SysEng 6542
Model Based Systems Engineering

MBSE Example: Residential Security System

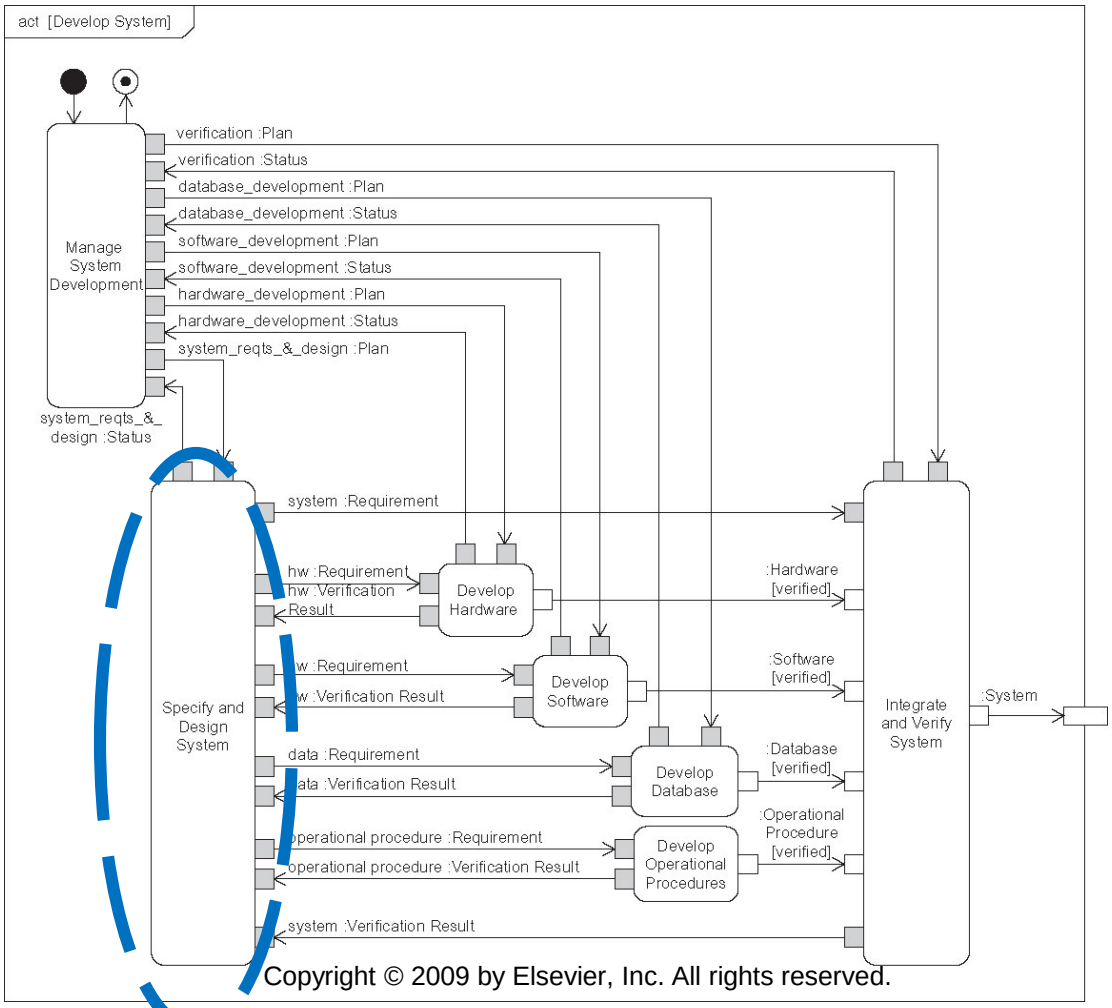
Dr Quoc Do

Overview

- Object-Oriented Systems Engineering Methodology
  - System Development Process
  - System Specification and Design Process
- Example: Residential Security System

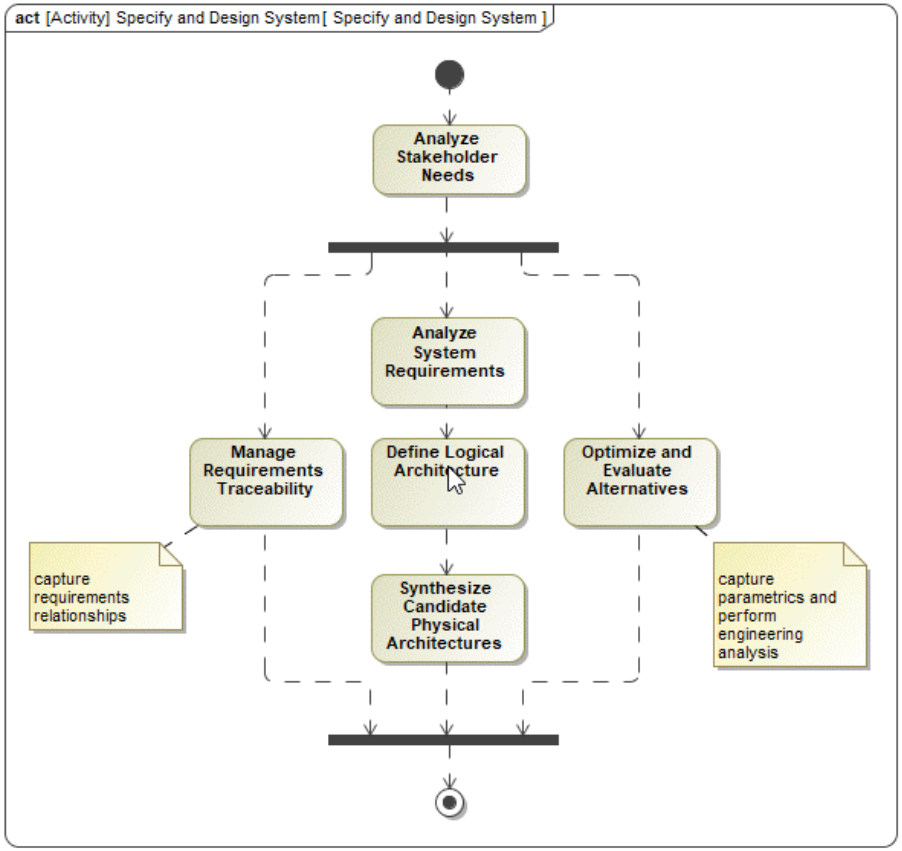
Object-Oriented Systems Engineering Methodology (OOSEM)

