Information Modeling for Systems Integration

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Introduction

The Information Model presented was developed to provide an enterprise solution to information management. It provides a map to the application and integration of program and system elements. The model is tool independent, it provides a guide for modeling and simulation applications, tool capabilities, tailoring and deployment. Model elements and results embedded within the Information Model and tools are customized to automate the workflow defined in the model including the production of work products.

Following this modeling approach creates a daily work environment that facilitates integrated data development following preferred processes and reflecting modeling results in further proposals and products. Once the workflow and processes become an integral part of the data development it becomes easier to understand the impact of discoveries and changes on the program. This in turn supports ease of identifying solutions to integration and development problems. Ingenuity in design allowing program development to utilize existing structures in new ways is enabled through this approach.

In addition using an information model approach allows simultaneous “live” views of the data from different concerns including management and IPTs. The inclusion of program concerns such as Risk and Test gives a more complete response to problems and issues in those areas.

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About Us

BBII provides experts in Systems Engineering and Architecture. The company has developed an Information Model approach to integrating program functions. Customers include Bombardier, Northrop Grumman, NASA, SAIC, Sikorsky, the State of Texas, ViaSat, and others. BBII has maintained partnerships with a variety of tool vendors. BBII can provide a team to identify the model, modify the tools, write instructions, mentor and train staff, develop data, provide systems engineers, systems architects and engineering support.

Claudia Rose is the president and creator of BBII, a Systems Engineering Consulting and Support Company. She has presented papers on Systems Engineering tools and processes at INCOSE, NDIA and AFCEA conferences and others. She has served on boards of directors in recent years that include INCOSE San Diego, NDIA small business forum, AUVSI and the La Jolla Cove Swim Club. She holds an MAIT (Master International Transactions) from George Mason University, with studies Tribhuvan University Kathmandu, and a BA from the University of Wisconsin-Madison. Her research has focused on bringing order out of chaos. She has worked as a consultant on Health and Development projects at The World Bank and USAID, presented papers on the health development policy process, created databases for canning companies and personal trainers, before bringing the special organization credo of BBII to the world of systems engineering.

Information Model Benefits

- OPTIMAL DESIGN
  - The information model facilitates a design where gaps in the satisfaction of operational needs drive an adaptive solution to reduce the gap
  - The information model facilitates the development of alternative approaches at higher levels, up to re-characterization of the operational needs, to allow an overall design solution which better satisfies the operational needs of the platform
  - Characterized by measures of effectivity
- ENTERPRISE ARCHETECTURE
  - Tie together stakeholders and represent their needs
  - Tie together System Elements
  - Integrate Management
- WORKFLOW AUTOMATION
  - Allows information to be viewed in its entire context
  - Work products including specifications and reports are produced as byproducts of the database
  - Collaboration is supported as part of the workflow
- DESIGN ASSURANCE
  - Disciplined Systems Engineering process
  - Validation
  - Verification

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Why this Approach?

- Providing the best value solutions
- Use of modeling and tools that allow team members to collaboratively integrate their work with the entire program
- Collaborating to produce better options with existing resources
- Finding new ways to accomplish new objectives within existing framework
- Identifying and evaluating options throughout the program development process
- Re-characterize statements of need and higher level requirements to allow innovative and ingenious solutions

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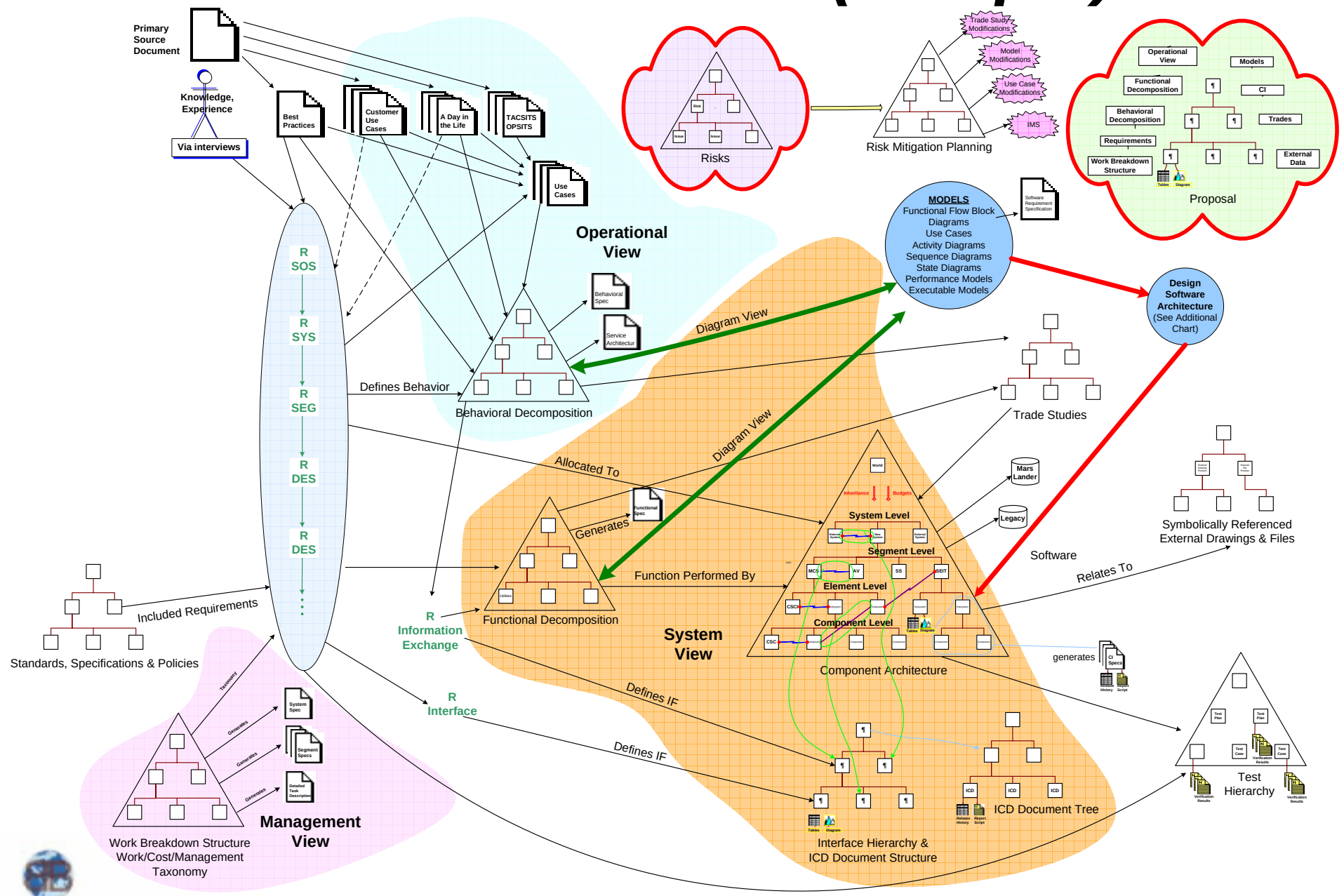
Information Model (Sample)



