SIMBASE:
A tri-national initiative supporting PLCS and Synthetic Environments

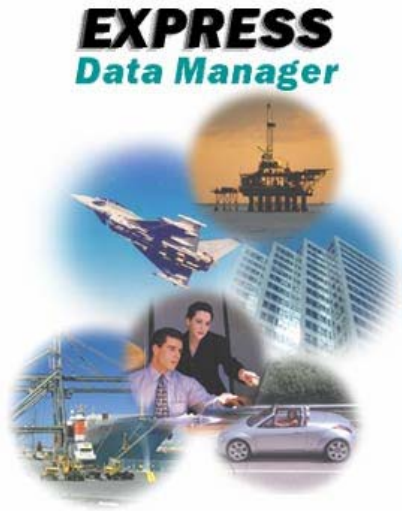
Presenter - Mark Tantillo
Jotne EPM Technology

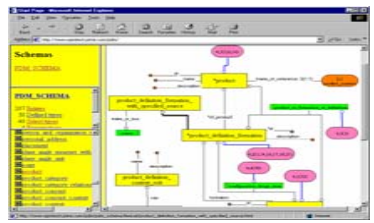
Authors
Dr. Tim King LSC Group (UK), Curzio Batini, Datamat (IT) , Kjell Bengtsson, Jotne EPM Technology (NO)

Jotne **EPM TECHNOLOGY**

World leaders in Industrial Data Management using ISO standards

- **Data modeling**
  Create your own data models, or use for viewing and documentation (ISO)
- **Database management**
  The ideal tool for data integration and application development projects
- **Rule engine**
  Validate your data sets, using your own business, knowledge rules or any other sets of rules
- **Web services**
  For use in web server applications (thin clients)





Universal Solutions for Interoperability and Sharing of Product Data

EADS

AIRBUS

esa

NATO OTAN NAMSA

SIEMENS

BAE SYSTEMS

NORTHROP GRUMMAN

Rockwell Collins

PTC

PDES, Inc.

BOEING

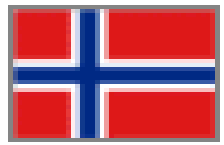
SAAB

Georgia Institute of Technology

THE FIGHTER ENTERPRISE

DEPARTMENT OF THE NAVY UNITED STATES OF AMERICA

Benvenuto
Velkommen
Welkom
Welcome

SIMBASE

What is SIMBASE?

- three-year research programme
- set up under the Western European Armaments Group (WEAG) & now sponsored by the European Defence Agency (EDA)
- the challenge
  - deliver a practical demonstration of the process known as either Synthetic Environment Based Acquisition (SEBA) or Simulation Based Acquisition (SBA)
  - in the form of
    - a coherent & consistent approach to the acquisition process
    - effective & efficient systems engineering processes
    - software interoperability through the use of open, neutral standards
    - modelling & simulation supporting the overall engineering process

The Project participants

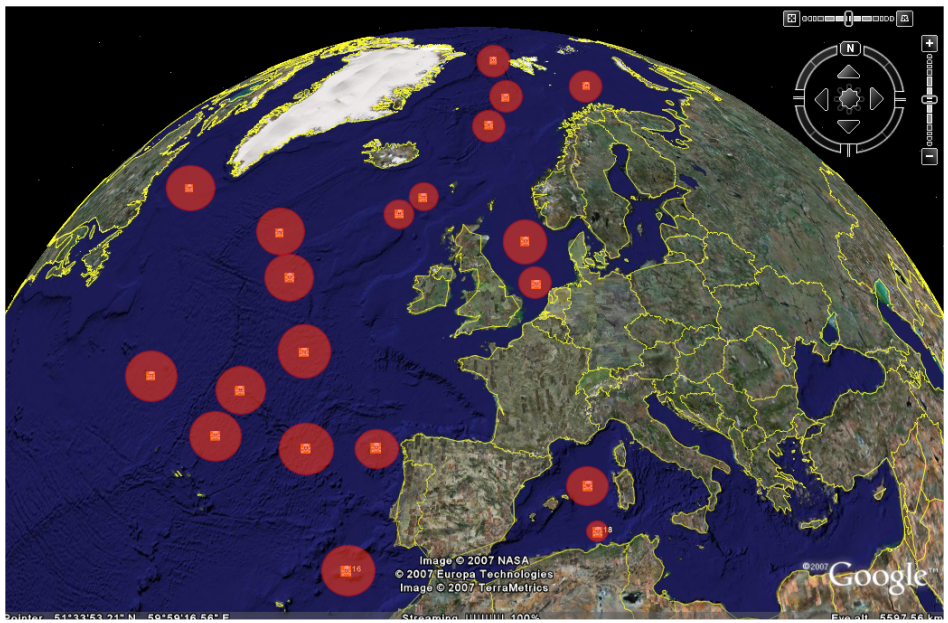
- Ministries of Defence
  - UK MoD
    - Directorate of Analysis, Experimentation & Simulation
  - IT MoD
  - NO MoD
    - represented by FFI (Norwegian Defence Research Establishment)
- Industrial Entities
  - Datamat (IT)
    - http://www.datamat.it/
  - Jotne EPM Technology (NO)
    - http://www.epmtech.jotne.com/
  - LSC Group (UK)
    - http://www.lsc.co.uk/

The challenge ...

- deliver a practical demonstration of the process known as either Synthetic Environment Based Acquisition (SEBA) or Simulation Based Acquisition (SBA)
- in the form of
  - a coherent & consistent approach to the acquisition process
  - effective & efficient systems engineering processes
  - software interoperability through the use of open, neutral standards
  - modelling & simulation supporting the overall engineering process

Case Study – Submarine Rescue

The case study was the deployment and execution of a small submarine crew rescue vehicle.