- Systems Development Process overview
- Based on the Integrated Systems and Software Engineering Process (ISSEP)



OOSEM

- System Specification and Design Process



Example Project: Residential Security System

Context and Problem

- Security Systems Inc. has been providing security systems for a local area for years.
- Security systems are installed at local residences and are monitored at a Central Monitoring Station (CMS).
- Upon an intruder, operators at the CMS contact local emergency unit to dispatch police to intercept the intruder.
- Due to emerging competitors in the last few years, the company has decided to develop an Enhanced Security System (ESS) in order to remain competitive and regain market domination.
- A Systems Engineering Integrated Team (SEIT) is responsible for the definition, specification, design, development, verification and validation of the ESS.

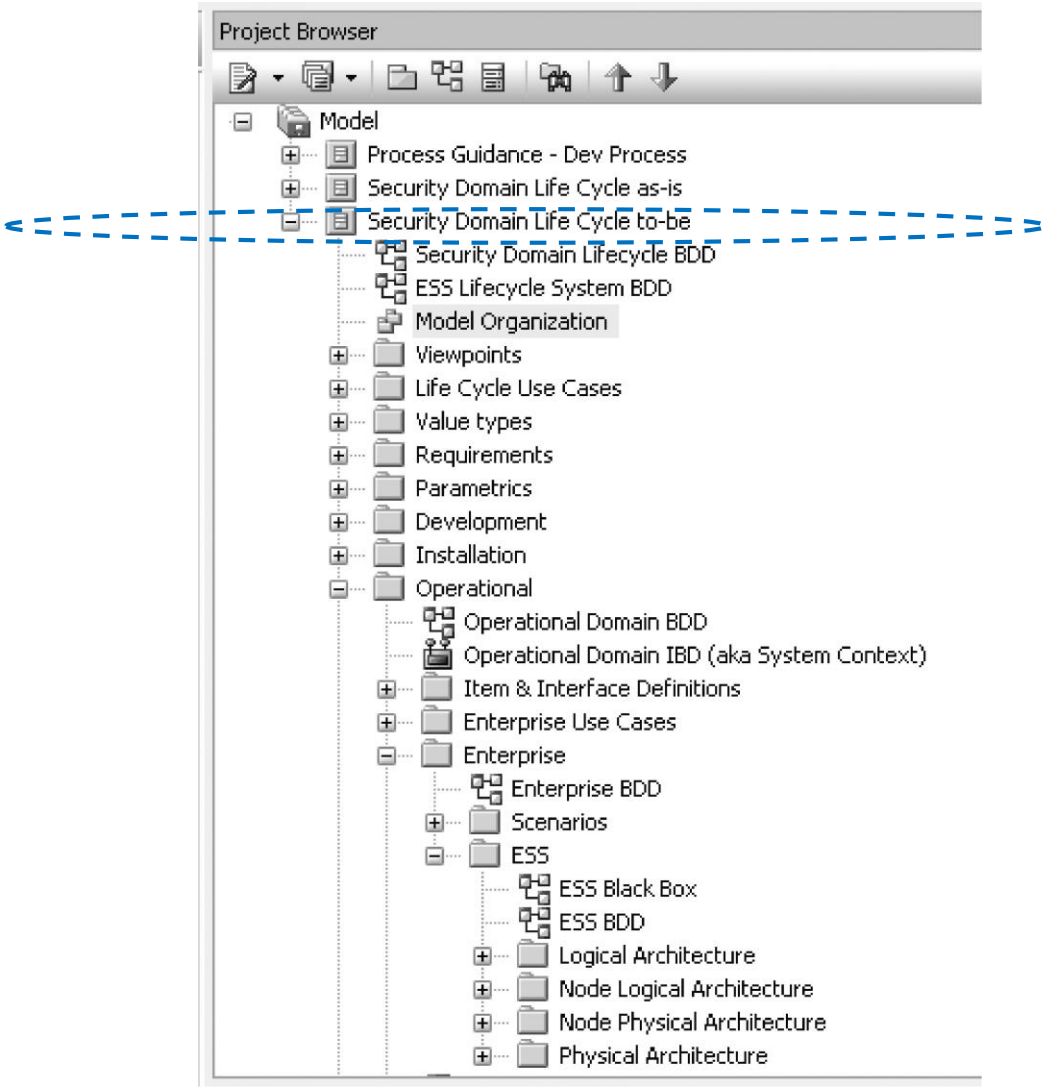
ESS - SEIT

- Project Plan:
  - Define the project scope
  - Define the modelling objectives
  - Define the scope of the model
  - Develop a Work Breakdown Structure (WBS)
  - Technical Approach
    - Select and tailor method and modelling convention
    - Select modelling language and acquire tools
  - Schedule modelling activities
  - Establish a Project Team structure
  - Provide training as necessary
  - Set milestones and deliverables
  - Identify risks, issues and opportunity
  - Commercial