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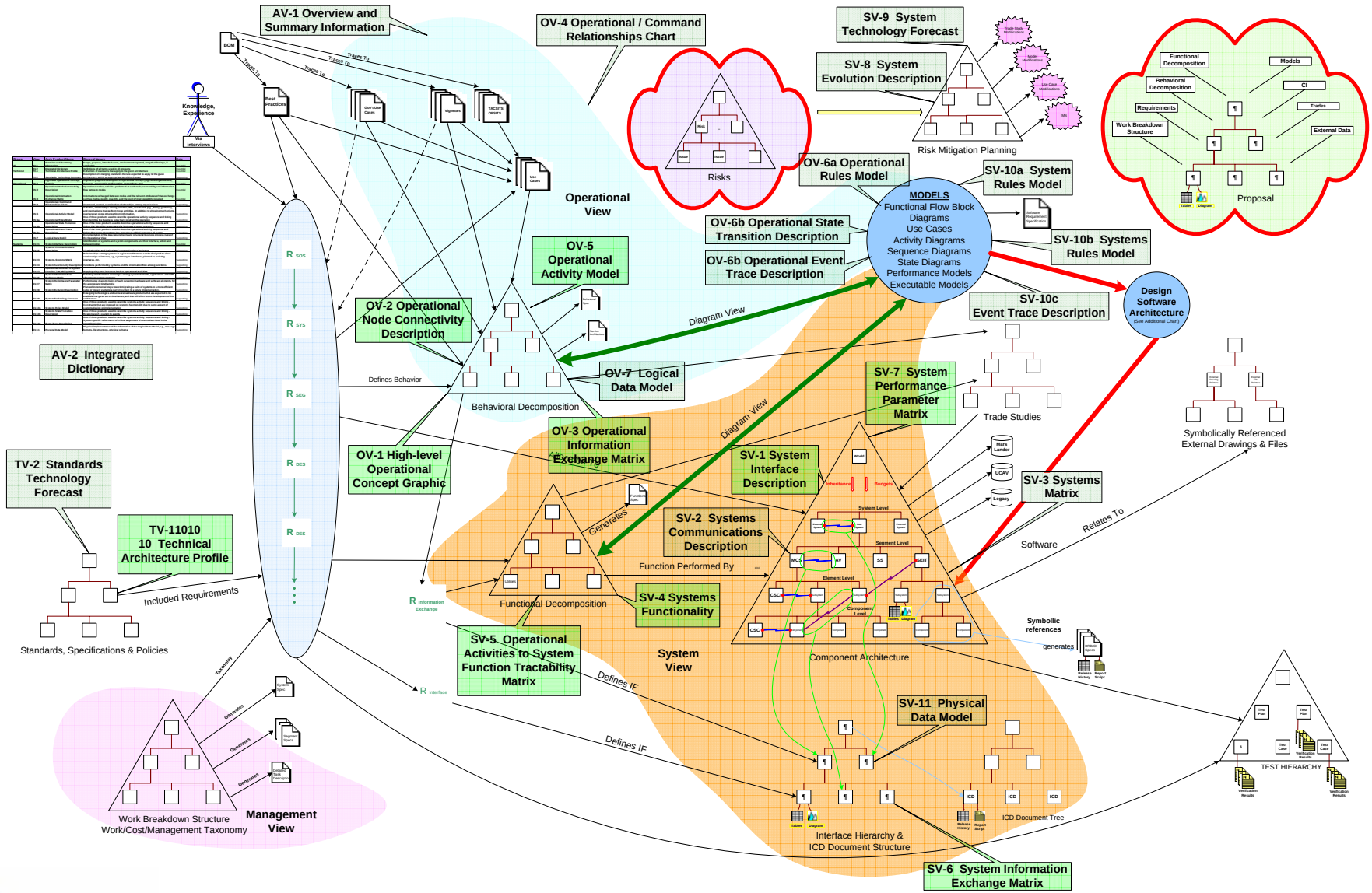

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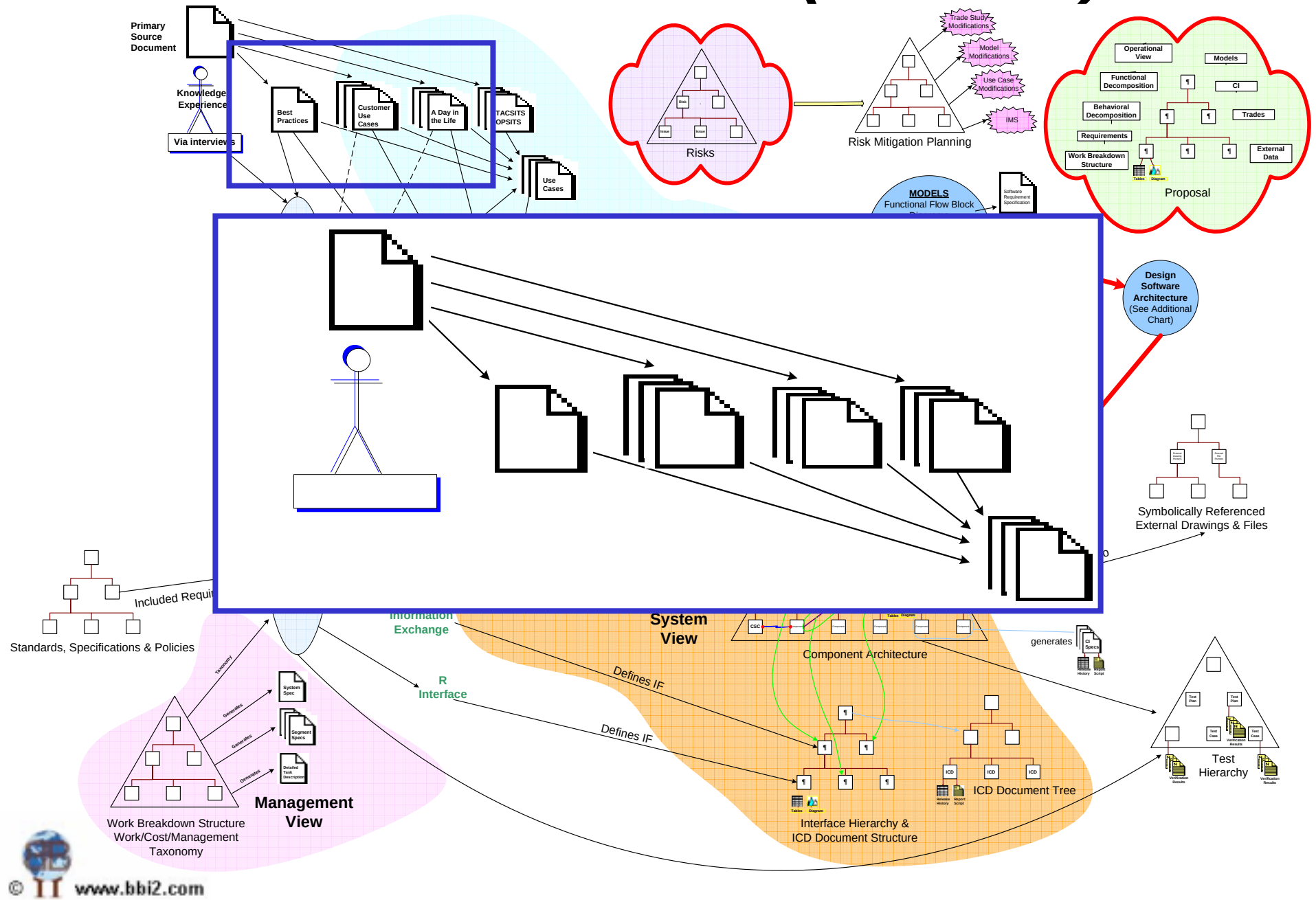
Information Model (Sources)