Core demo team and their roles

Systems Engineer
Ann Meads

Logistics Engineer
Hussein Khimji

Synthetic Env. Engineer
Raffaella Colaci

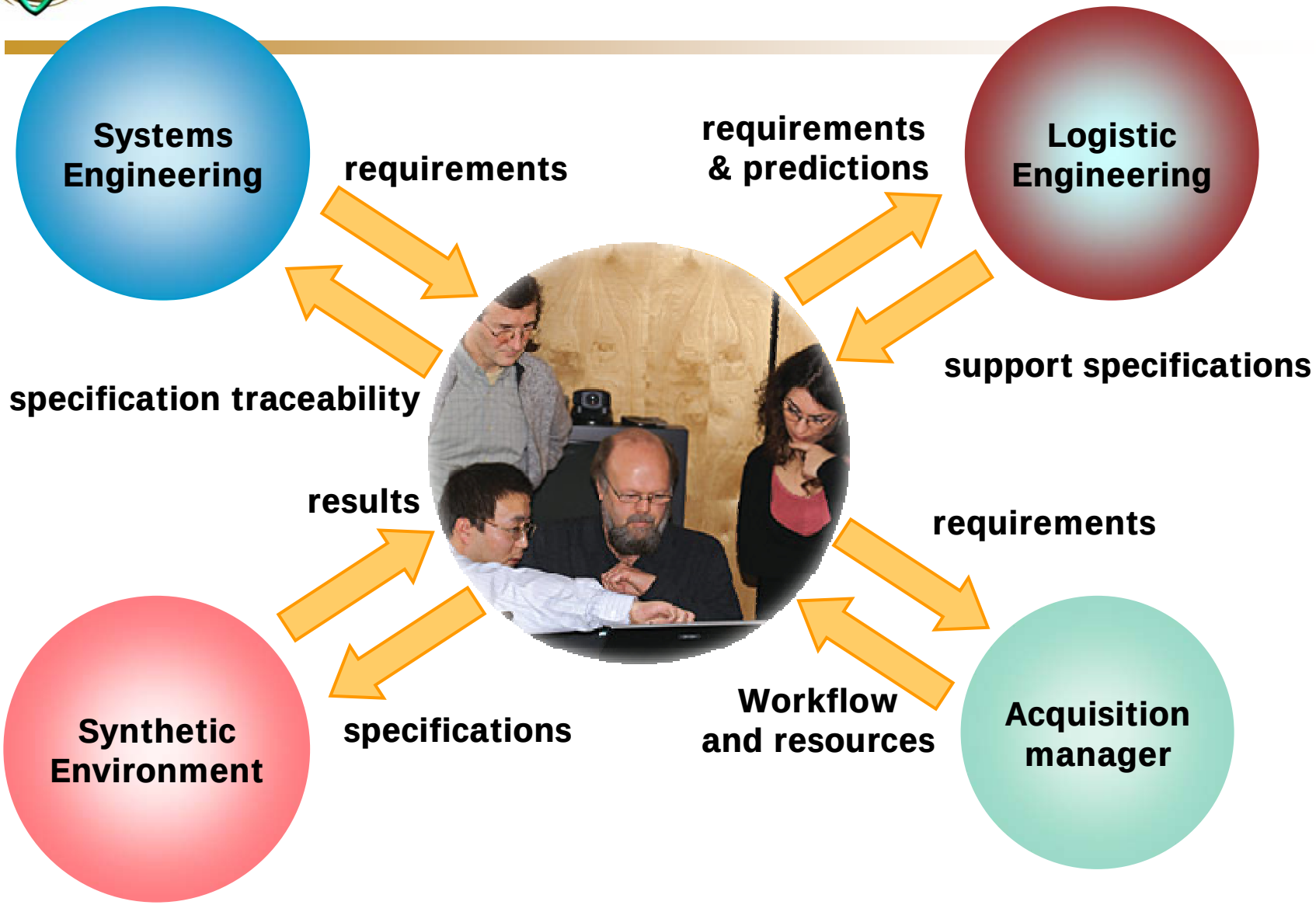
Acquisition Manager

Jochen Haenisch

SIMBASE

interoperability repository

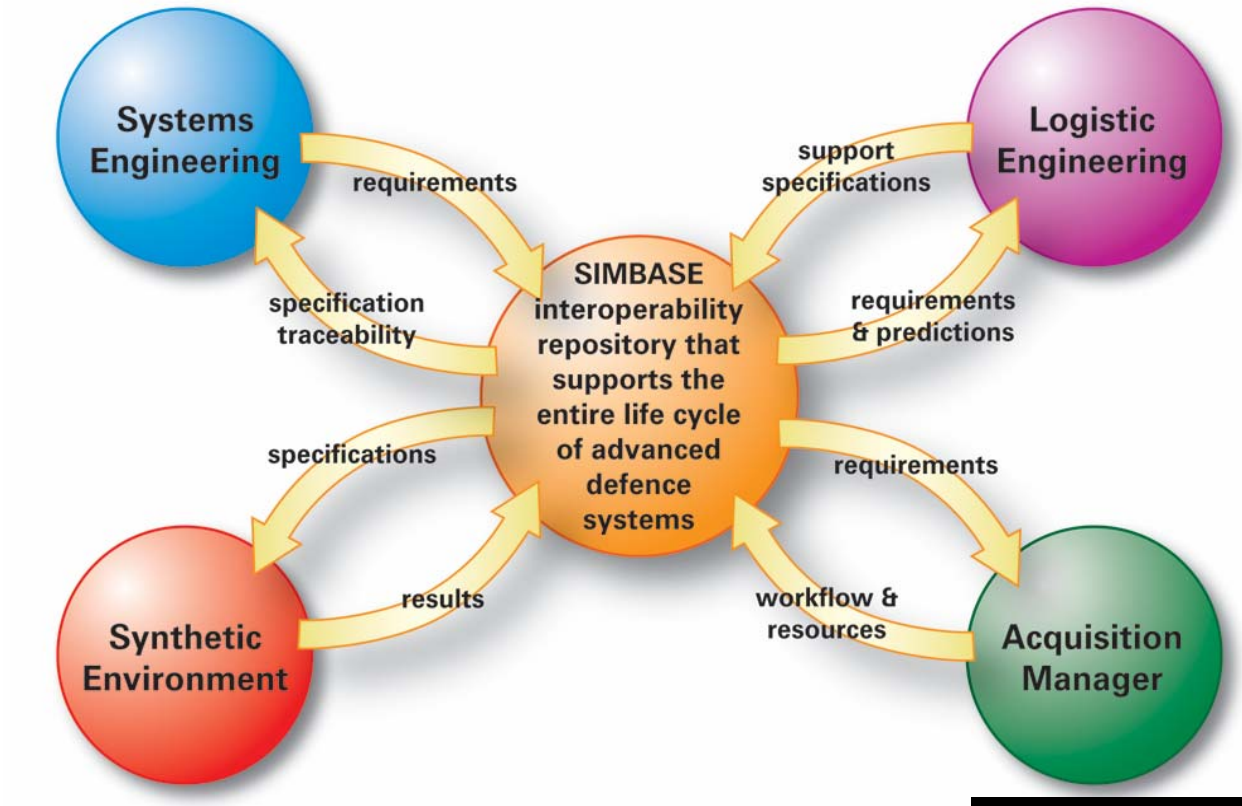
Core SIMBASE Functionality



Tools used in demonstration

DOORS from Telelogic

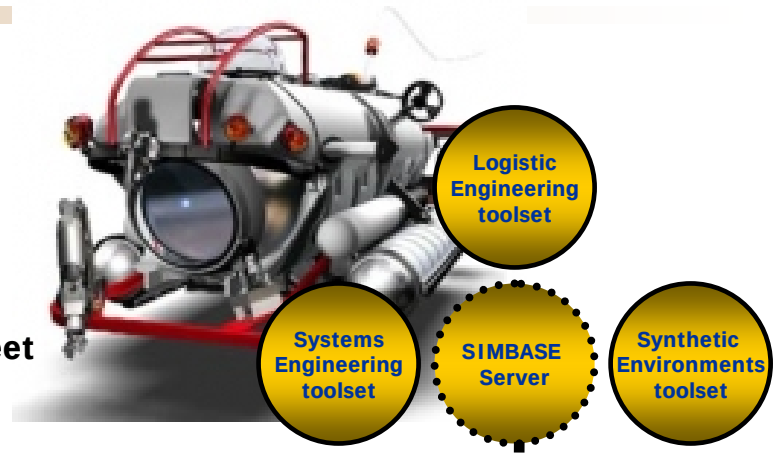
SPARS Clockwork Solutions



Battle Lab from KESEM

EXPRESS Data Manager
Jotne EPM Technology

Architectural Viewpoint



Domain Models
(Engineering views)

- Input sheet
- Output sheet
- Calculation sheet
- Result sheet

PARTNER

CONTRACTOR

USER

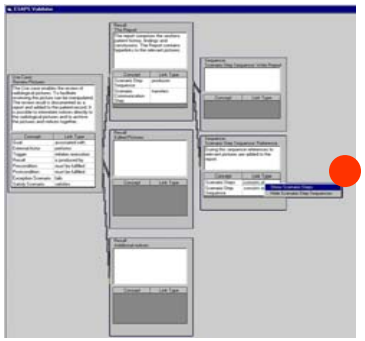
- XML and Web services
- PLCS, Systems Engineering and Synthetic Environments
- Reference Data Libraries
- Open and Publicly available Object definitions by ISO/STEP
- Database

ISO International Organization for Standardization

PLCS (Support Engineering, Inventory Management, CM/Change Control, Product Maintenance)

SIMBASE Demonstration

Systems Engineering



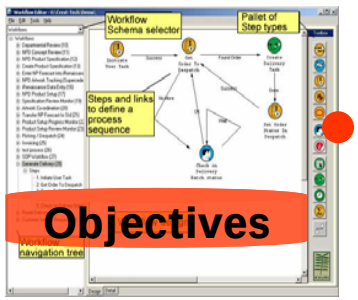
Logistics Engineering

Data sharing

Study questions

10303-239

Acquisition Manager

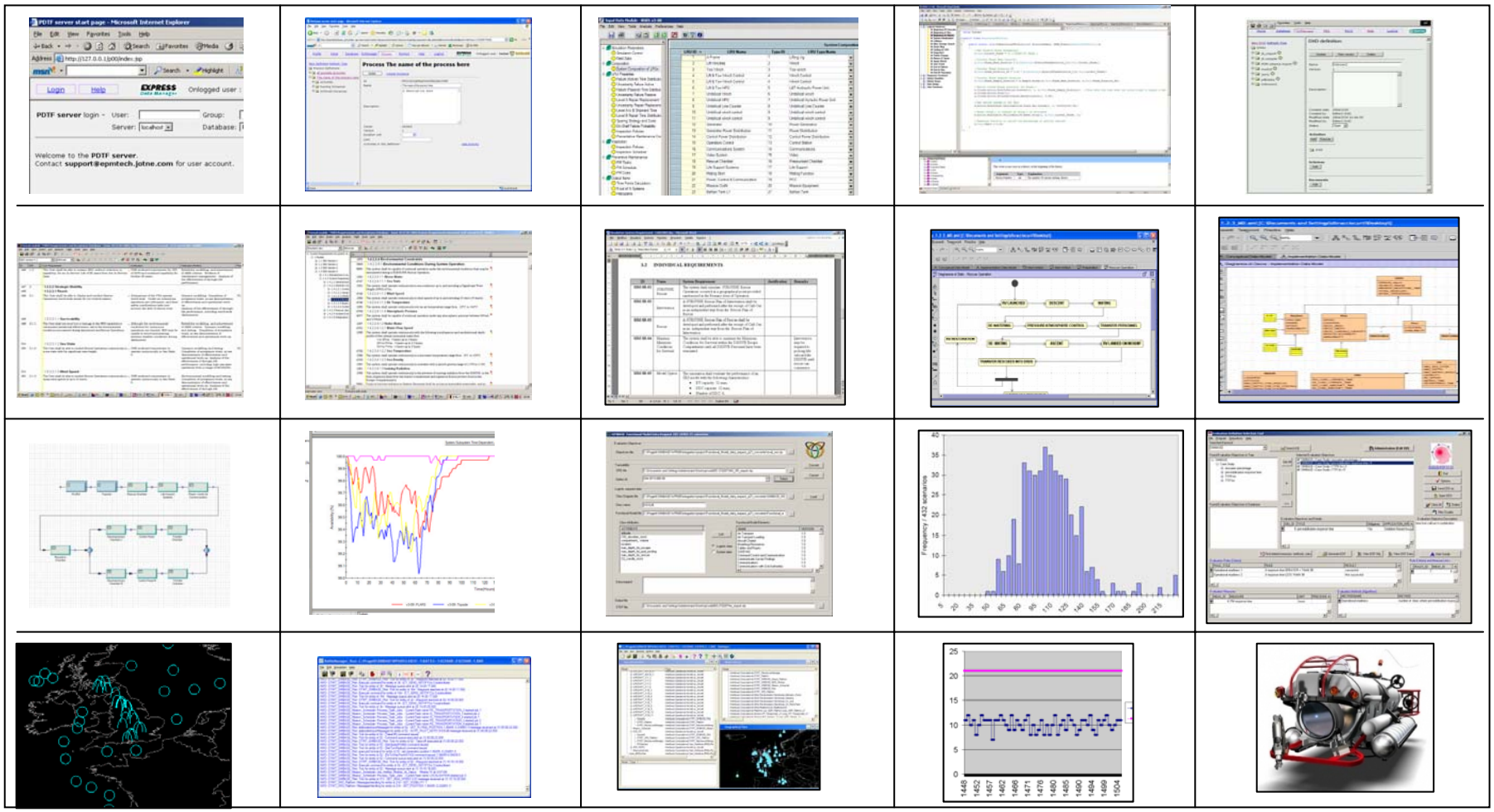


Synthetic Environment

Data sharing – Detailed overview

	URD	SRD	Study question	Synthetic environment user requirement	Functional model	Synthetic environment system requirement
Start	✓	✓	✓	✓	✓	✓
Review	-	URD	-	Study question	Study question	
Create	✓	✓	✓	✓	✓	
Translate	✓	✓	✓	✓	✓	
Load	✓	✓	✓	✓	✓	
Verify	✓	✓	✓	✓	✓	

User perspective - processes



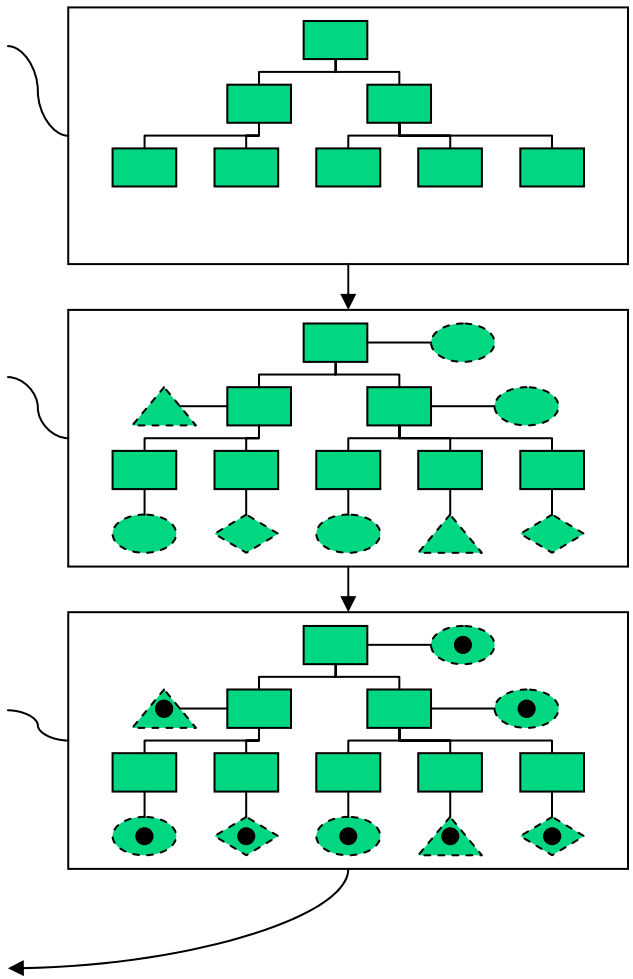
Progression through the scenario

systems engineer develops functional model

synthetic environment engineer identifies required characteristics against elements in the functional model

logistic engineer performs analysis to provide values for required characteristics

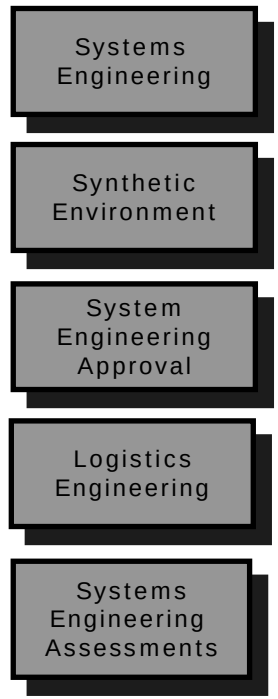
synthetic environment engineer uses values to execute simulation



