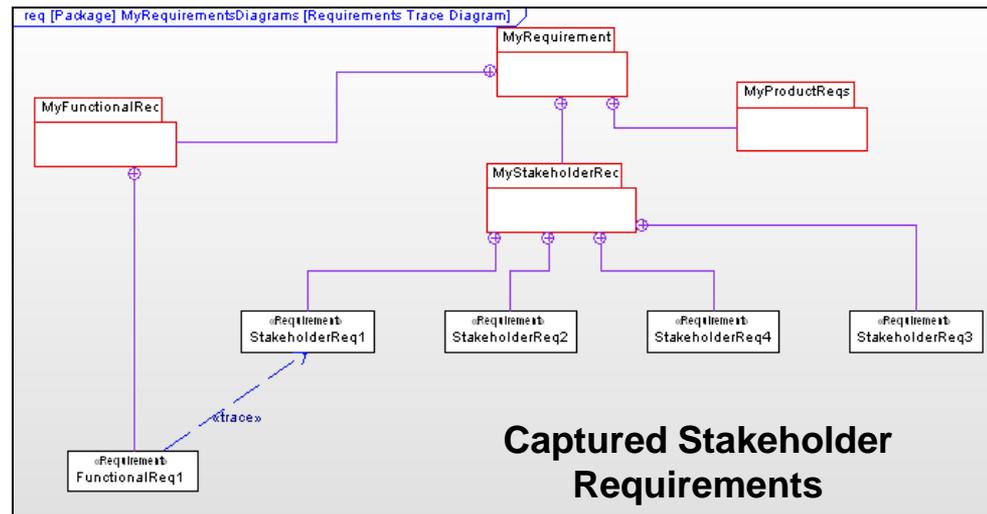
# ***MBSE - General Definition***

- Model built up from individual data objects
  - Systems, People, Functions, Interfaces, etc.
  - Pre-defined relationships between object types
- Analysis and specification artifacts generated from model
  - System Spec
  - Test Requirements (TEMP)
  - Interface Control Documents
- Executable Models may be simulated

# Capture Stakeholder Needs

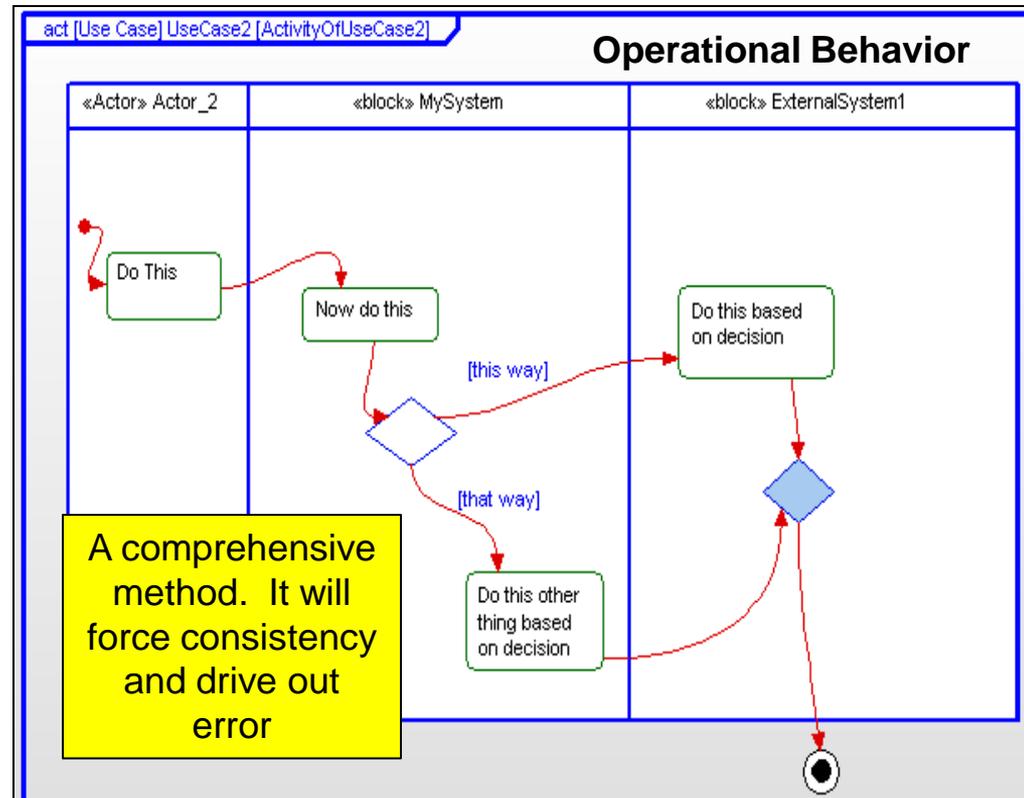
- Collect Stakeholder needs as objects within a systems modeling tools
- Or capture them in a requirements database and synch them with the model (AKA *DOORS*)
- Capture and manage relationships between requirements
- Auto Generate Requirements Trace Matrices and Specifications