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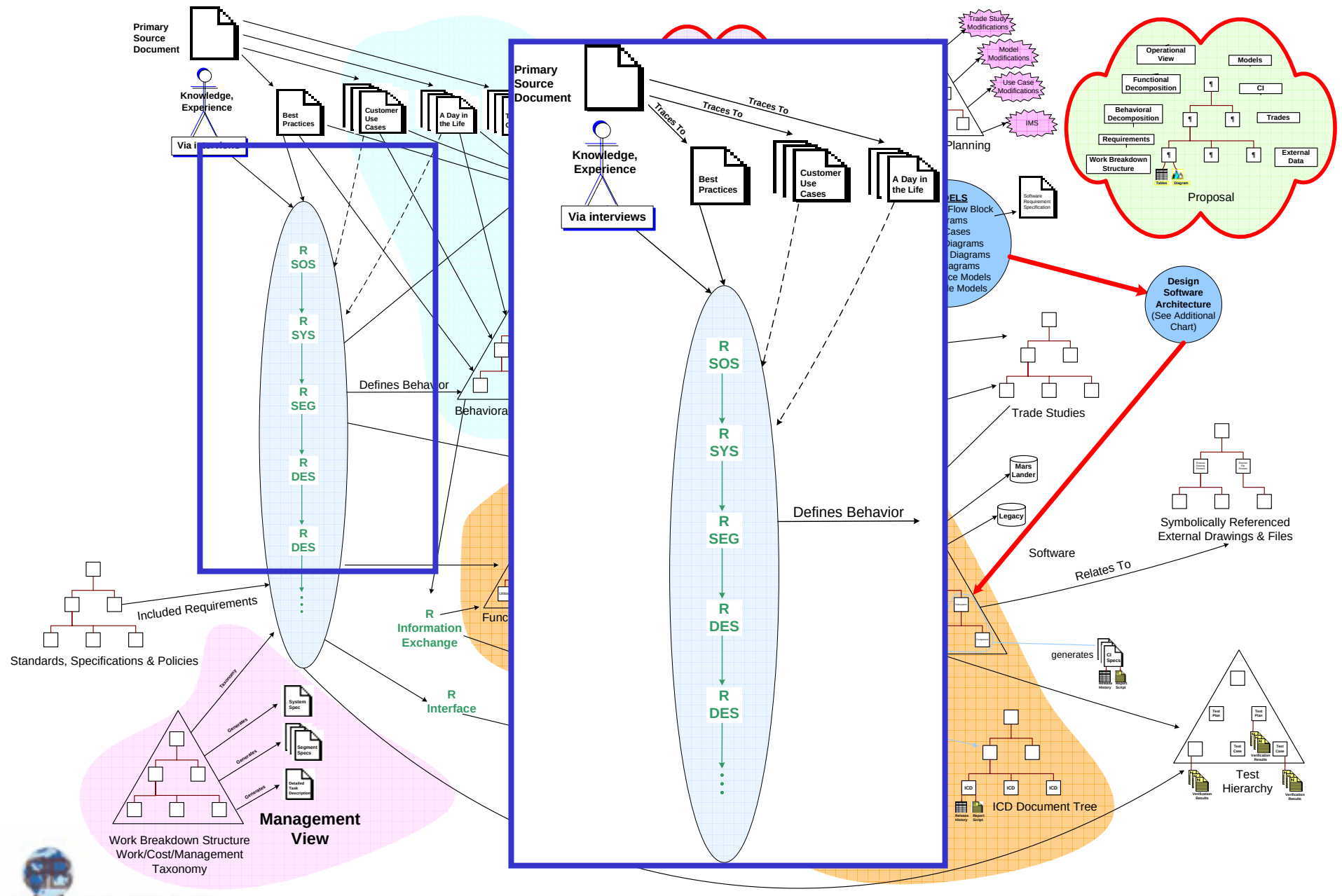
Primary Source Document
Knowledge, Experience
Via interviews
Best Practices
Customer Use Cases
A Day in the Life
Traces To
Traces To
Traces To
Trade Study Modifications
Model Modifications
Use Case Modifications
IMS
Planning
Operational View
Models
Functional Decomposition
CI
Behavioral Decomposition
Trades
Requirements
Work Breakdown Structure
External Data
Proposal
Software Requirement Specification
Design Software Architecture (See Additional Chart)
R SOS
R SYS
R SEG
R DES
R DES
Defines Behavior
Defines Behavior
Trade Studies
Mars Lander
Legacy
Software
Relates To
Symbolically Referenced External Drawings & Files
Included Requirements
Standards, Specifications & Policies
R Information Exchange
R Interface
generates
CI Specs
Test Hierarchy
ICD Document Tree
Taxonomy
Generates
System Spec
Segment Specs
Detailed Task Description
Management View
Work Breakdown Structure Work/Cost/Management Taxonomy

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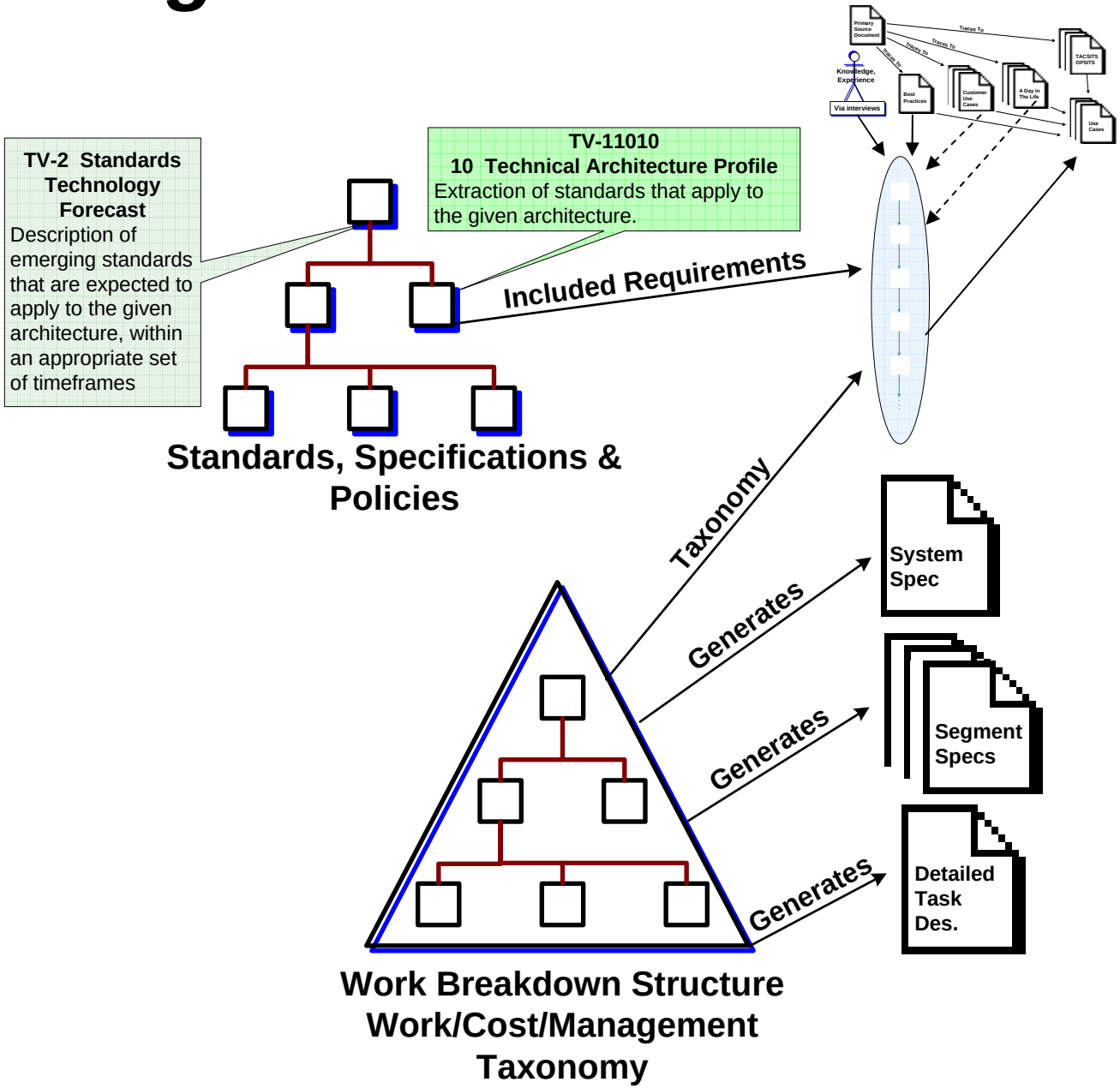
Management View and Standards