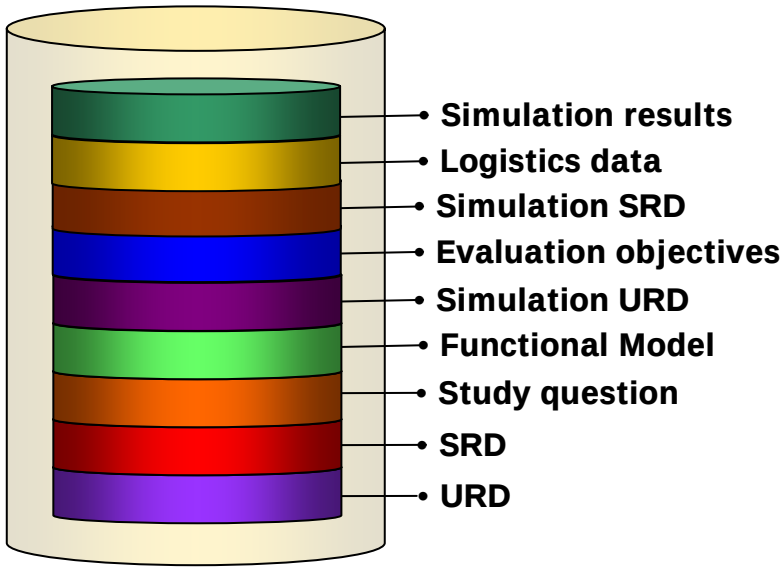
Overview

- participants
  - Acquisition Project Manager
  - Systems Engineer
  - Synthetic Environment Engineer
  - Logistics Engineer -
- process
  1) identify project resources
  2) develop URD
  3) develop SRD
  4) identify need for modelling & simulation study
  5) formulate study question
  6) identify appropriate expert to perform simulation study
  7) develop simulation user requirements, evaluation objectives & scenario
  8) create functional breakdown
  9) request approval for simulation user requirements, evaluation objectives & scenario
  10) approve simulation user requirements, evaluation objectives & scenario
  11) develop simulation system requirements & conceptual model
  12) design & implement simulation
  13) request other domains to provide required data
  14) perform logistic analysis
  15) submit results of analysis
  16) perform synthetic environment simulation
  17) send simulation results to systems engineer
  18) review results & assess consequences of answer to study question

Progression



Walkthrough of capabilities using the SRS Test Case



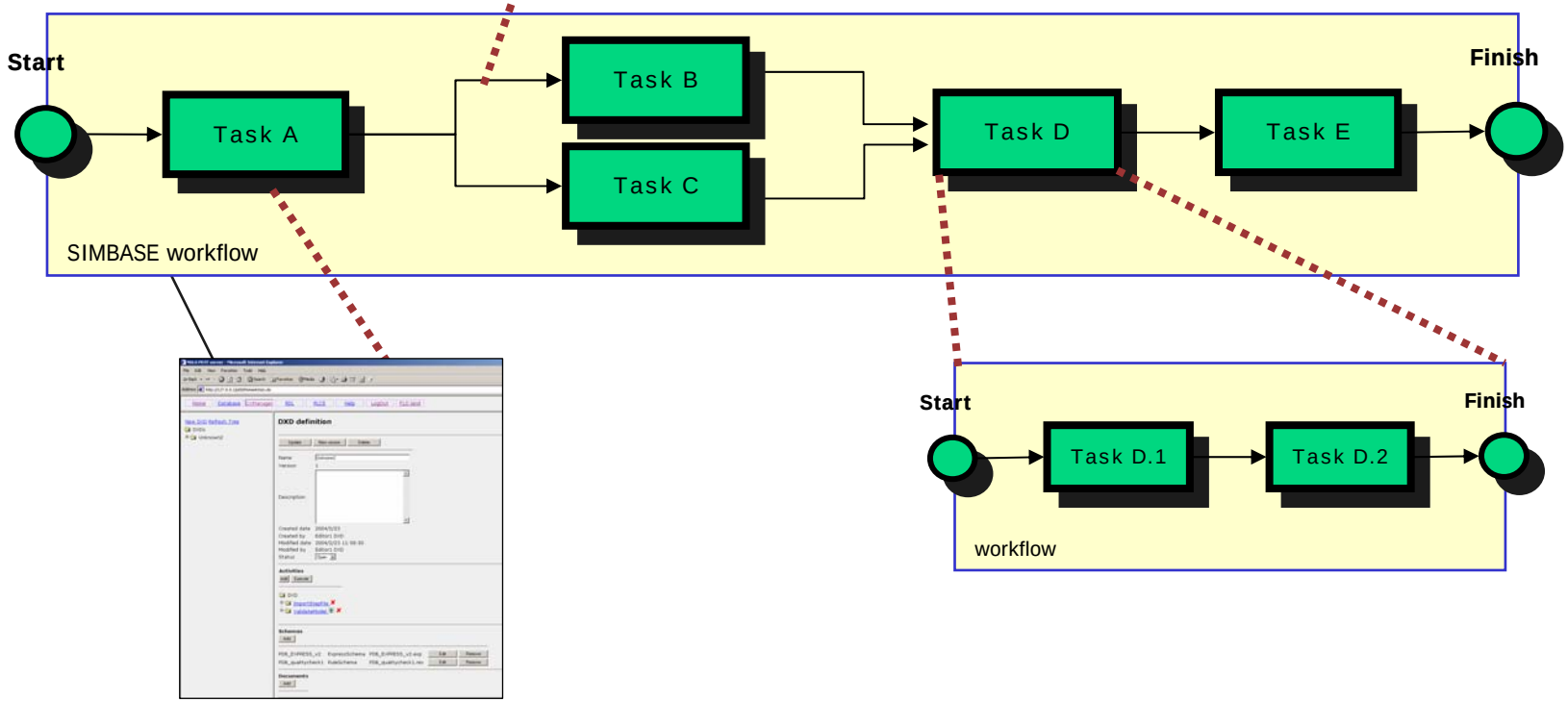
SIMBASE

interoperability repository

Acquisition manager

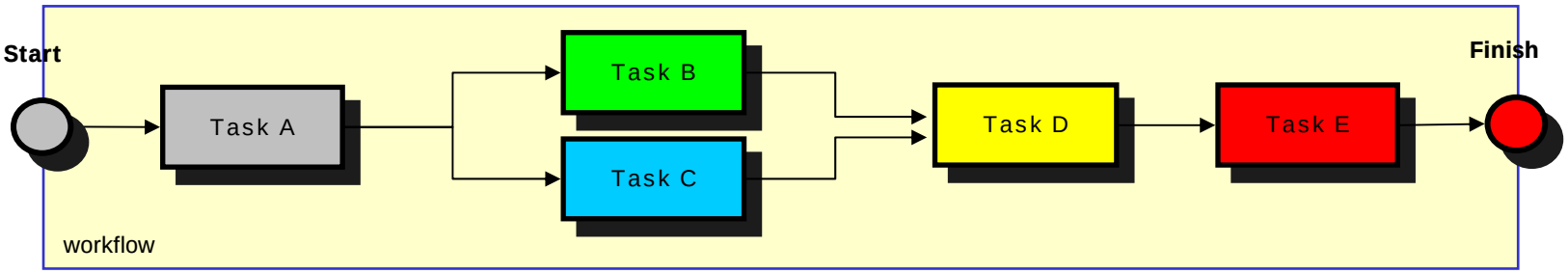
SIMBASE Process Definition

Link:
- data flow between activities
- defined type of data



Simbase Server workflow definition
- automatically started upon task execution

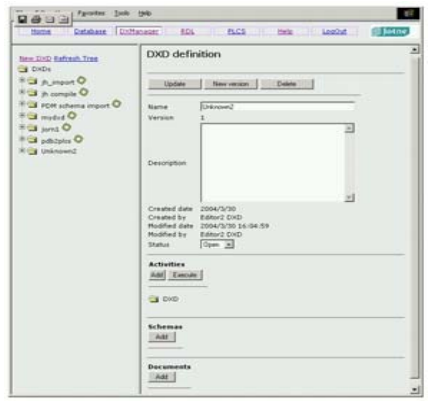
SIMBASE Process Status



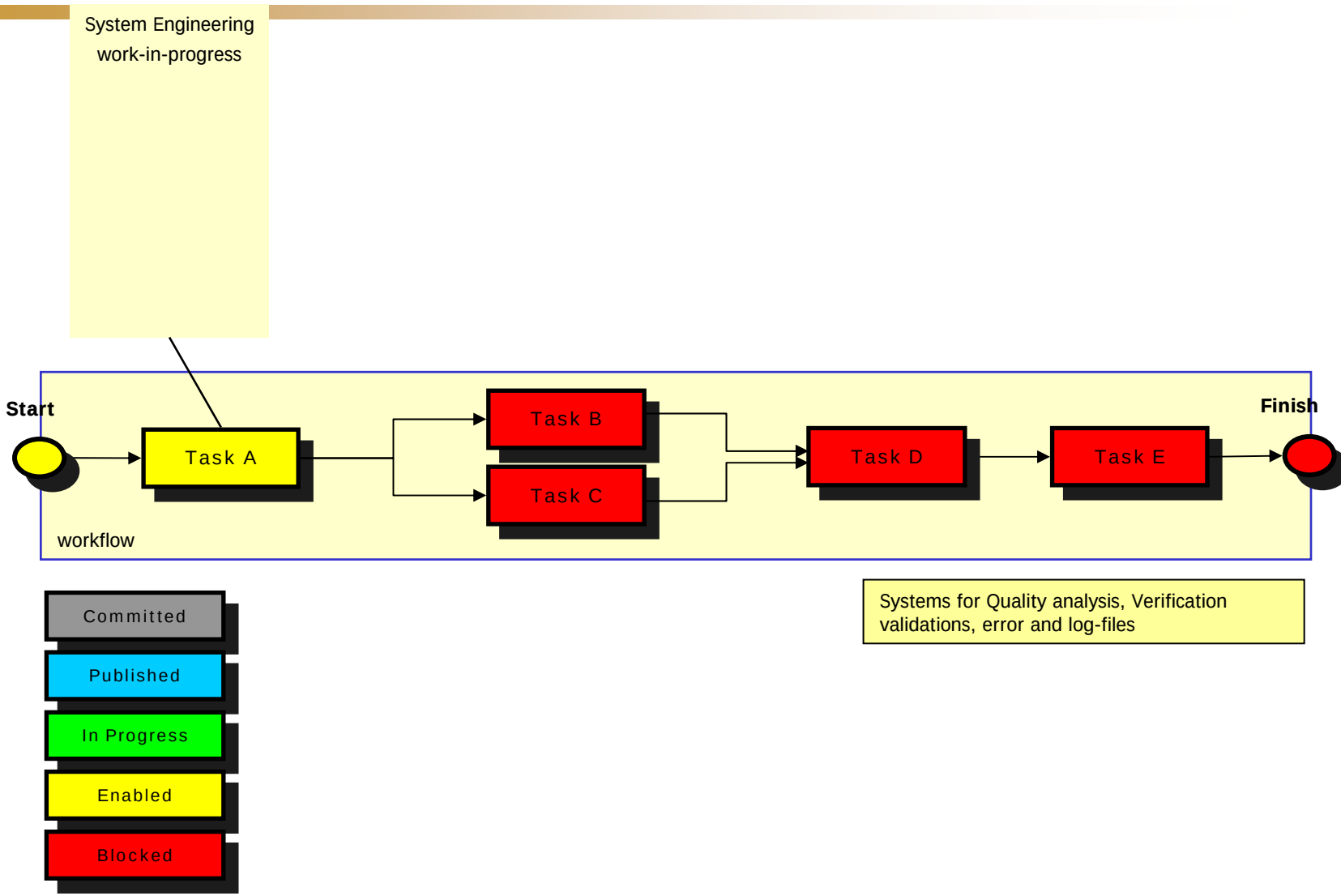
Committed	Task has Finished, Issued Data
Published	Task has Started, Intermediate Data Exported to Other Tasks
In Progress	Task has Started, Data Available within Task
Enabled	Task Ready to Start, Input Data Available
Blocked	Task Waiting for Input Data to Become Available

SIMBASE Workflow Definition

- who
  - Acquisition and Project Manager
- Setting up project resources and SIMBASE server management
  - Logon as user in SIMBASE server system
  - Select predefined tasks and create activities
  - Link tasks (assign workflow order and data)
  - Assign tools, as required
  - Store workflow as template as a SIMBASE Server Definition