ID	Name	Specification
SR0001	StakeholderReq1	Req Text for SR1
SR0002	StakeholderReq2	Req Text for SR2
SR0003	StakeholderReq3	Req Text for SR3



# Analysis of Functional Requirements

- Further define requirements in terms of behavior and scenarios
- Provides a precise definition of required functionality
- It serves the purpose of Analyzing and validating the requirements
- Establishes Functional System Boundary
- Goal is to translate stated requirements into stimulus / response expectations
- State/Mode, Functional flows, Sequence Diagrams also legitimate

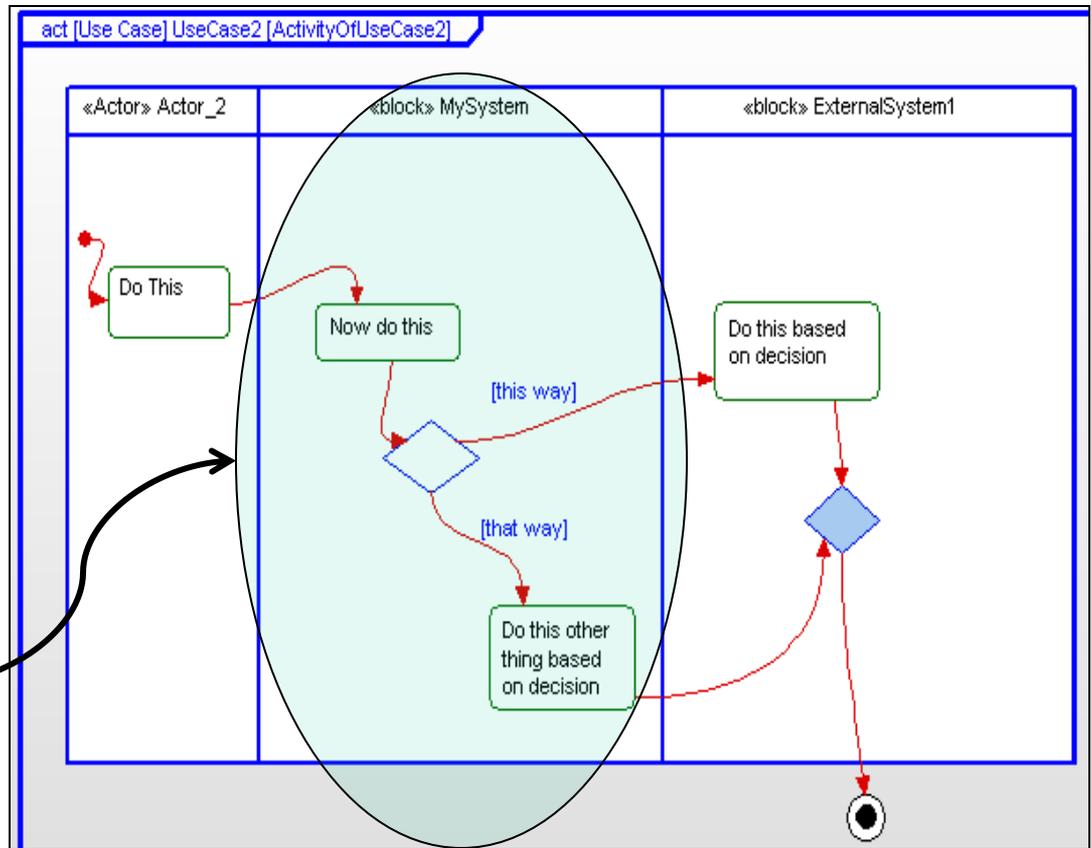


**What are the conditions?**



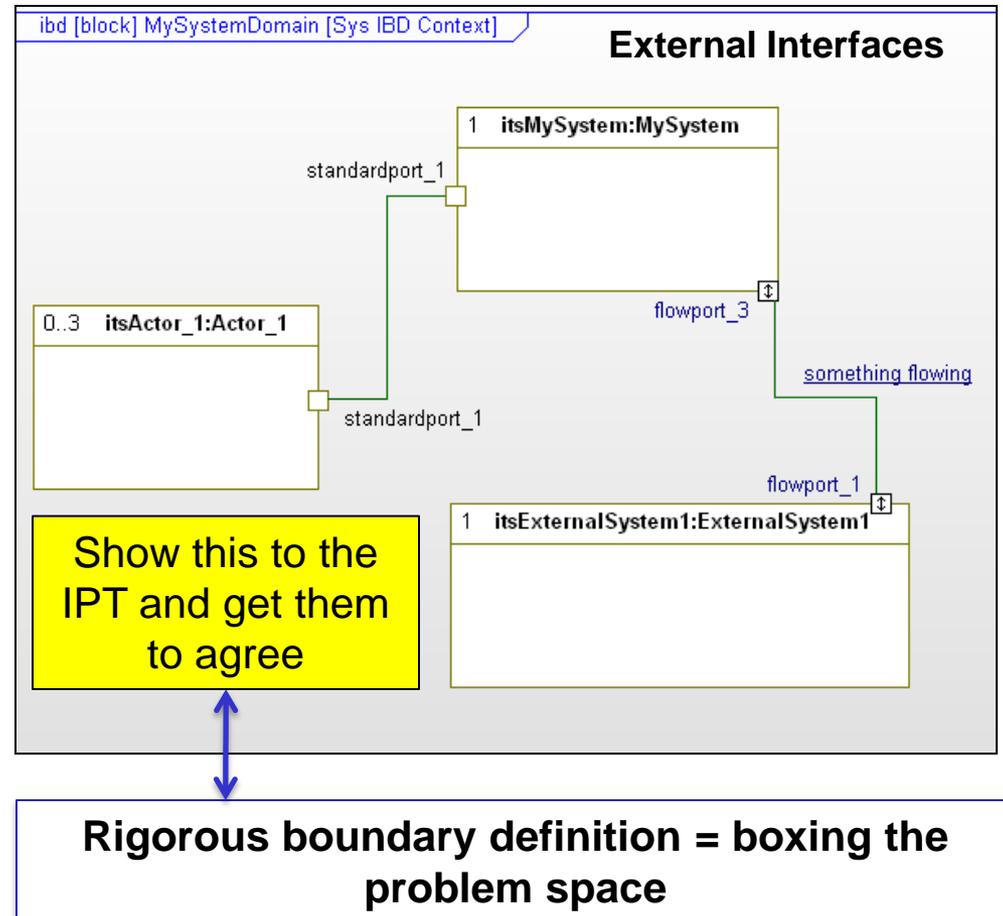
# Caution: Not Designing System

Be careful  
not to start  
system  
design



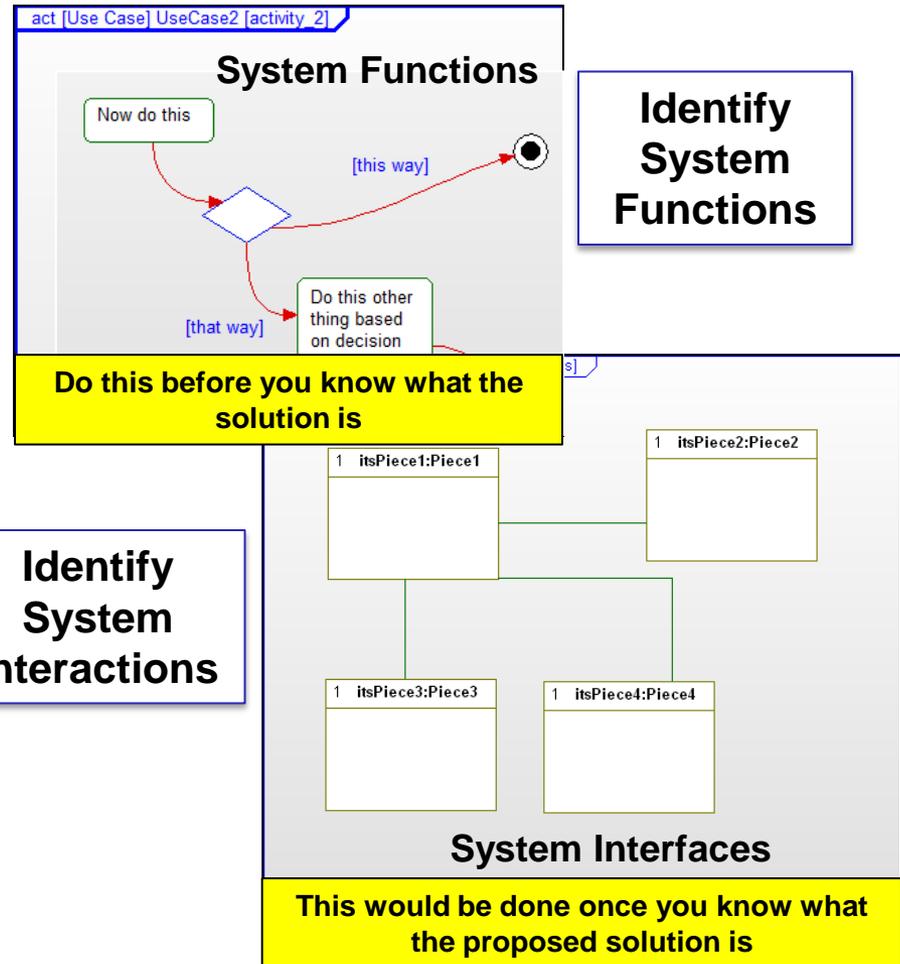
# System Interfaces

- Use block diagrams to to elicit requirements and identify interface requirements
- Rigorous and explicit capture and documentation of external interfaces.
- Serves the purpose of Analyzing and validating the interface requirements