ESS - SEIT

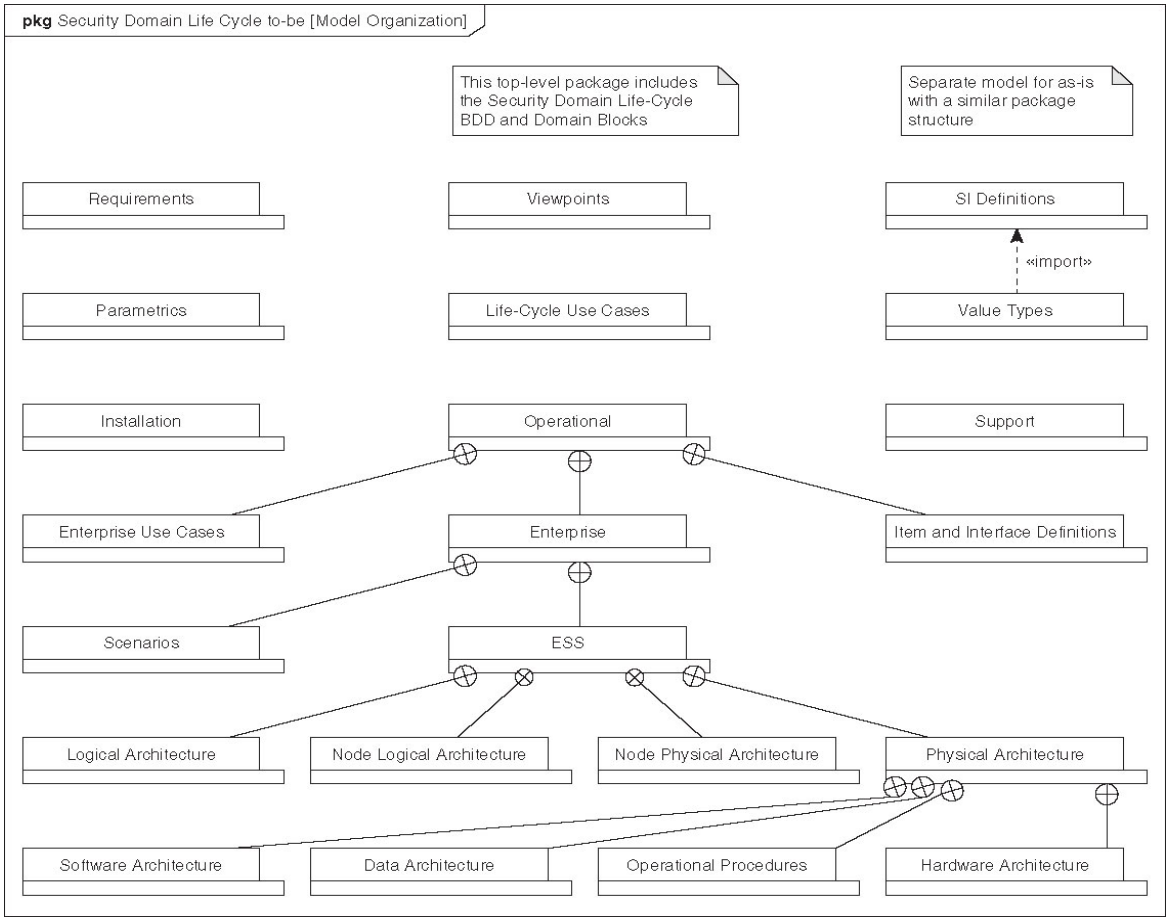
- Selected OOSEM
- Language – Selected SysML
- Tool – Selected Cameo Systems Modeller
- Modelling Convention and Standards:
  - Ensure consistent of SysML representation and style across the model
- Naming convention on model elements:
  - Use of uppercase first letter for each word for naming all definition/types: blocks, requirements etc…
  - Use all lowercase letter for parts, properties, actions, and states.
  - Verb forms for behavior elements (i.e. activities, actions, use cases)
  - Noun forms for physical elements (i.e. blocks)
  - Pin Names on Act diagram - *in:Type Name* and *out:Type Name* (i.e. “in:Alert Status” or “out: Dispatch Request”.
  - Flow Port names – start with fp
  - Standard Port Names – start with sp