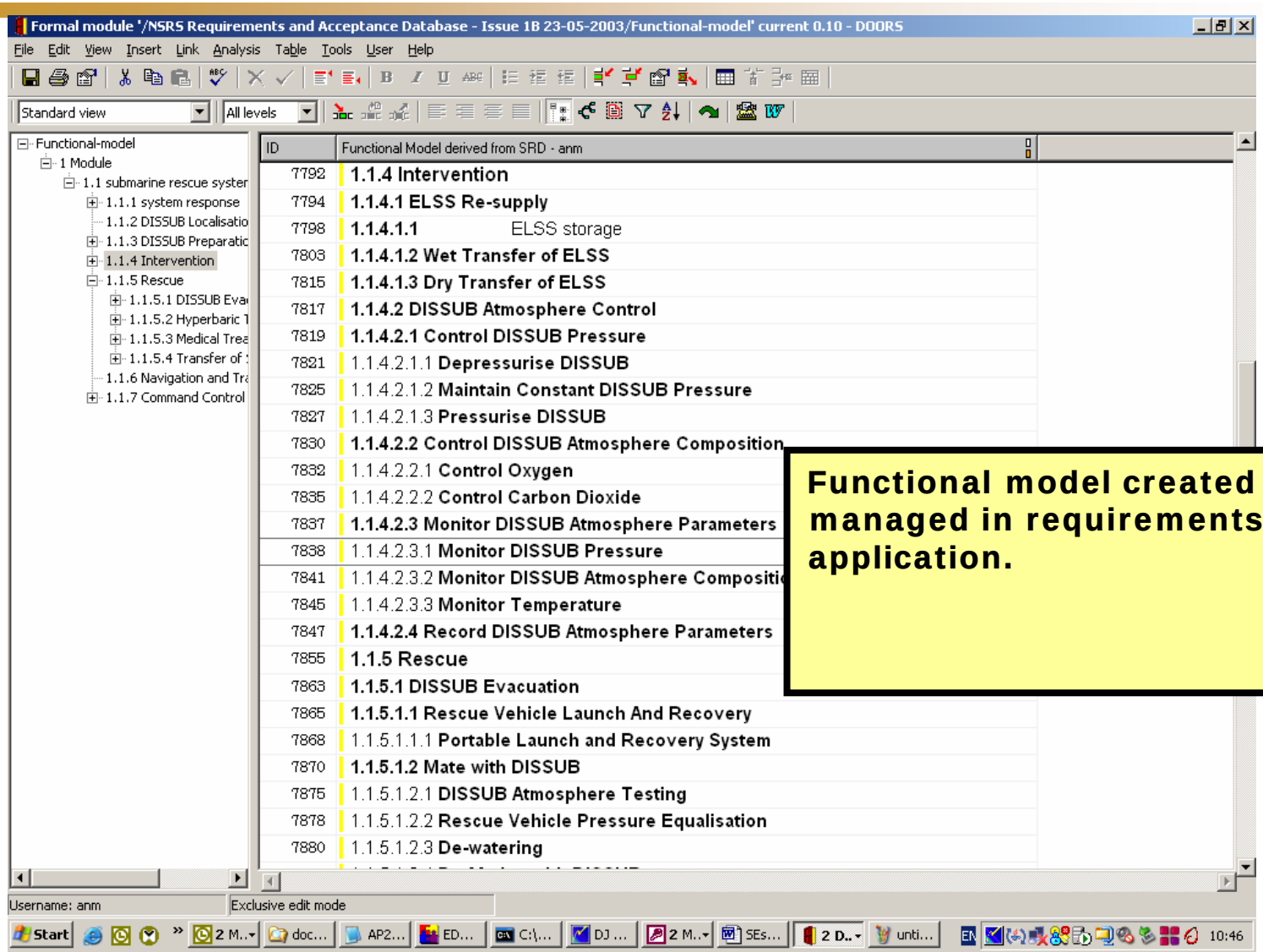
SIMBASE Process Execution (1)



Identify need for modelling & simulation study

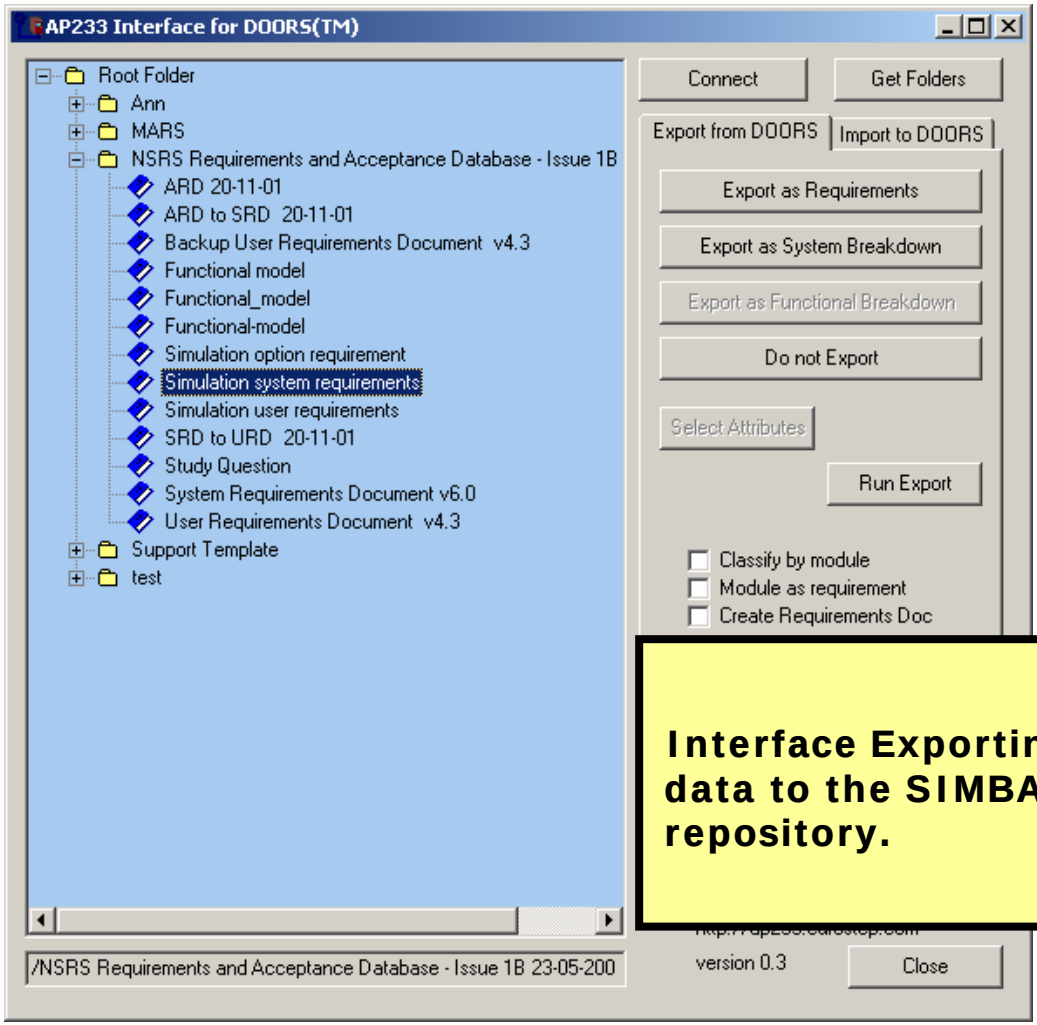
- who
  - systems engineer
- SIMBASE case study scenario
  - need to validate SRD against URD
    - in particular highlight emergent behaviours from considering how a conforming solution will behave as a total system

Create functional model



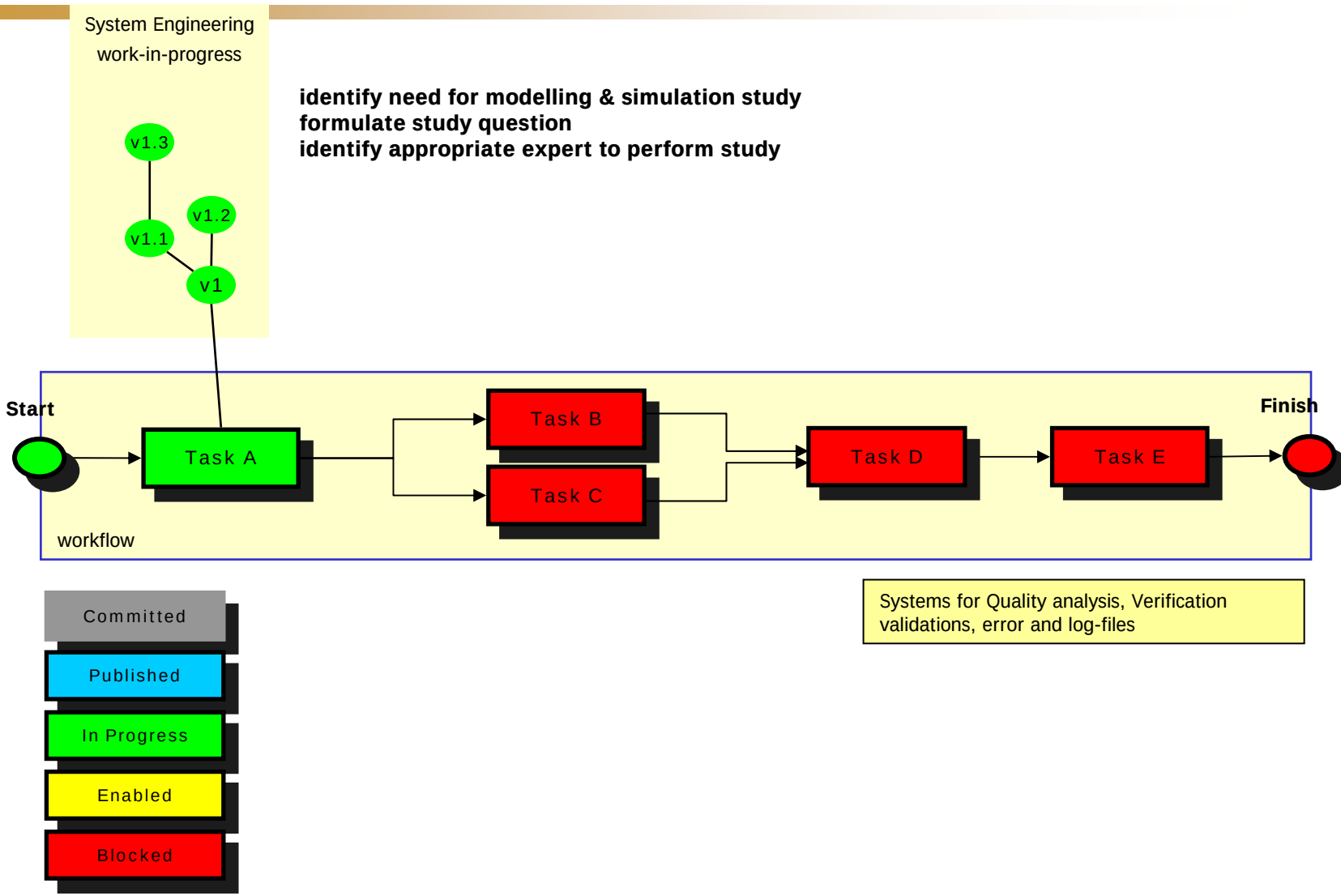
Functional model created and managed in requirements application.