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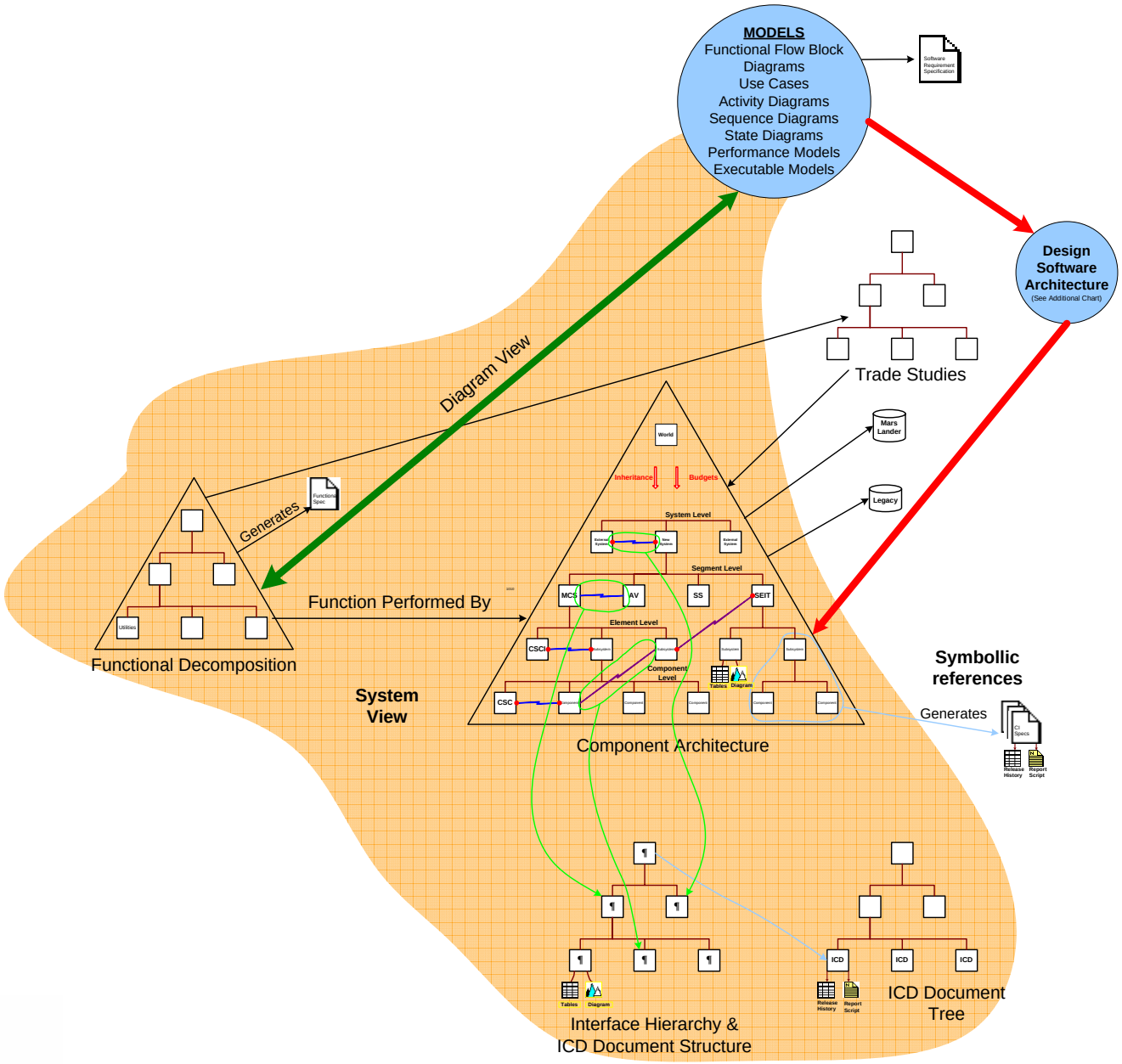
System View