ESS – Model Organisation

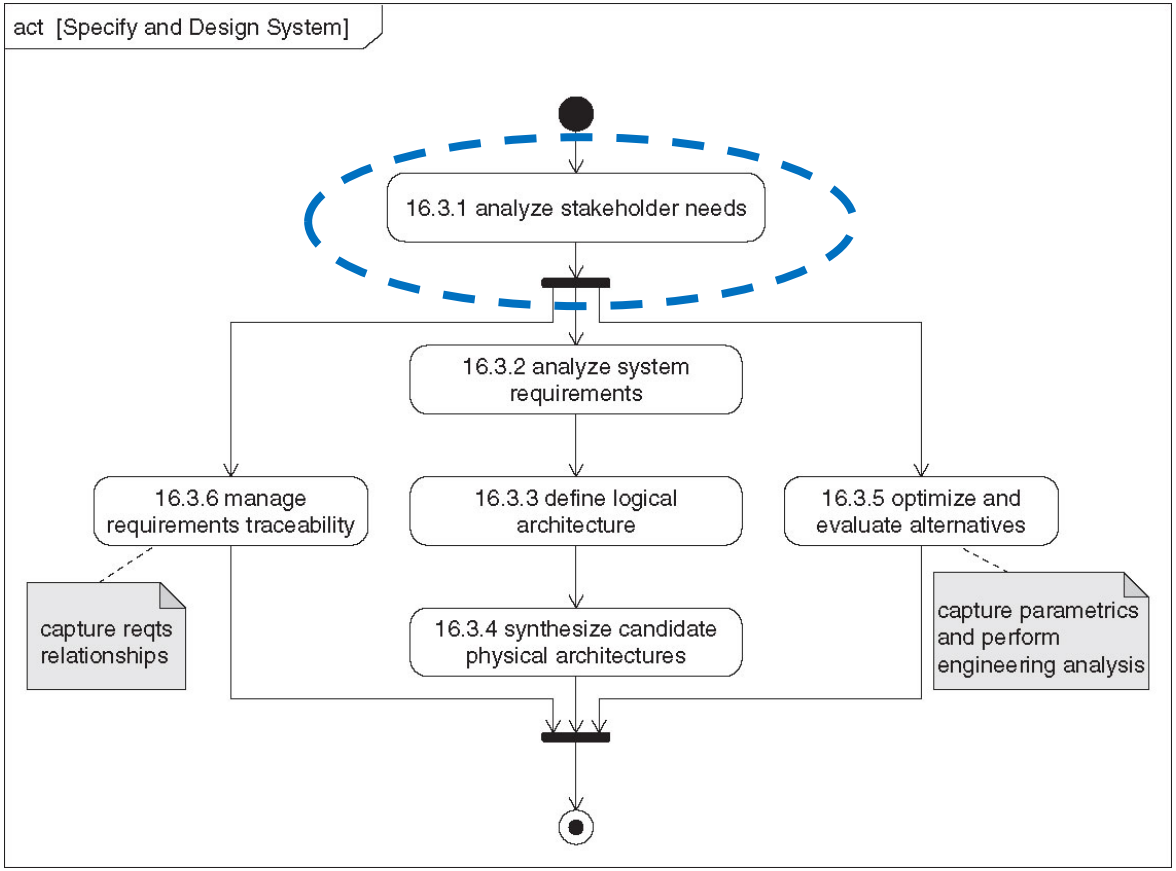


ESS – Model Organisation

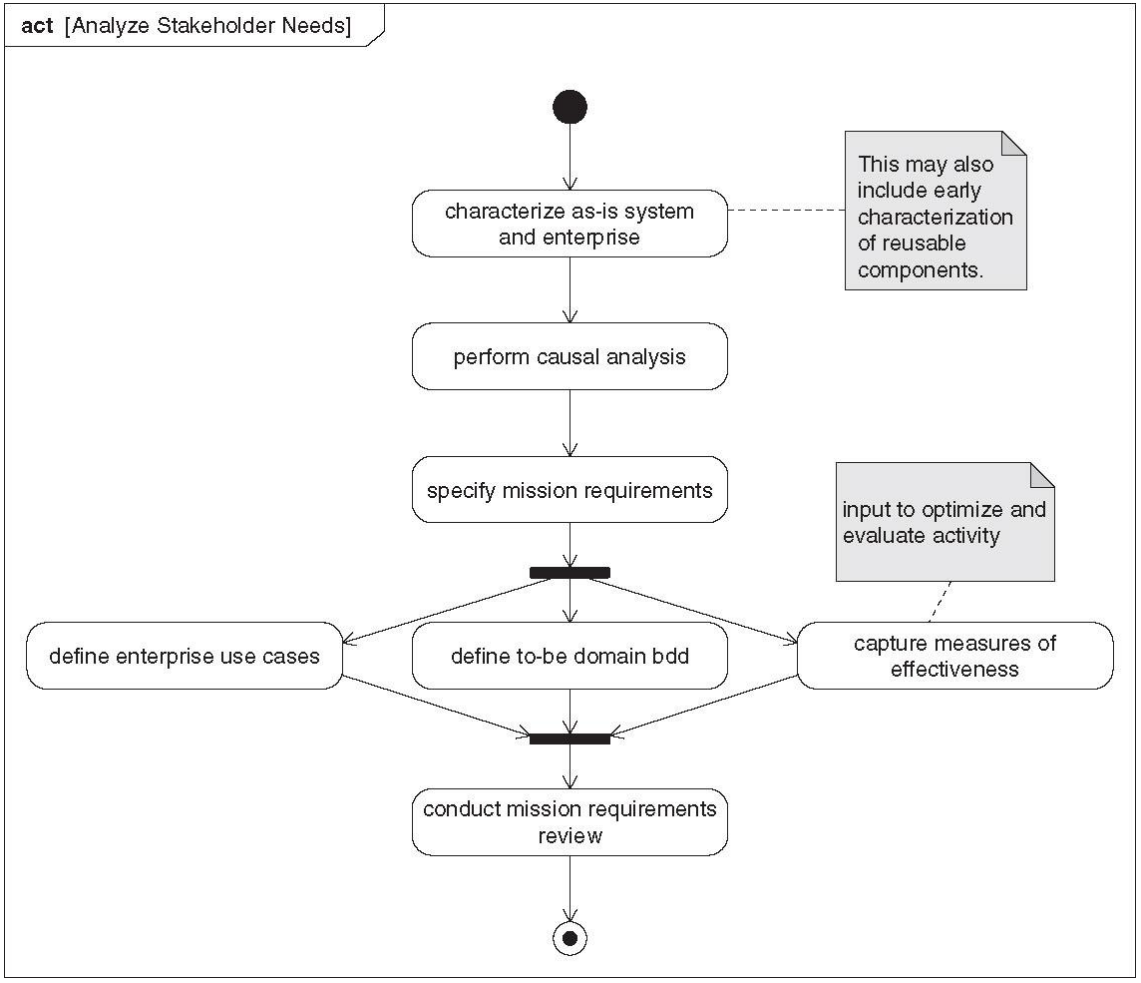
Security Domain Lifecyle "To-Be"