Export requirement data

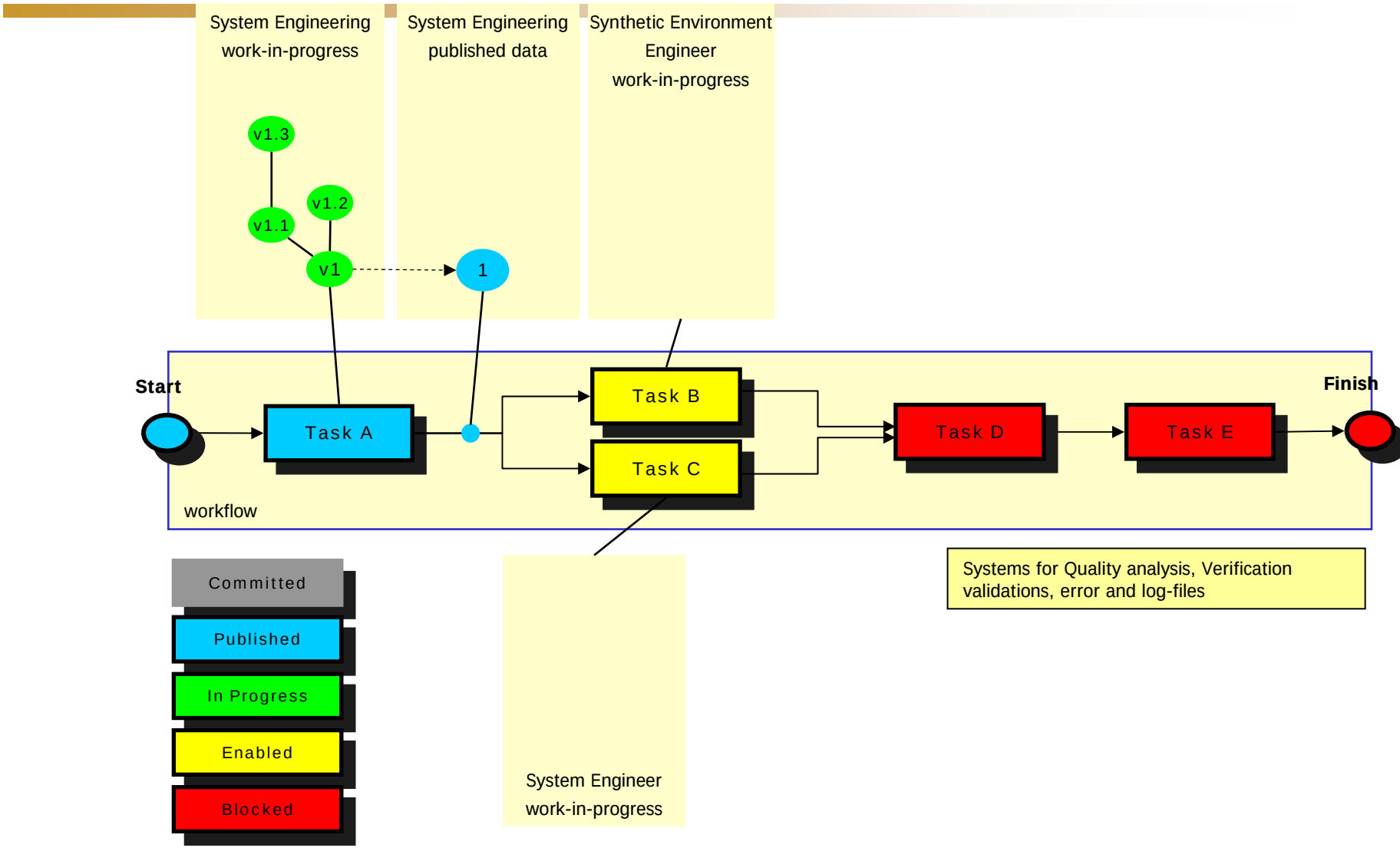


Interface Exporting AP233 data to the SIMBASE repository.

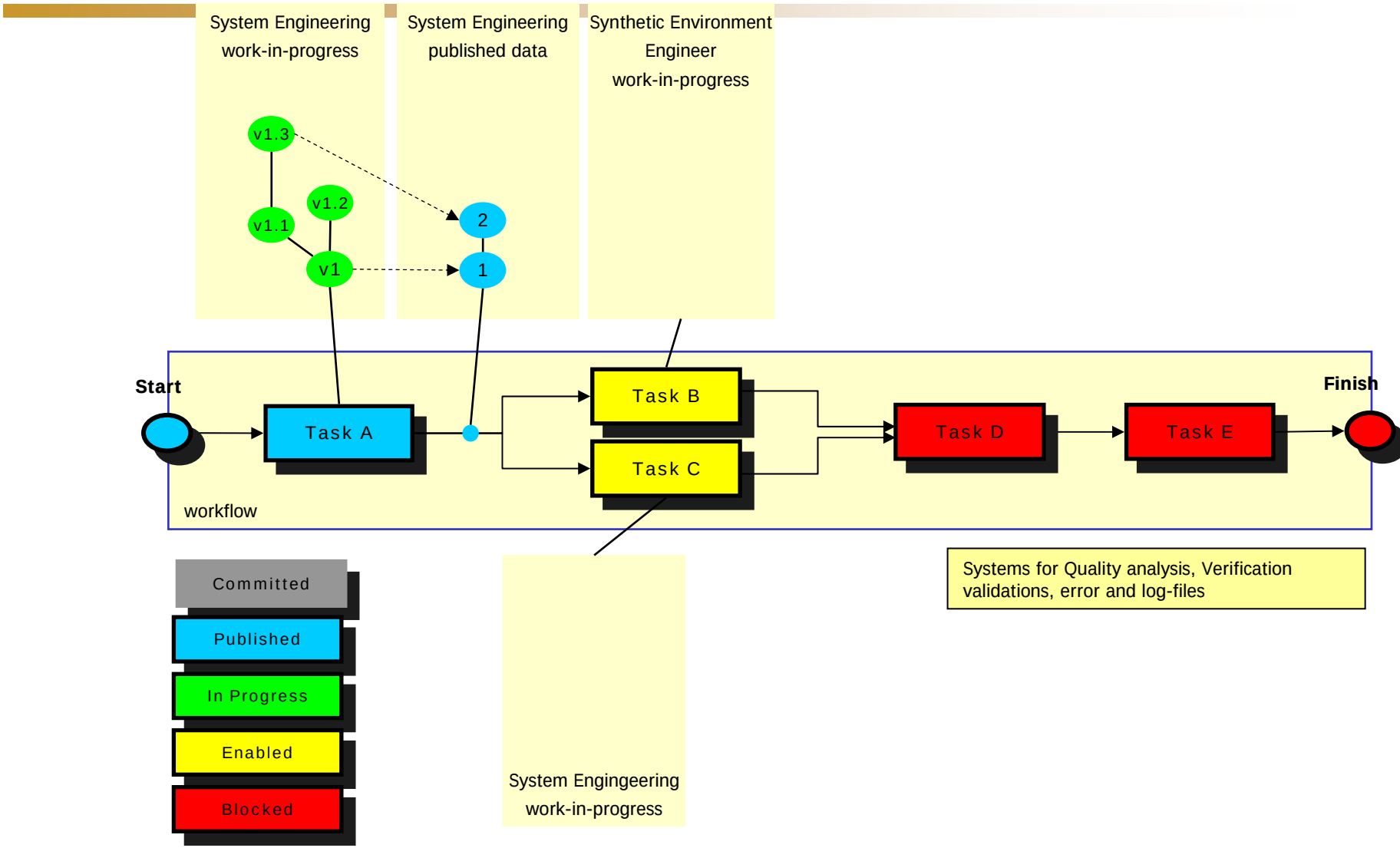
SIMBASE Process Execution (2)



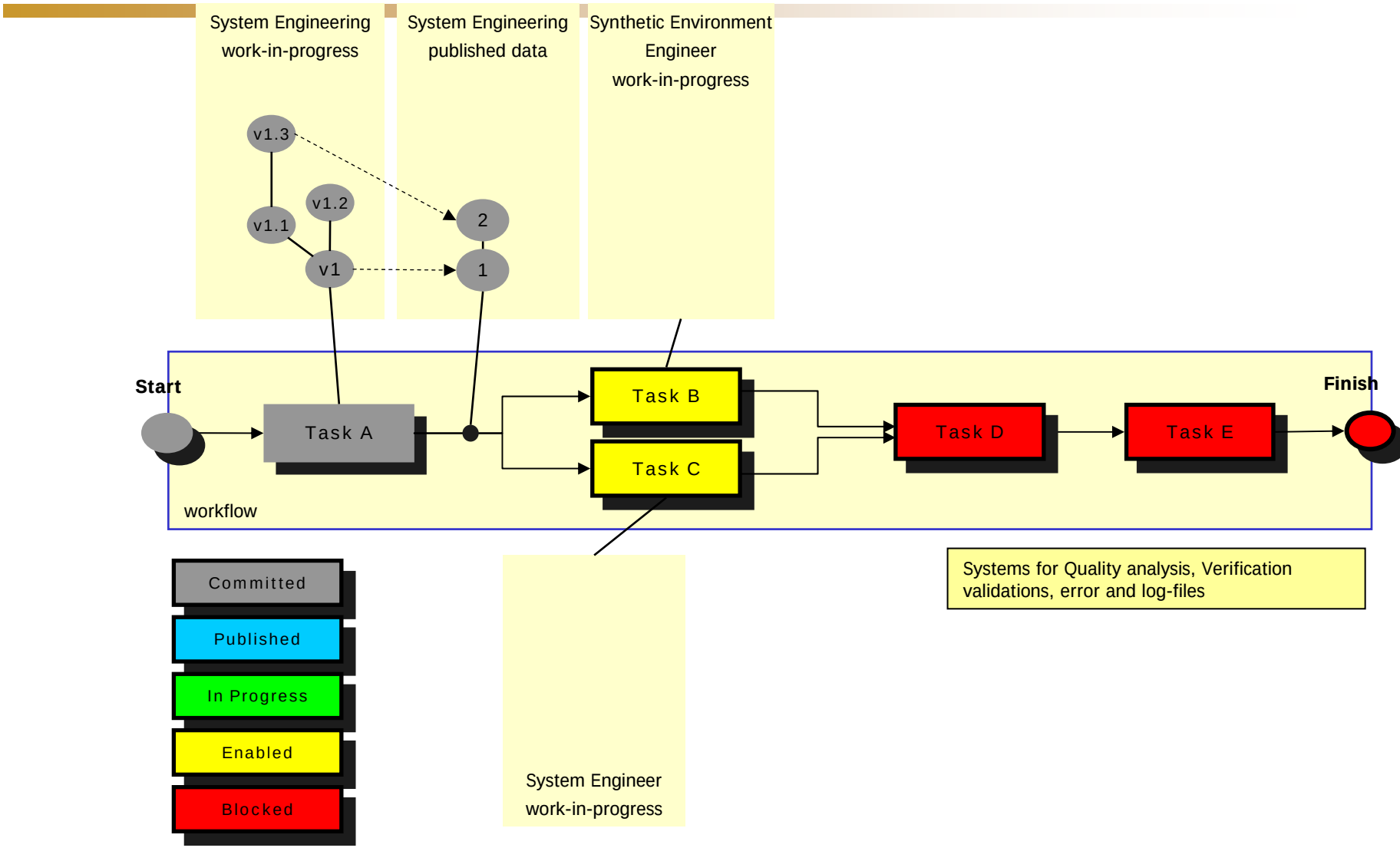
SIMBASE Process Execution (3)