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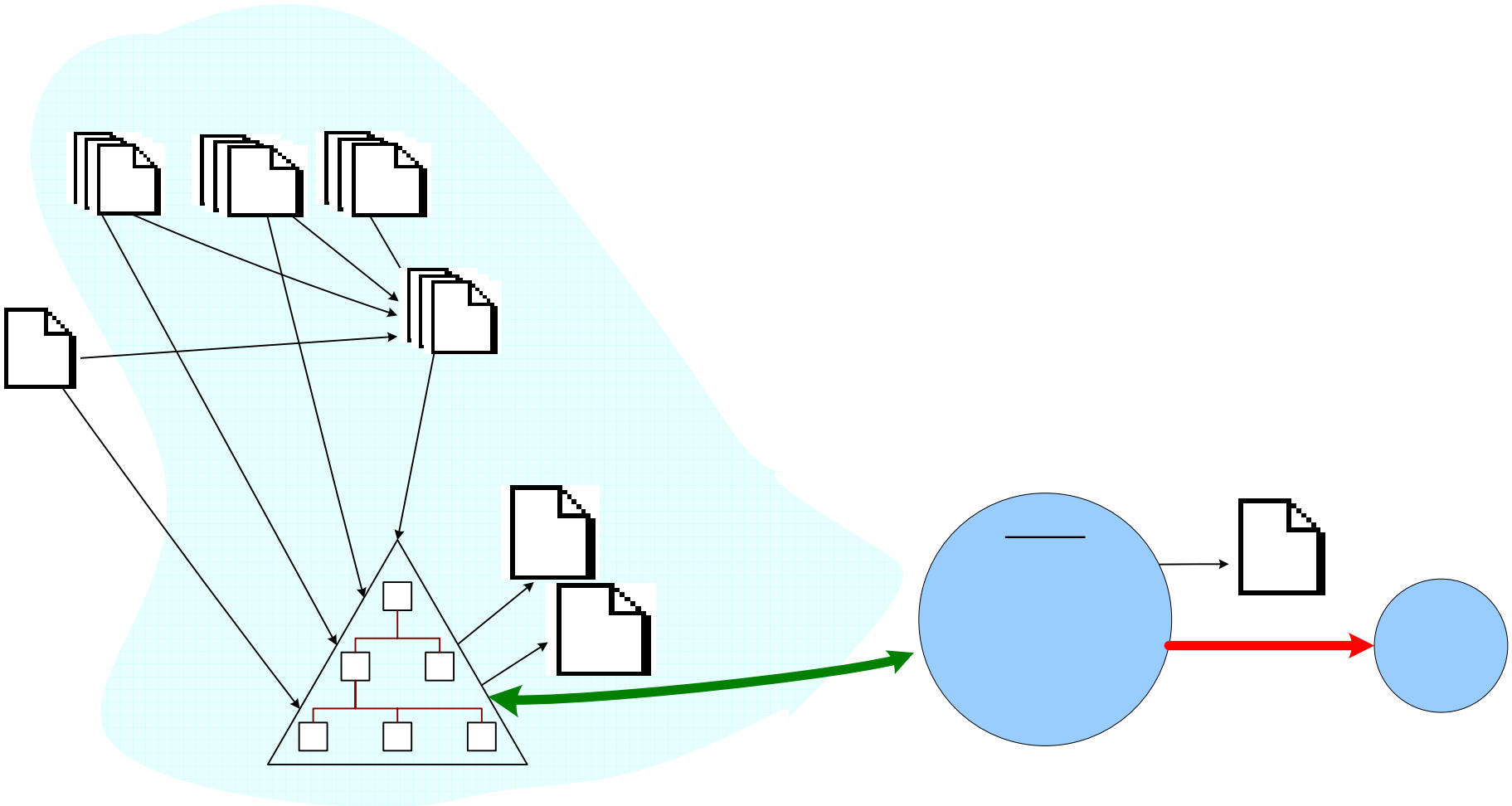
Operational View



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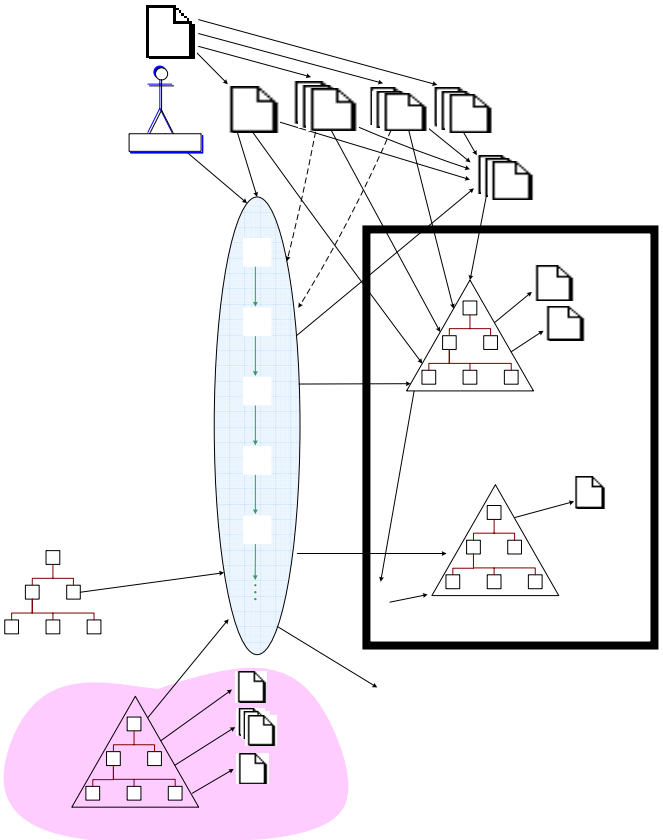
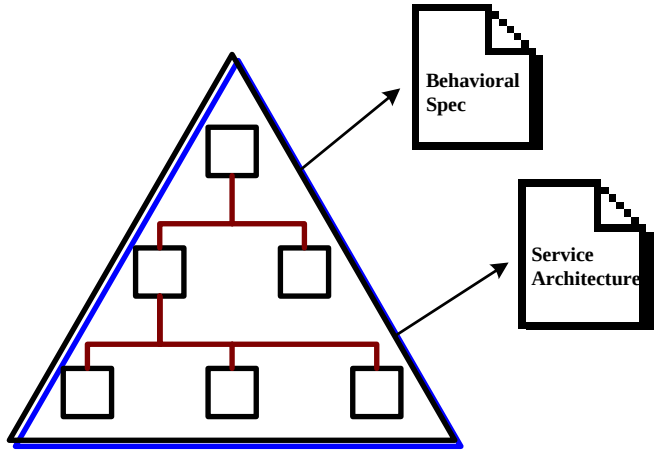
Decomposition





Behavioral Decomposition

Primary Source Document

R

Information Exchange

Knowledge, Experience

Via interviews

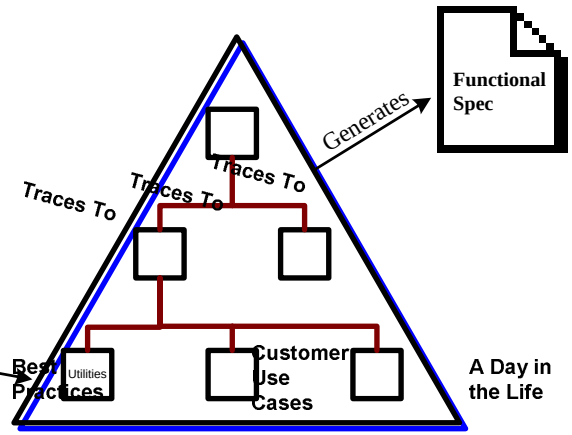
Traces To

Traces To

Traces To

Traces To

Generates



Functional Decomposition

TA
OF

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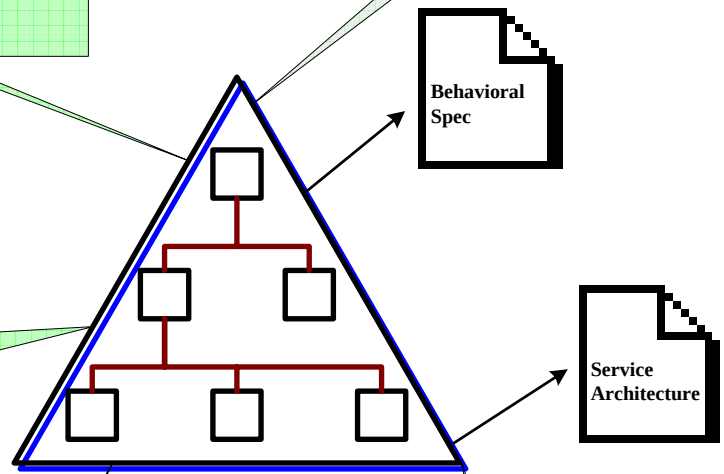
Decomposition OV examples

OV-5 Operational Activity Model
Activities, relationships among activities, I/Os, constraints (e.g., Policy, guidance), and mechanisms that perform those activities. In addition to showing mechanisms, overlays can show other pertinent information.

OV-7 Logical Data Model
Documentation of the data requirements and structural business process rules of the Operational View



OV-1 High-level Operational Concept Graphic
High-level graphical description of operational concept (high-level organizations, missions, geographic configuration, connectivity, etc.)