OOSSEM – Specification and Design of the ESS

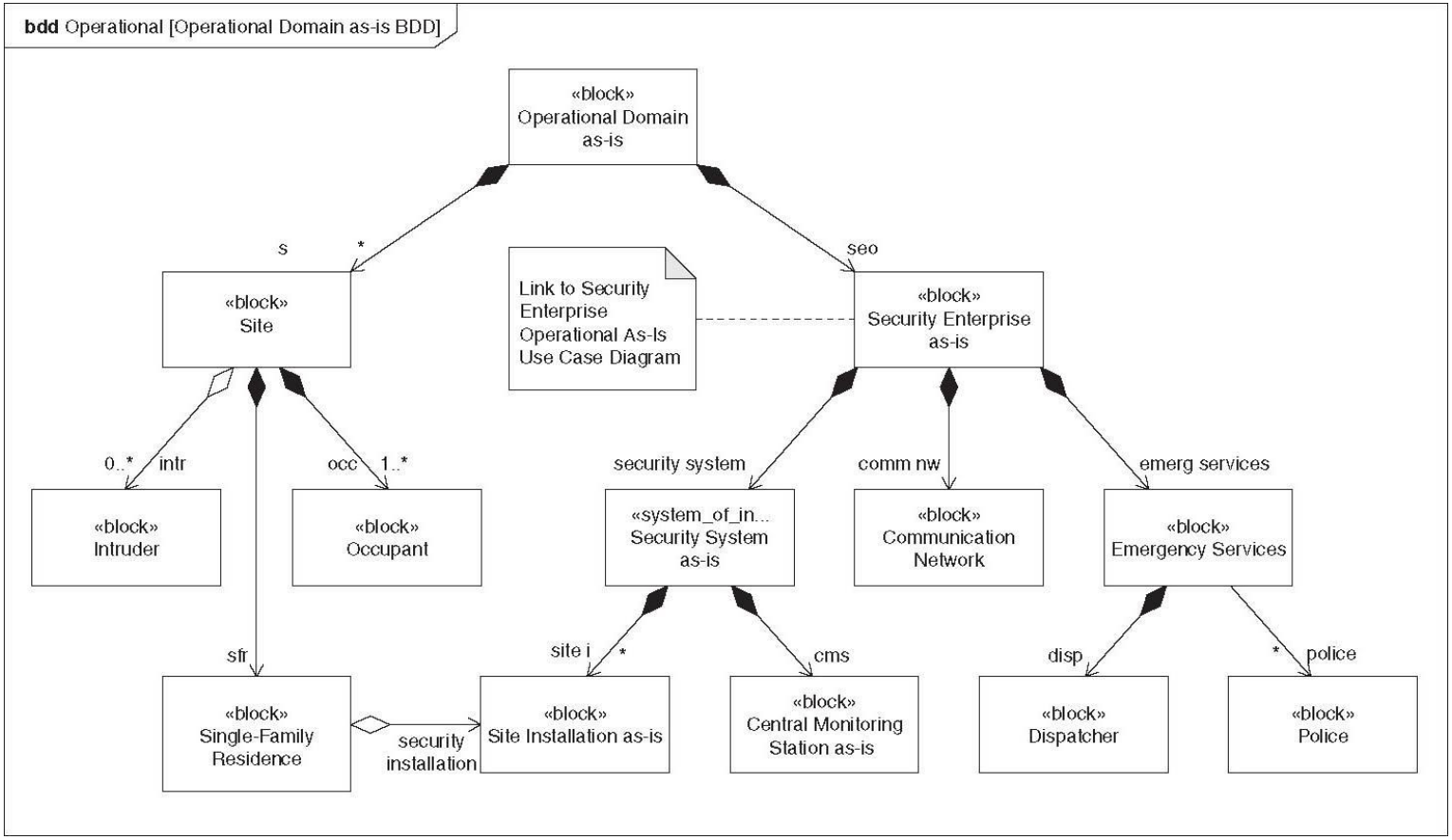


ESS System – Analyze Stakeholder Needs



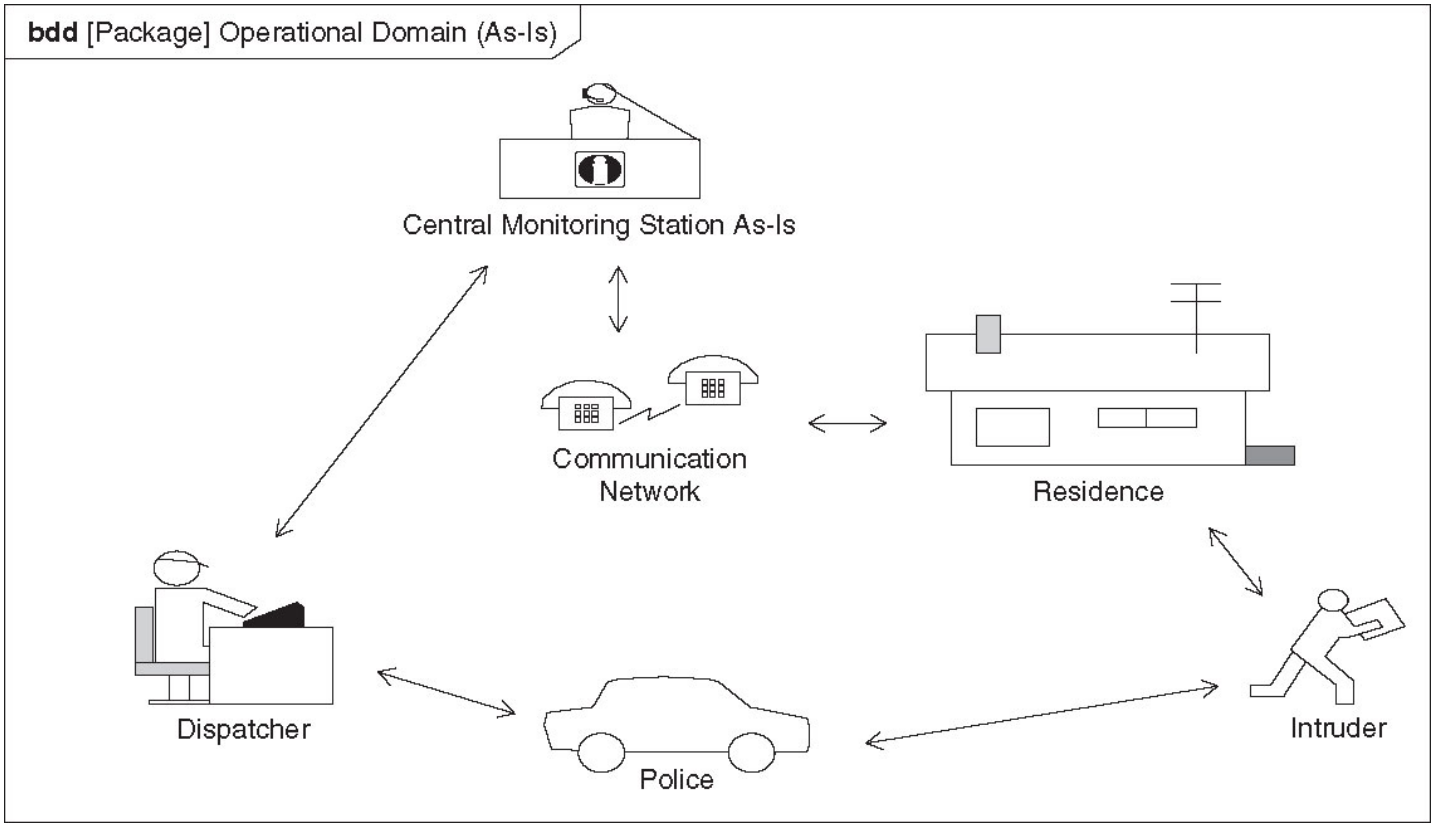