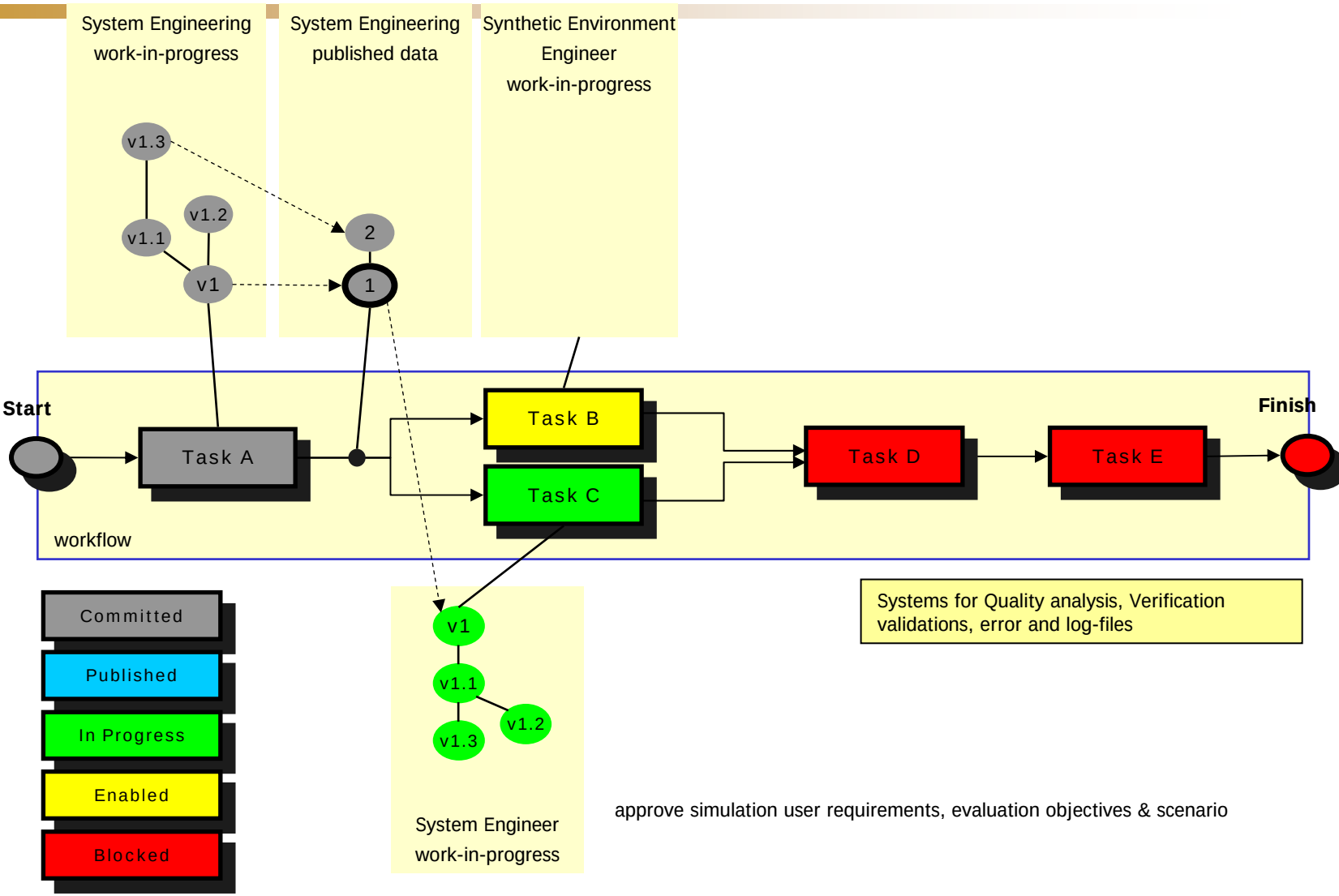
SIMBASE Process Execution (4)



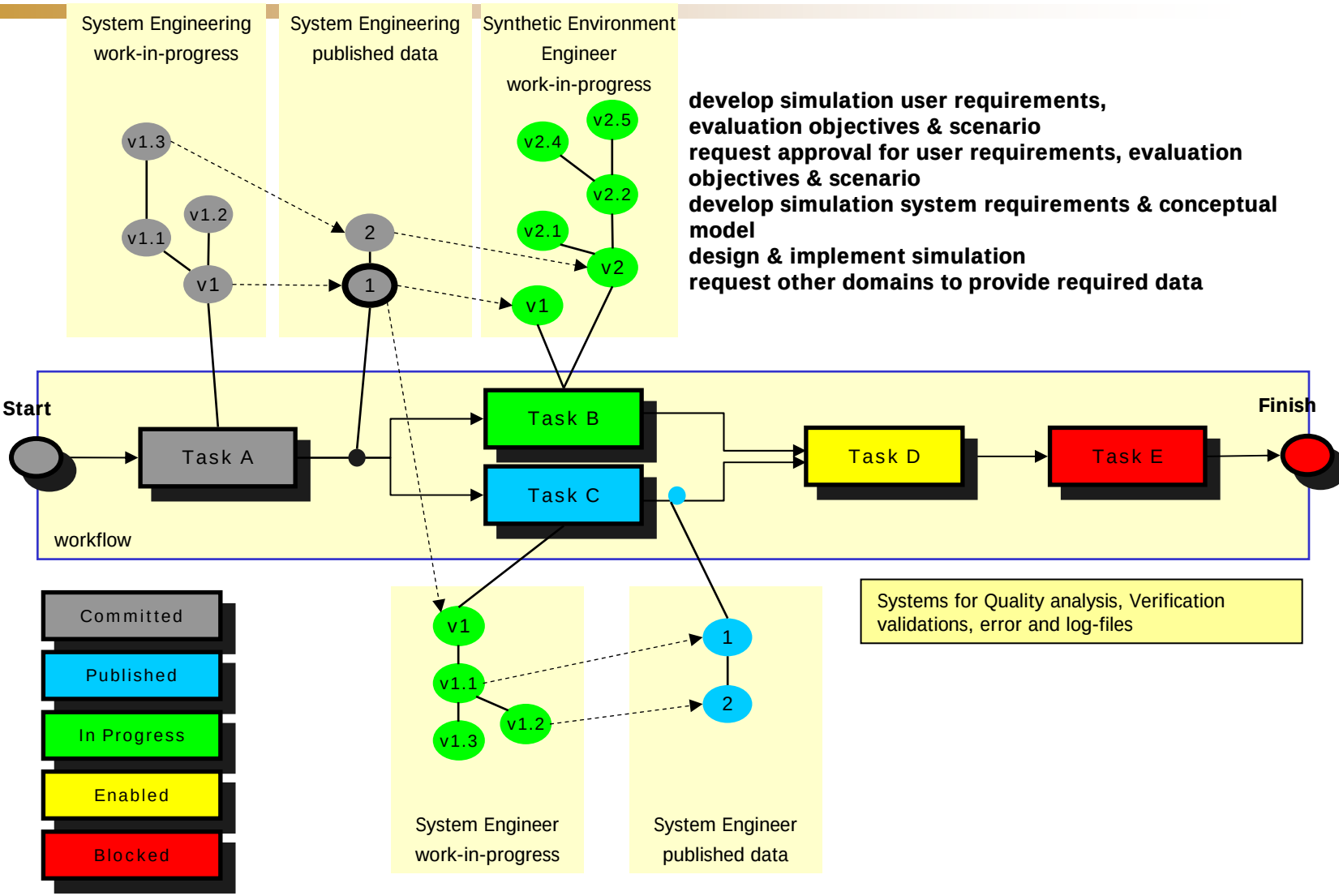
SIMBASE Process Execution (5)



SIMBASE Process Execution (6)



SIMBASE Process Execution (7)



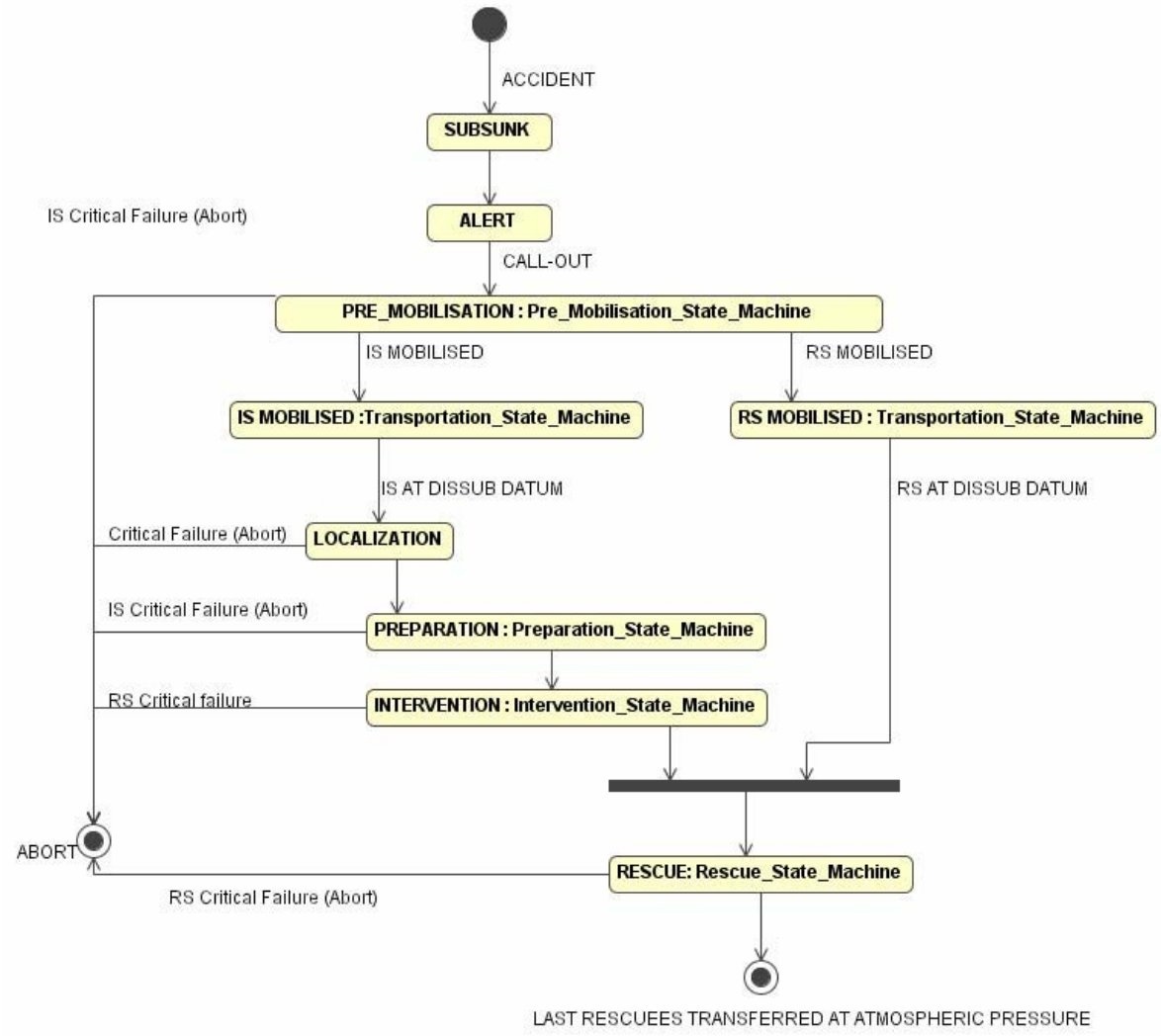
Request other domains to provide required data

- who
  - synthetic environment engineer
- process details
  - according to developed data requirements
    - output from design & implement simulation
  - identify supporting information to support the other domain
    - e.g. URD, SRD, functional model
- SIMBASE case study scenario
  - provide values for system characteristics by performing logistic analysis