Behavioral Decomposition

OV-2 Operational Node Connectivity Description
Operational nodes, activities performed at each node, connectivity and information flow between nodes

OV-3 Operational Information Exchange Matrix
Information exchanged between nodes and the relevant attributes of that exchange such as media, quality, quantity, and the level of interoperability required

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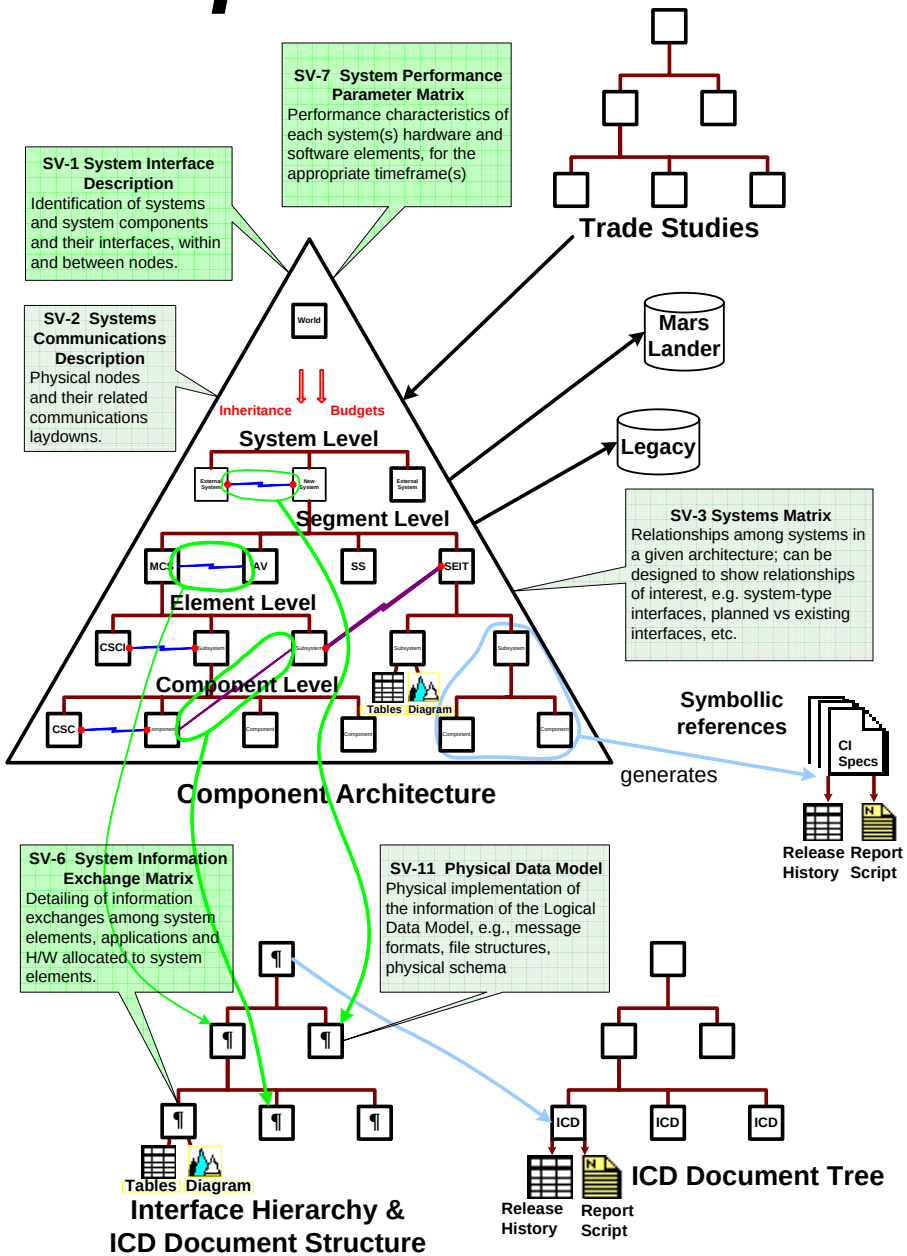
Component Architecture



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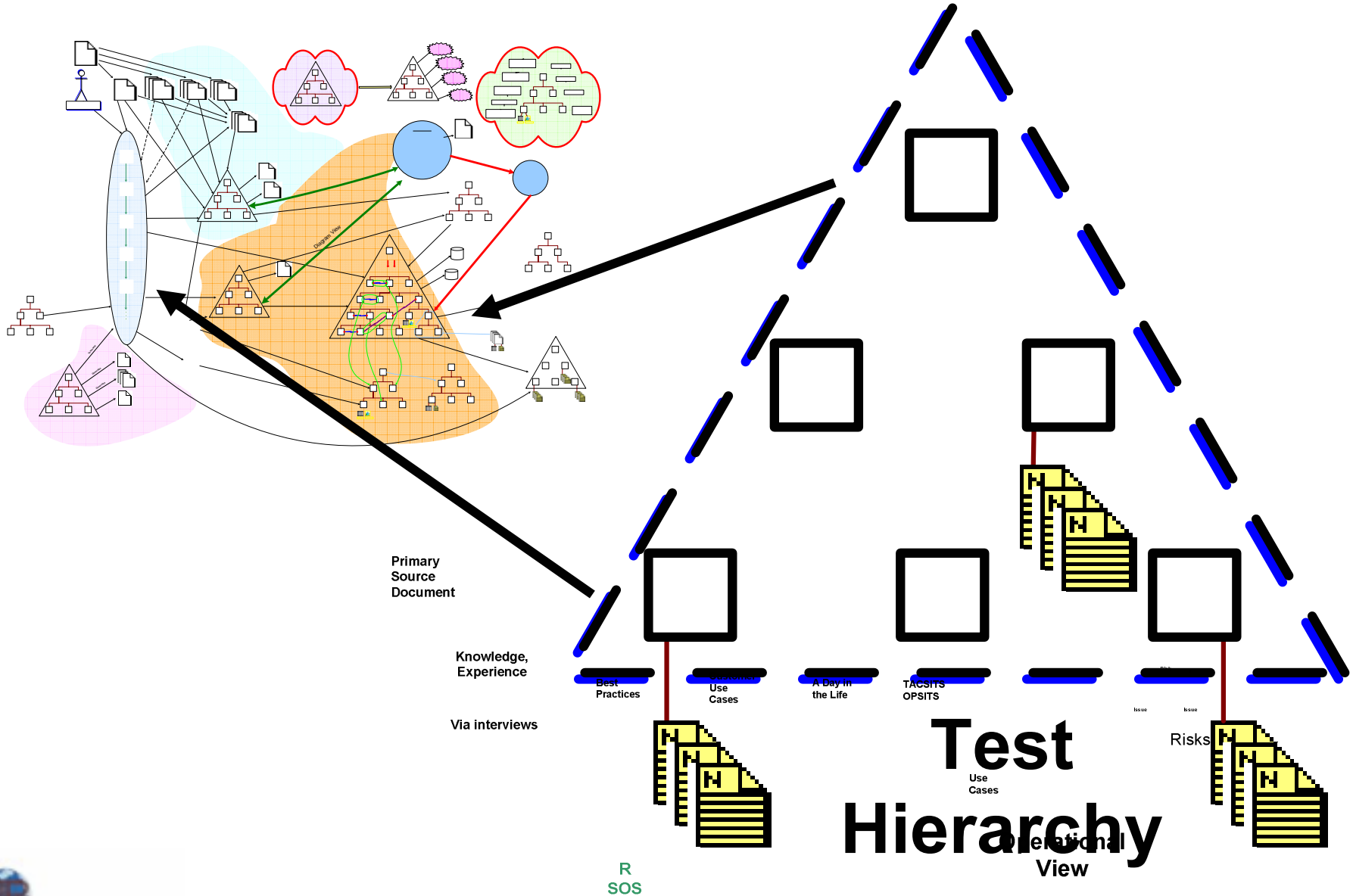
Test