Analyze Stakeholder Needs

- Characterise the “As Is” System



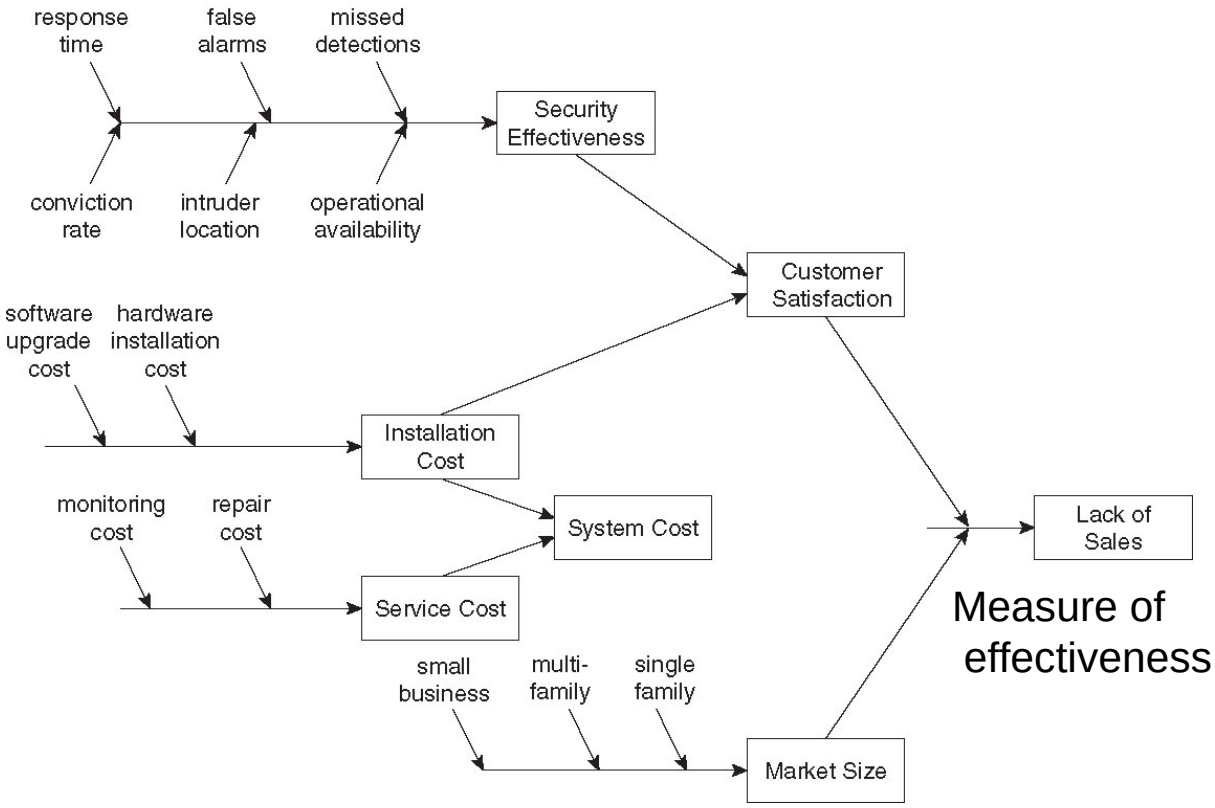
Analyze Stakeholder Needs

Characterise the "As Is" System



Analyze Stakeholder Needs