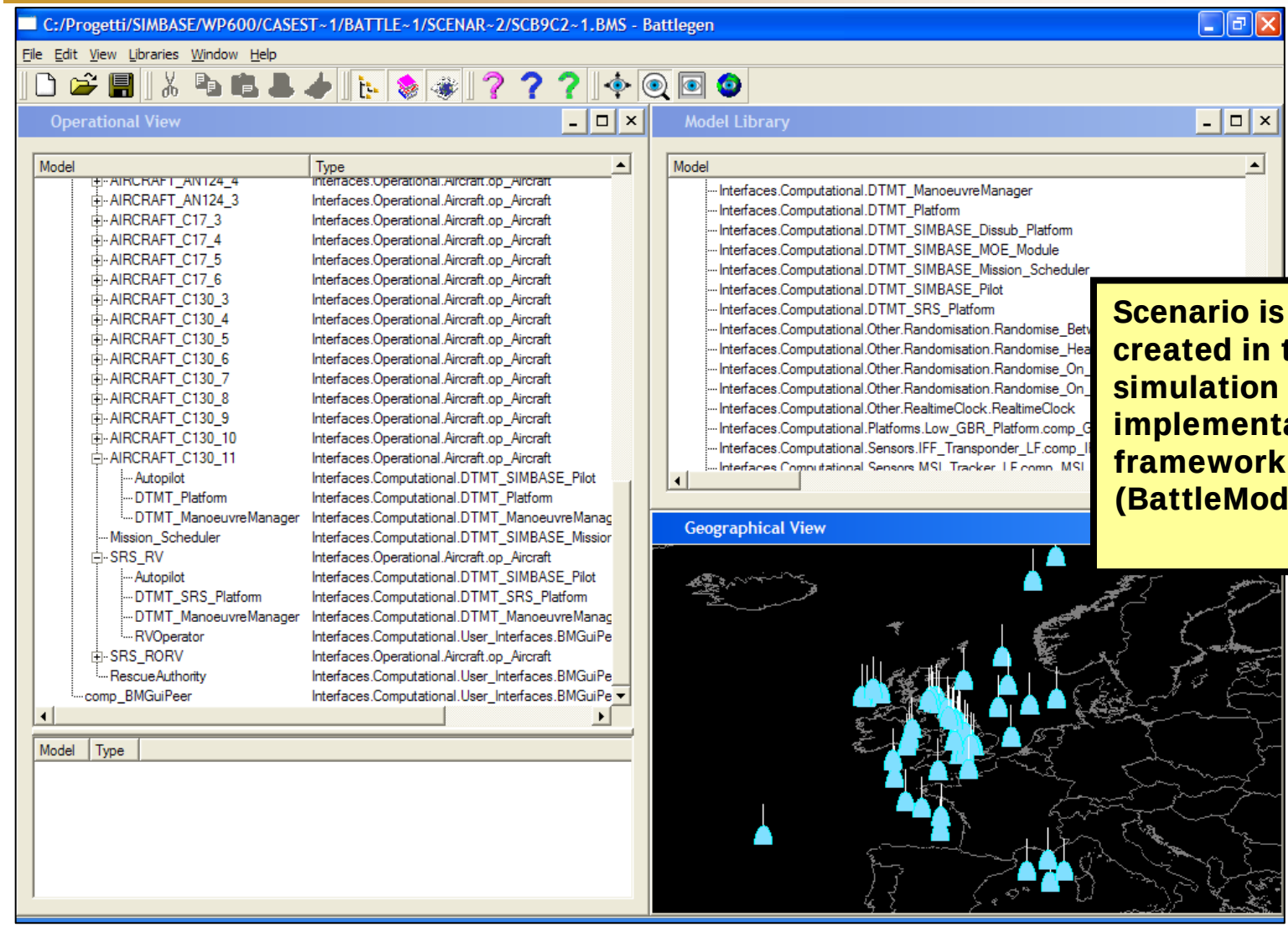
Search, intervention and rescue

Mission tasks

- Call-out
- Transit
- Search
- Prepare
- Intervene
- Rescue
- Return to stand-by

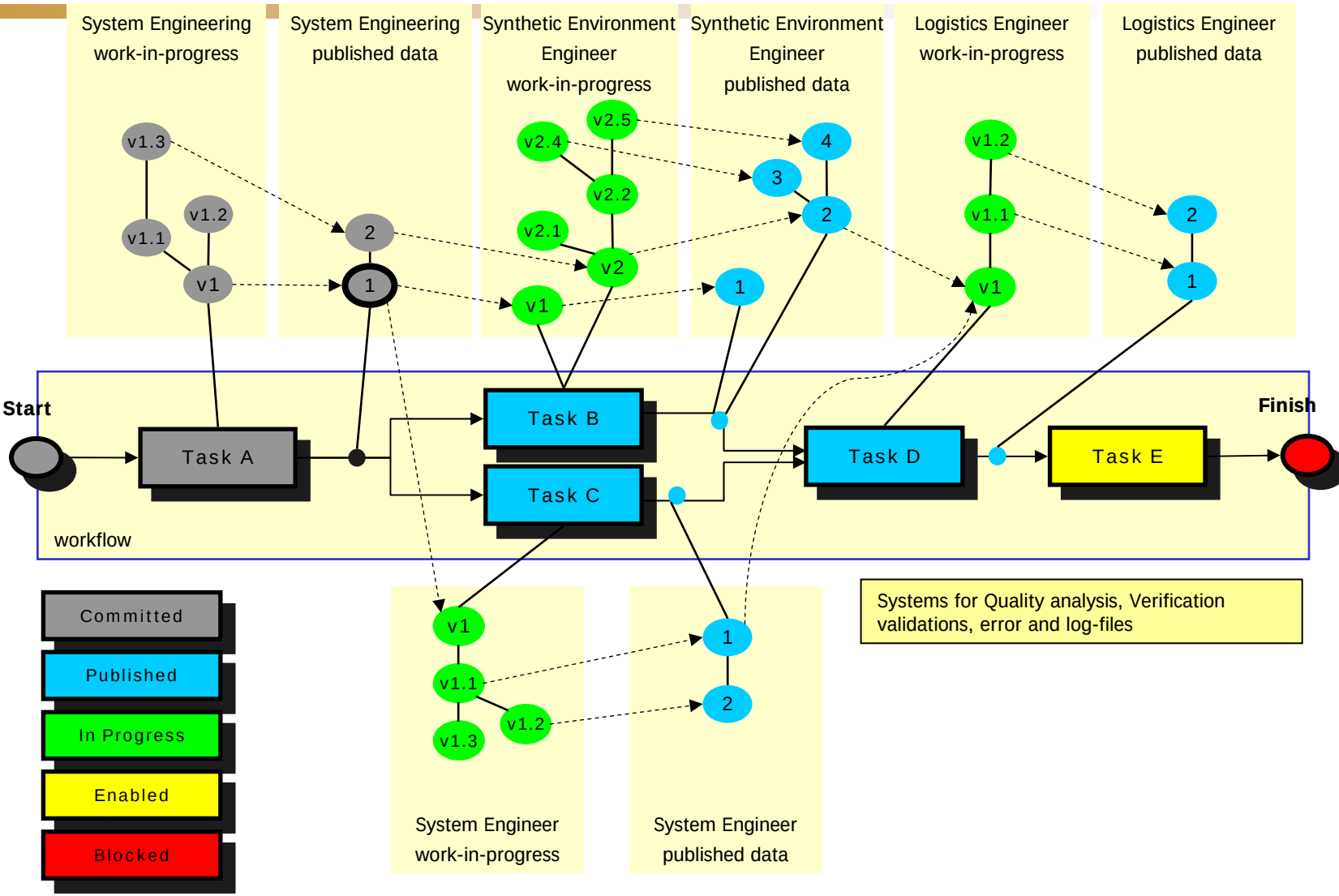


Implement Simulation



Scenario is created in the simulation implementation framework (BattleModel).

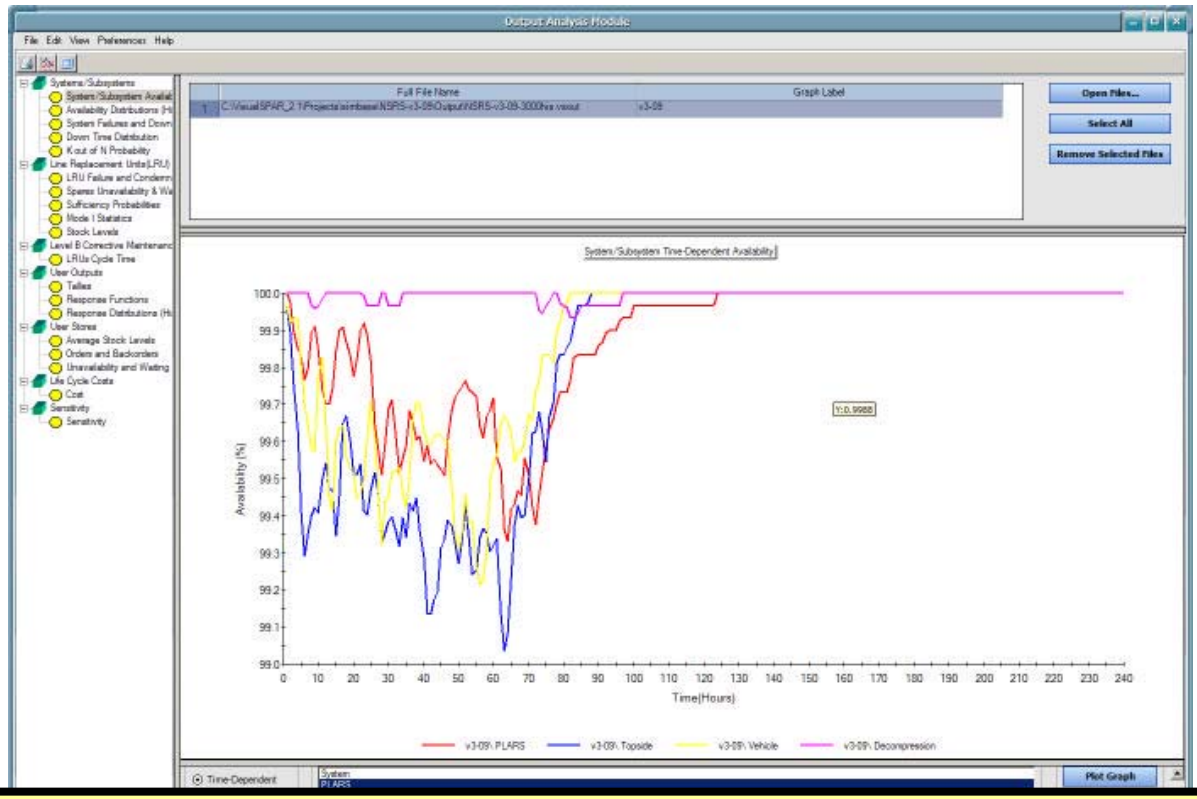
SIMBASE Process Execution (8)