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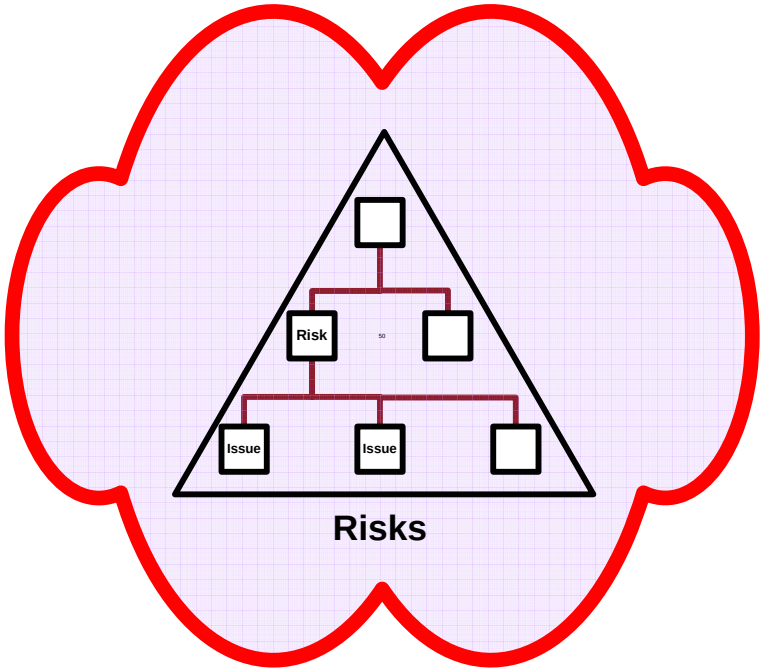
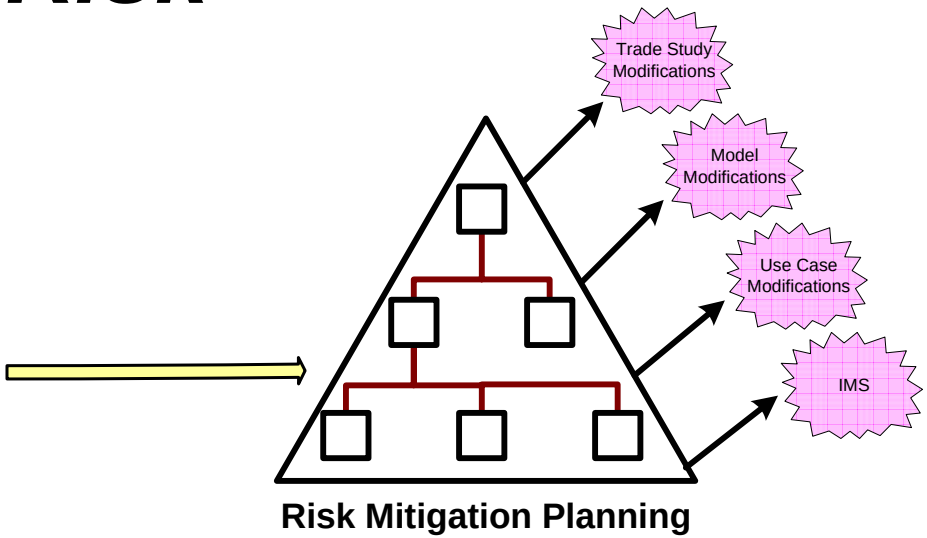
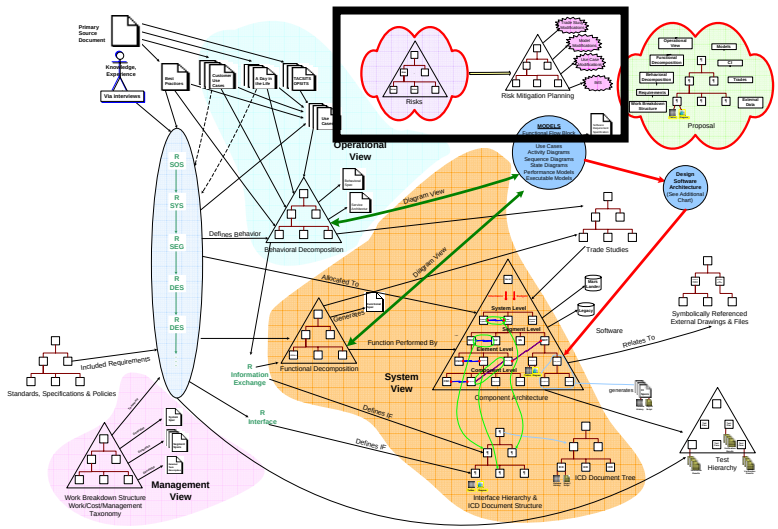
Risk







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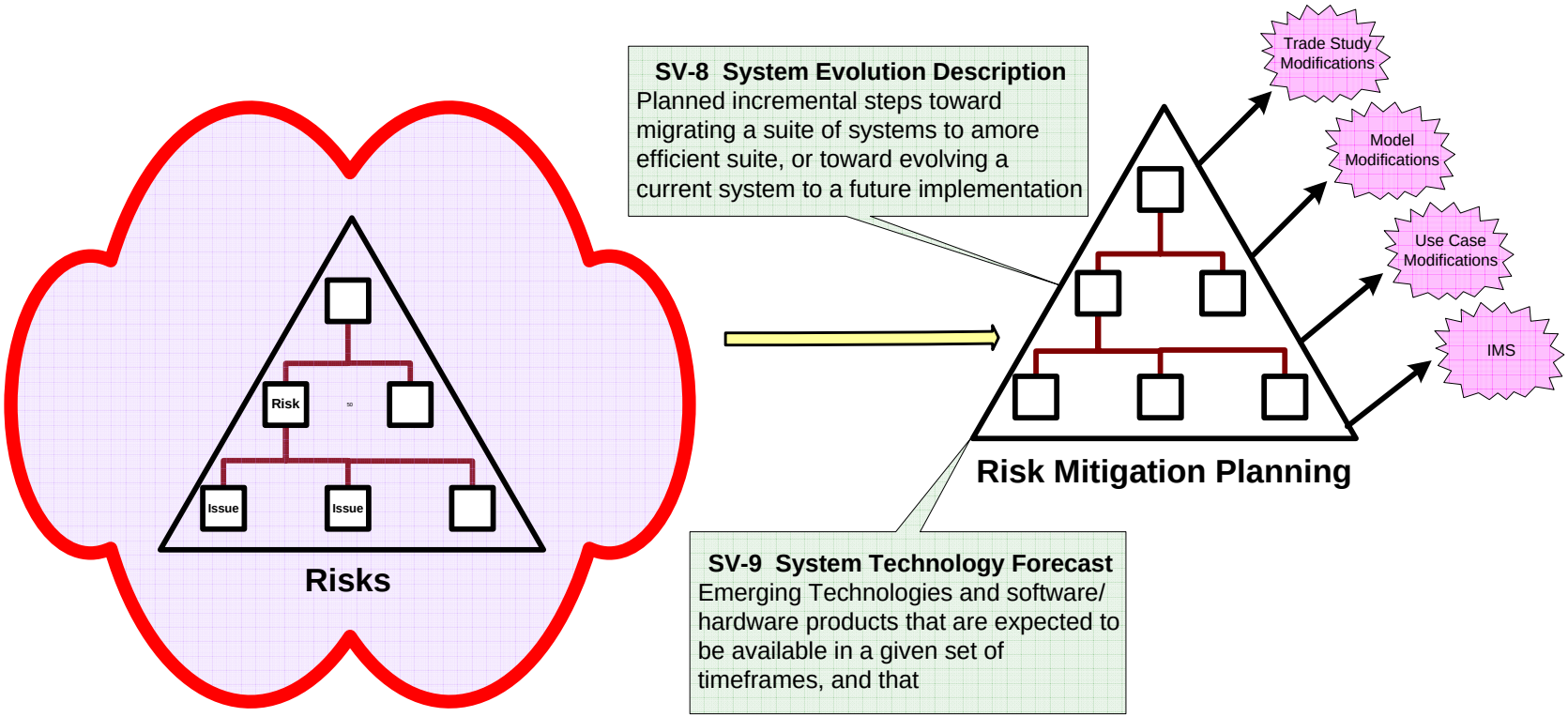
Risk