- Merge of physical and functional system boundary definition



# Functional and Physical Architectures consistent

- Identify behaviors and derive functional requirements of your system and system components
- Use Block Diagrams to capture the arrangement and association between a selected system solution alternative.
- Identify Interface Requirements



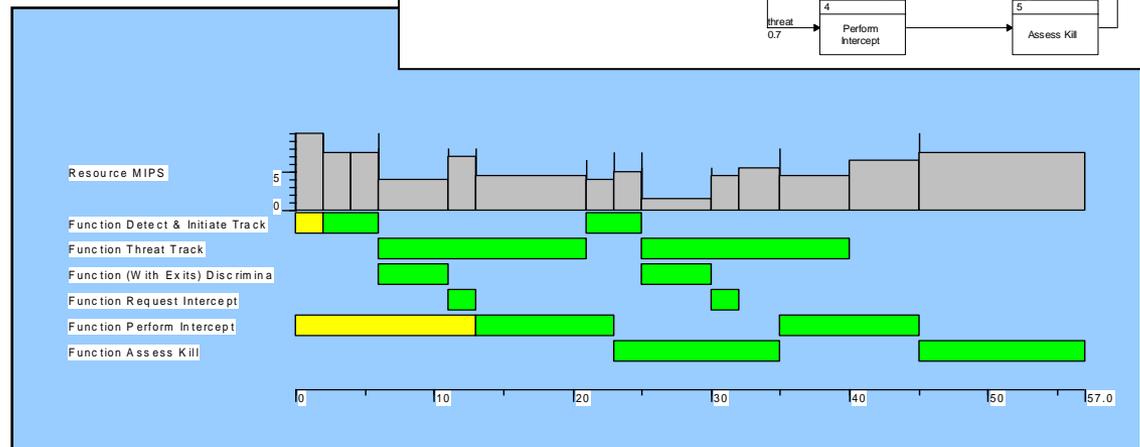
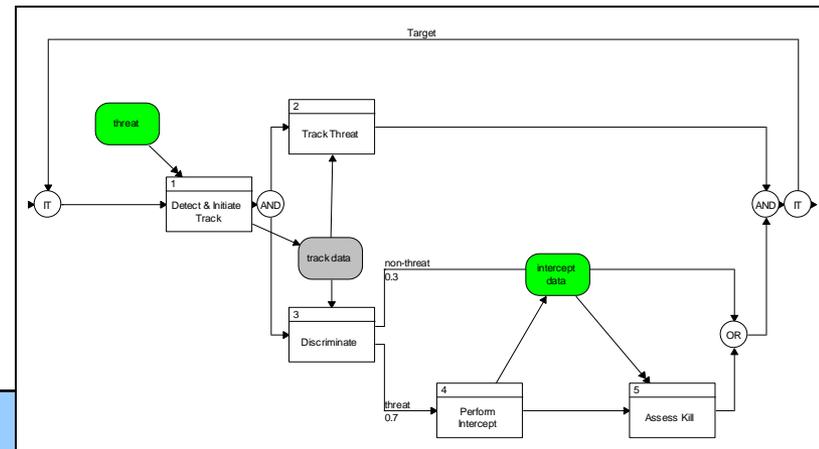
# ***Commercial Modeling Environments***