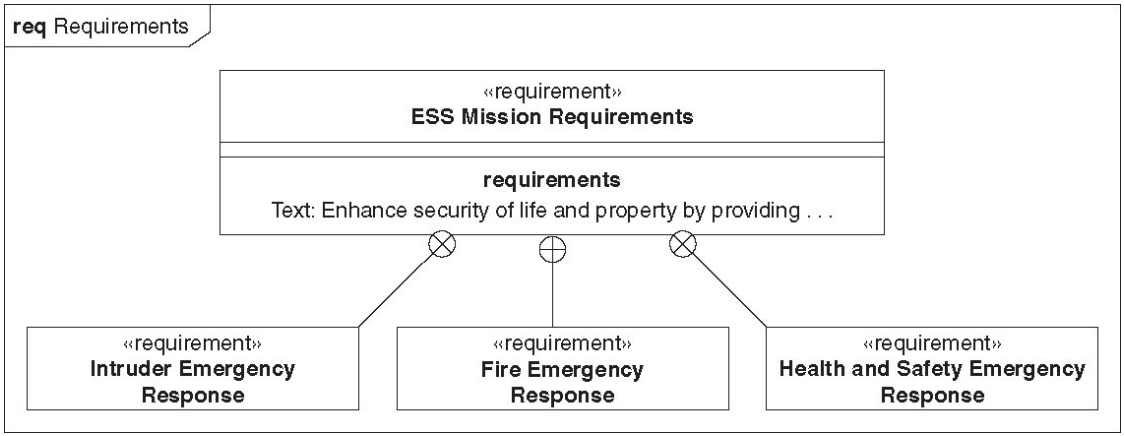
Perform Causal Analysis using a “fishbone” diagram

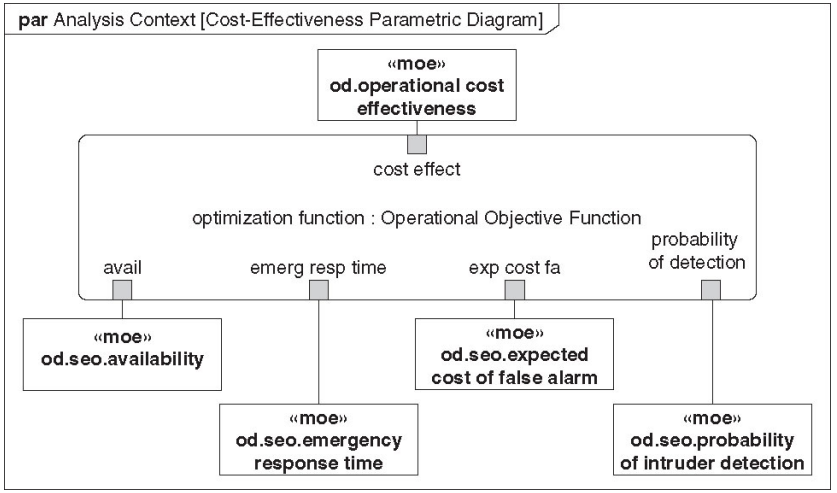


Measure of effectiveness (MoE)