Perform logistic analysis

- who
  - logistic engineer

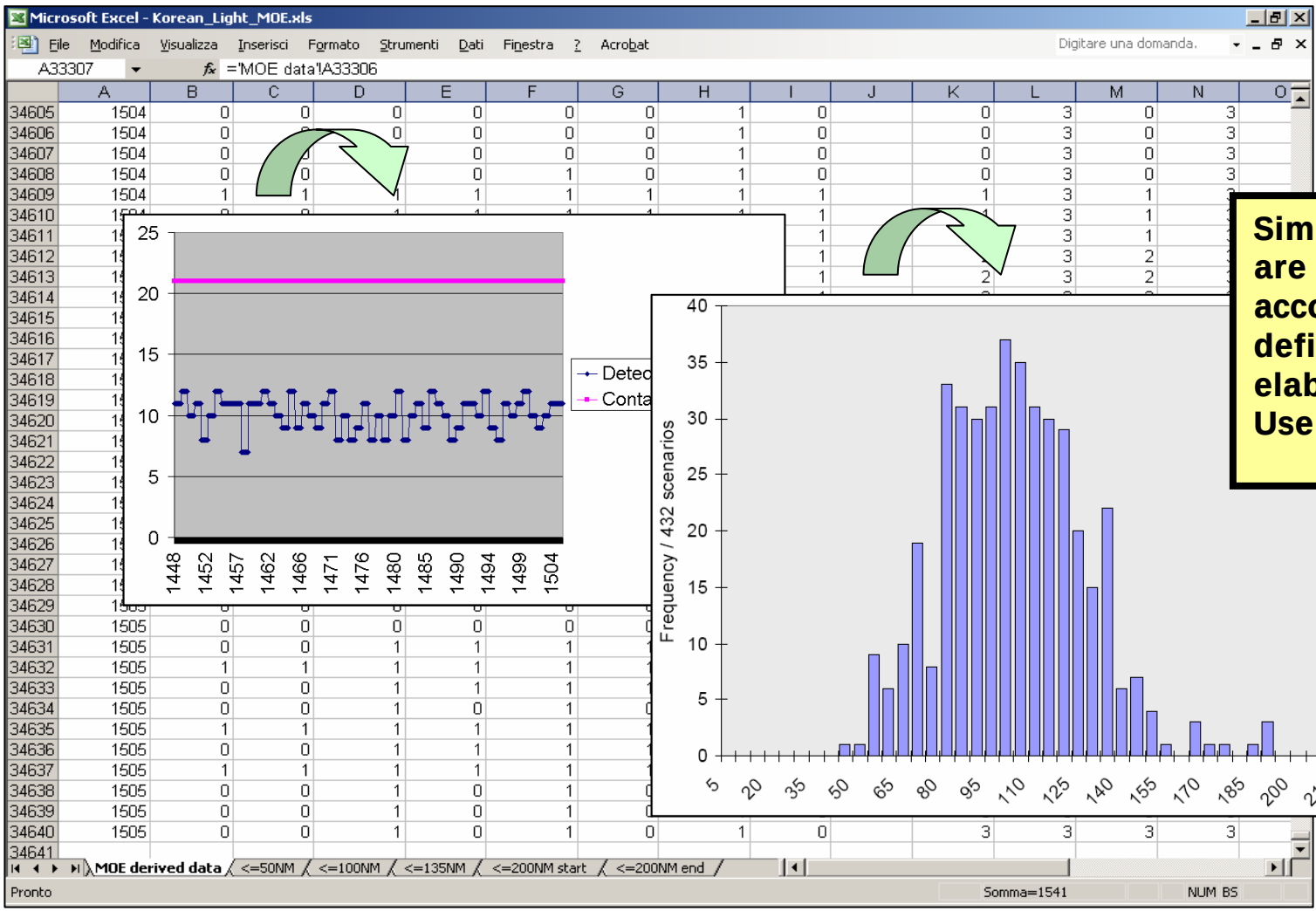
Perform Logistics Engineering



OUTPUT: The outputs can be shown in various formats, here is the subsystems availability results in graphical format.

From the graph it can be seen that all systems were available at least 99% of the time or more.

Send simulation results to systems engineer

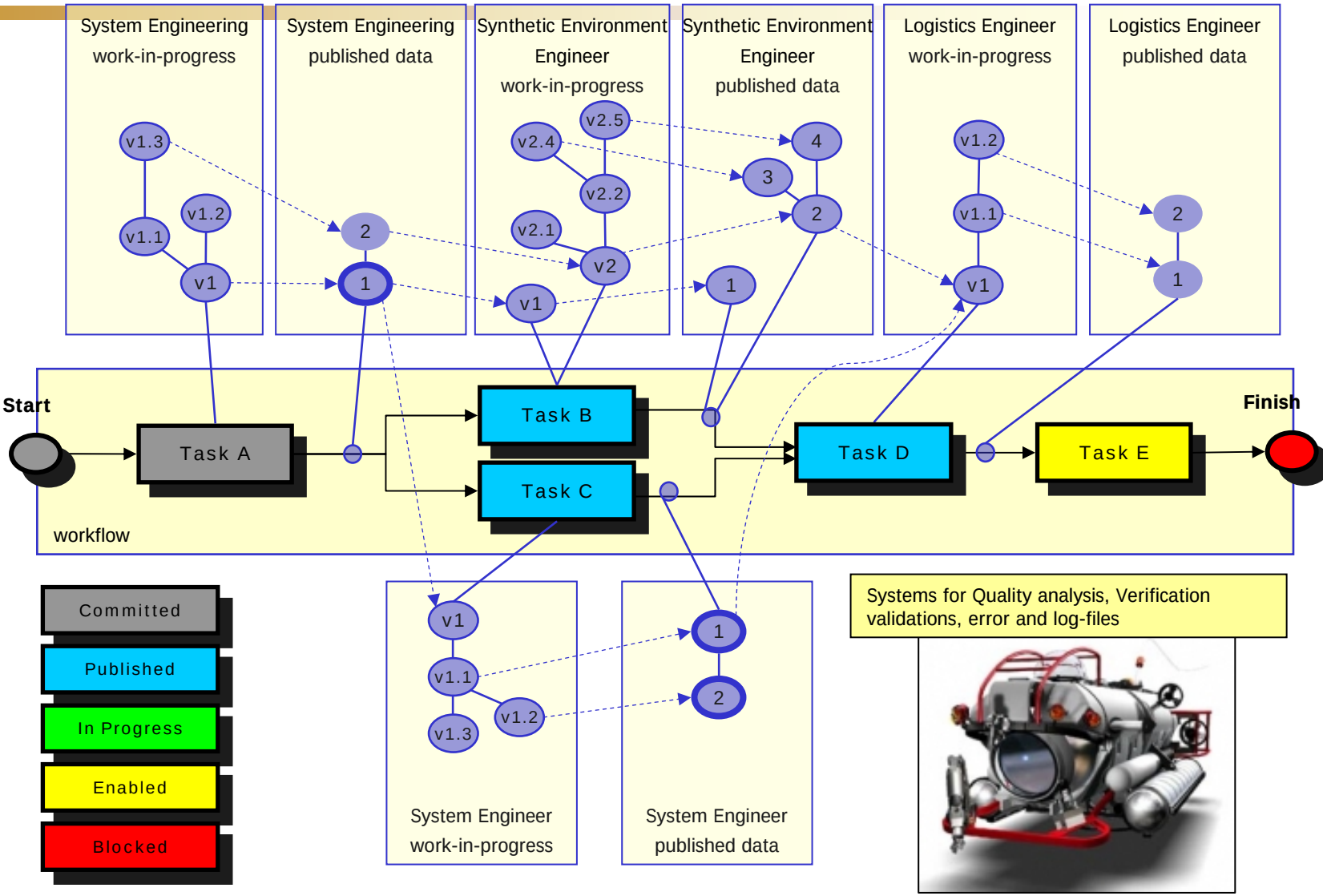


Simulation results are aggregated according to MOE definition and elaborated for User review.

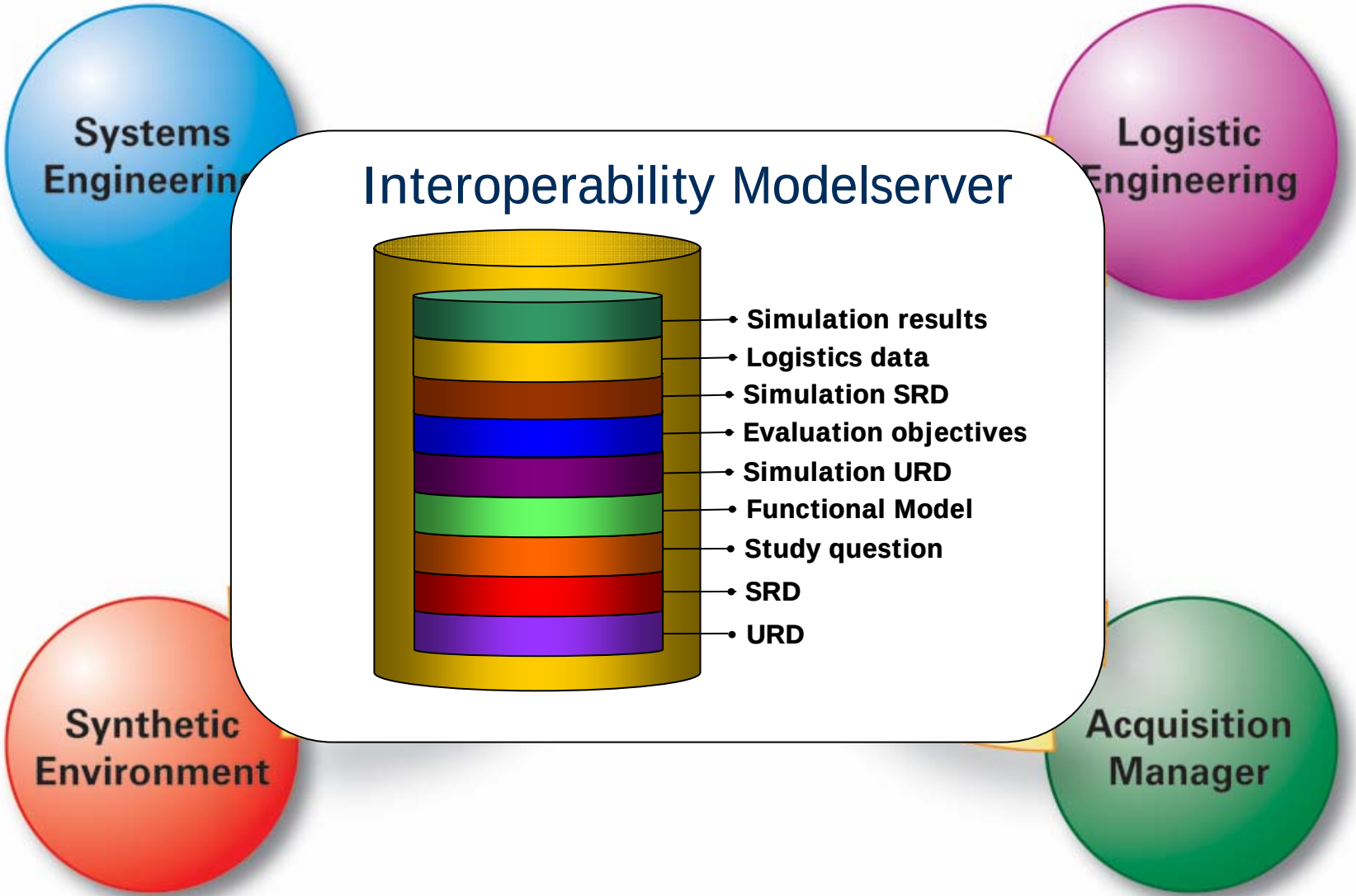
Review results

- full title
  - review results & assess consequences of answer to study question
- who
  - systems engineer

SIMBASE Data Management



SIMBASE Repository



Lessons learned

- challenges for coherence
  - common terminology
  - configuration management
  - multiple views
    - URD
    - SRD
    - functional
    - system
    - different models
- implementation requirements
  - role for additional standards
    - STEP
      - e.g. geometry, systems engineering
    - non-STEP
      - e.g. UML, SysML, NAF/MODAF

Conclusions

- Systems engineering and logistic engineering direct contribution to synthetic environment definition
- Implemented interfaces to/from ISO 10303-239 for synthetic environment COTS applications
  - simulation model configuration with data exported from SIMBASE repository

Conclusions

- model-based architecture
- standards-based
- linking legacy systems
- providing the integrated data view
- improving information quality
- enabling workflow support
- here applied to SBA, but not limited to this

Thank you!