- **OMG Family (IBM, Atego, No Magic, Sparx, etc.)**
  - **SysML**
  - **UPDM (Endorsed by DCIO)**
- **Vitech CORE**
- **3SL Cradle**
- 
- **...**



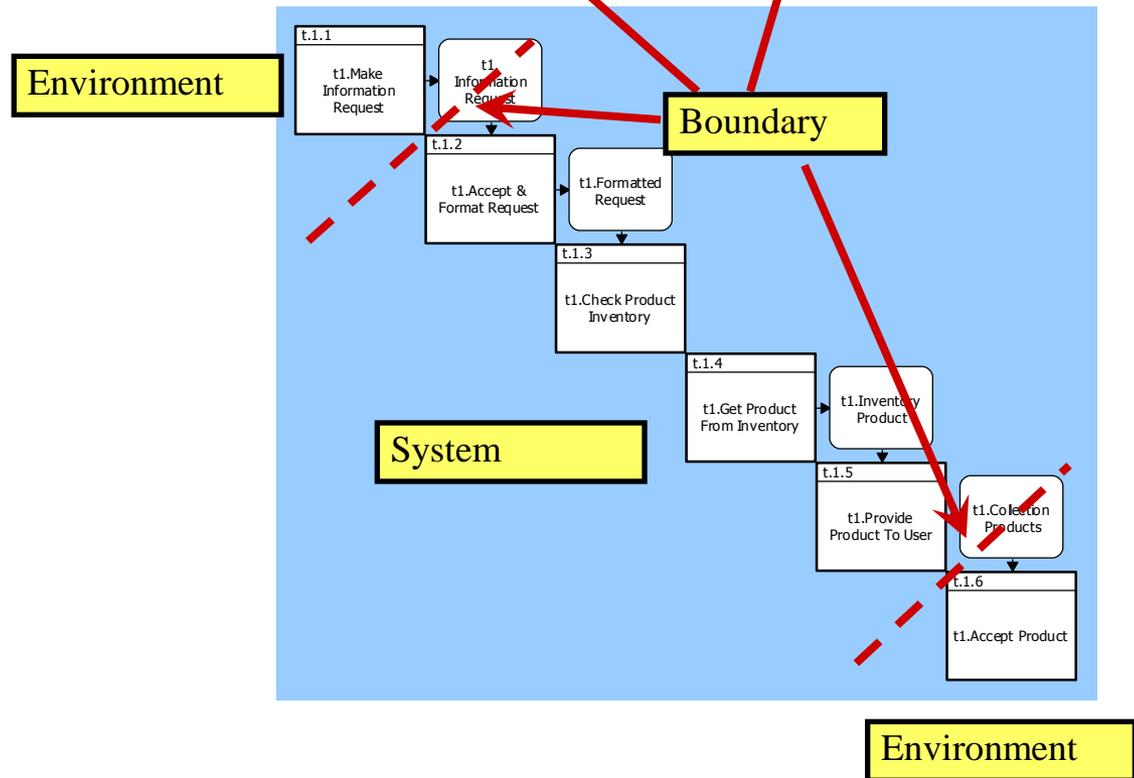
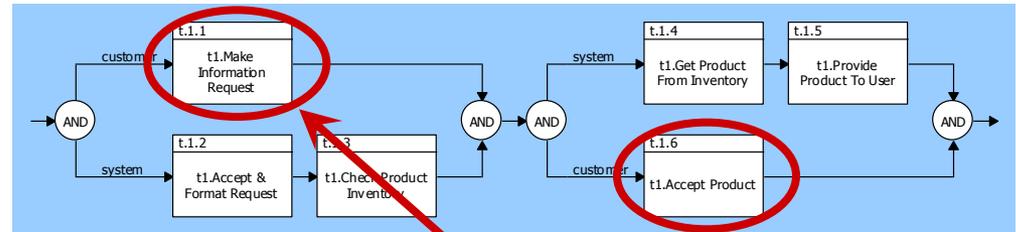
# Simulation

- Executable Models can be interpreted, simulated
- Better understanding of solution specified



# This is a T&E Conference

- Resulting System Model can be used for developing test requirements
- Required test environment touch points and system stimuli can be easily determined.





- Application of MBSE Methods during Requirements Development Process results in:
  - Better elicitation of requirements
  - Less ambiguity
  - Better understanding of requirement intent
  - Head start on T&E planning
- MBSE Processes can be mapped to DoD Acquisition Process/DAG