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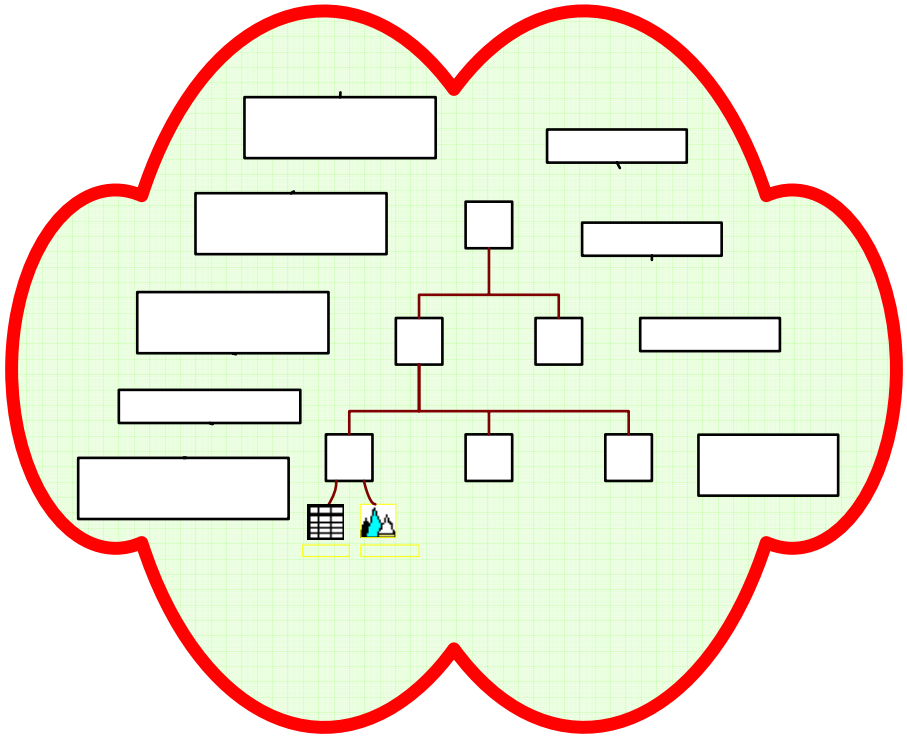
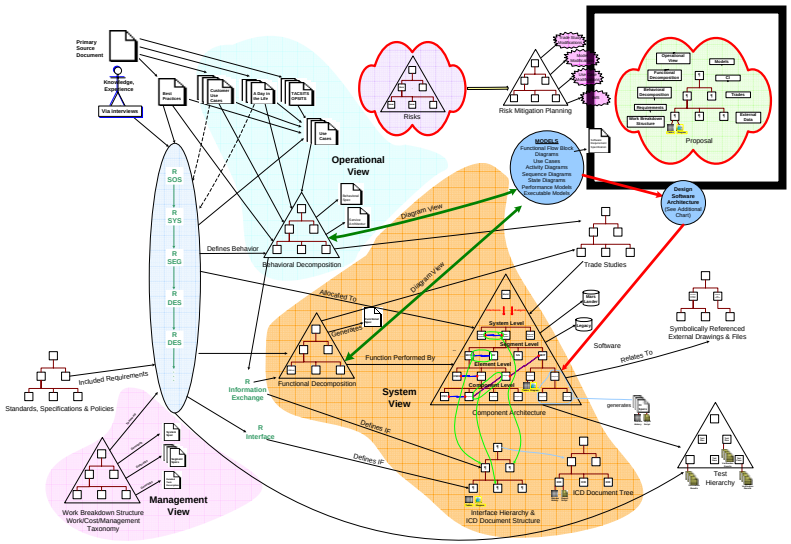
Proposal





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Keys to Successful Information Model Implementation.

- Reuse of (tailored) tools and models for each deployment
- Understanding the impact of changes on the entire program
- Processes which facilitate innovative changes
- Integrated work environment
- Ability to translate change at one level to changes at all levels within the WBS
- Understanding what needs to happen (Operational Requirements)
- Identification of gaps between operational needs and selected approach
- Value system to support focus on narrowing gaps with most impact
- Infrastructure which encourages and supports alternative approaches which can better satisfy higher level needs
- Infrastructure which supports rapid evaluation of the value and impact of alternative approaches
- Thinking outside the scope of current solutions

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Support Structure

- Integrated Information Model to facilitate common understanding and collaborative work environment
- Operational Requirements
  - Operational models
  - Flexibility to restate operational models and capabilities to meet original objectives with alternative approaches
  - Ability to recognize the value of enhanced or new capabilities
- Linkage of operational needs to design requirements
- Operational models
  - Facilitate understanding of needs
  - Organize information
- System and design models
  - Facilitate understanding of system and design
  - Organize information
- Continuous validation
- Measures of Effectivity and a Value System
- Best Practices
- Lessons Learned

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Validate Requirements to Satisfy Operational Needs

- Validation is a continuous ongoing process to make sure the right thing is being done
- Capturing Satisfaction Arguments as the analysis, decomposition and design proceeds identifies gaps early at a time they can be more easily resolved
- Measures of effectivity can be integrated with satisfaction arguments
- Formal Validation will tie together elements of the Information Model to validate that the operational needs are satisfied.

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Conclusion

An Information Model based approach supports an optimal design enhancing program capabilities. It drives a collaborative work environment reducing rework, revealing issues and supporting needed changes in an efficient manner.

The Information Model approach provides a roadmap for enterprise development through integration of corporate knowledge and experience. It supports the information maturity processes through their integration in elements of daily workflow. It reduces rework in preparation of work products and in the work process.

Models are key to both characterizing System Performance and relating this to the operational needs through the measures of effectivity

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