Analyze Stakeholder Needs

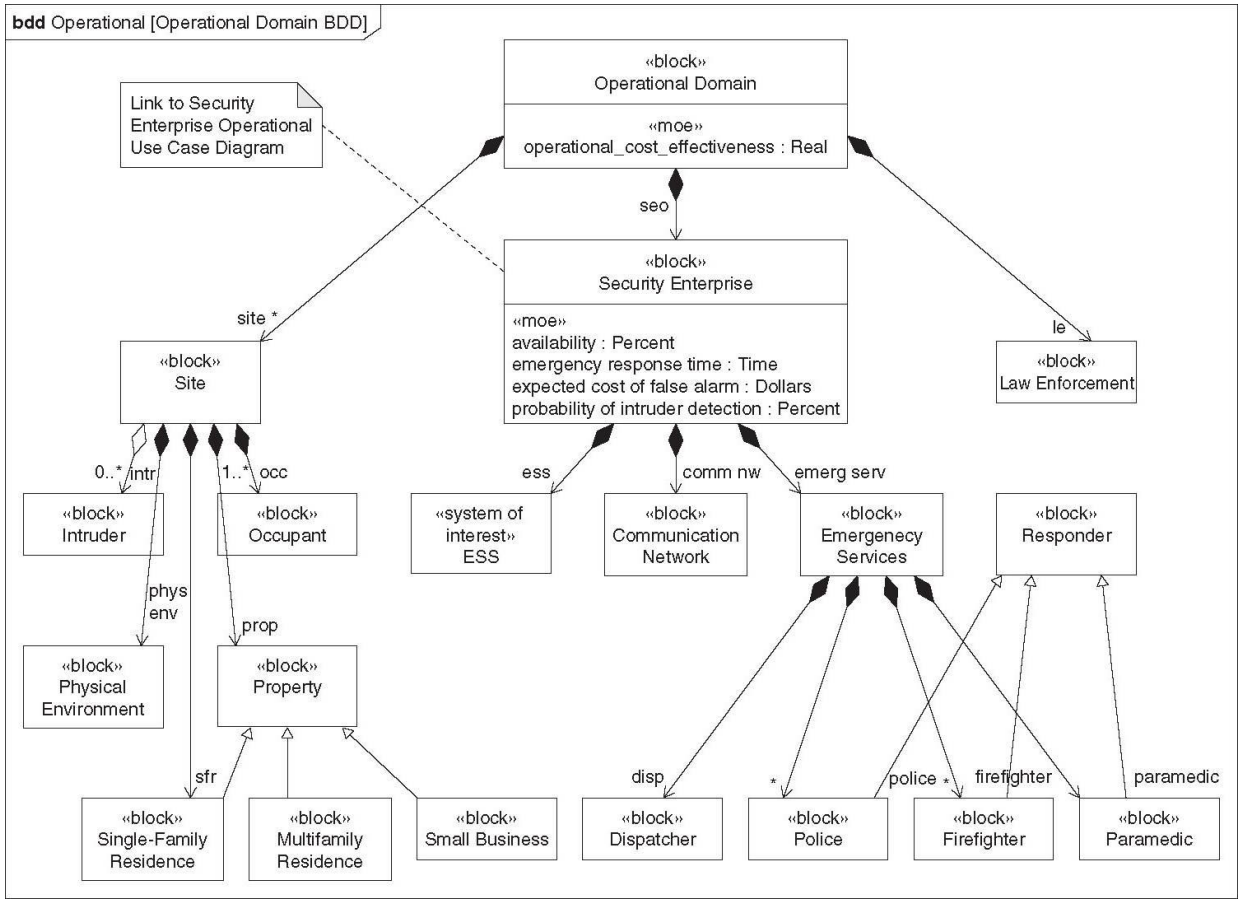
Specify Mission Requirements and MoEs





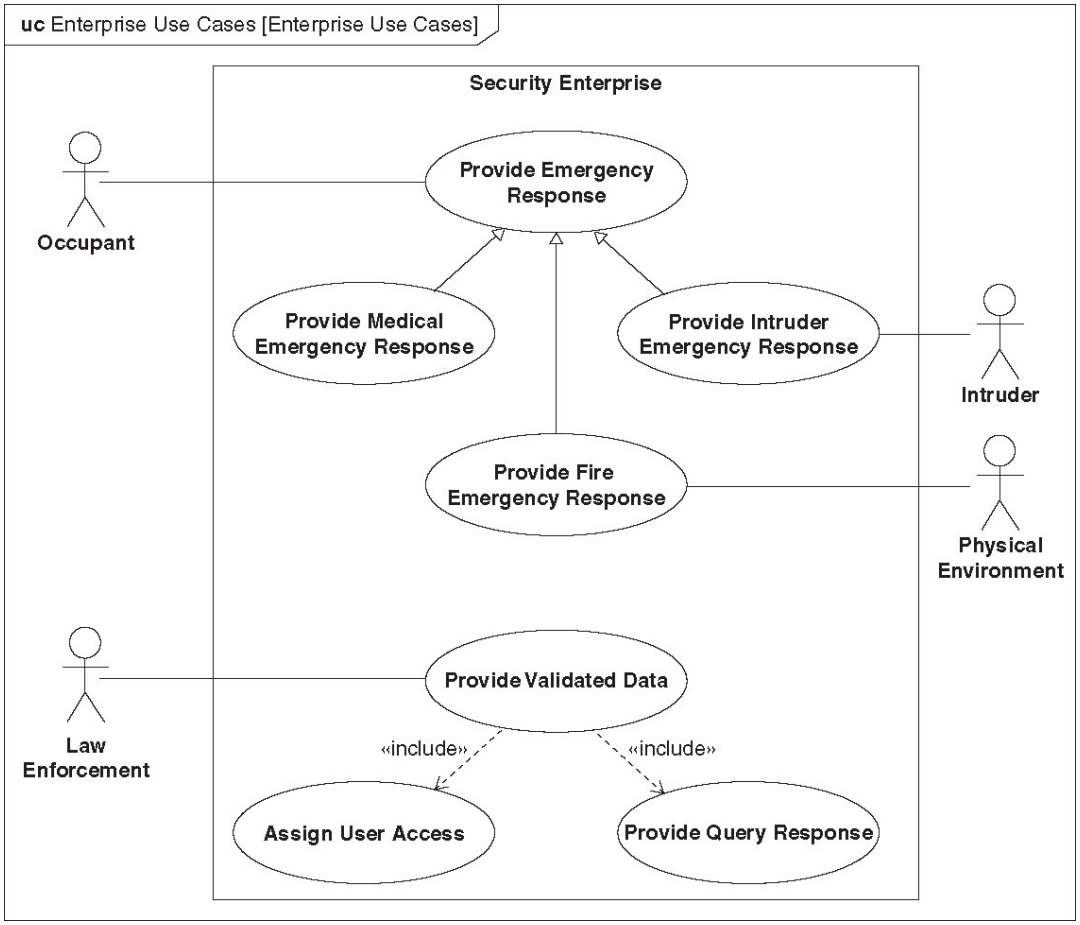
Analyze Stakeholder Needs

Define the "To Be" ESS Domain Model

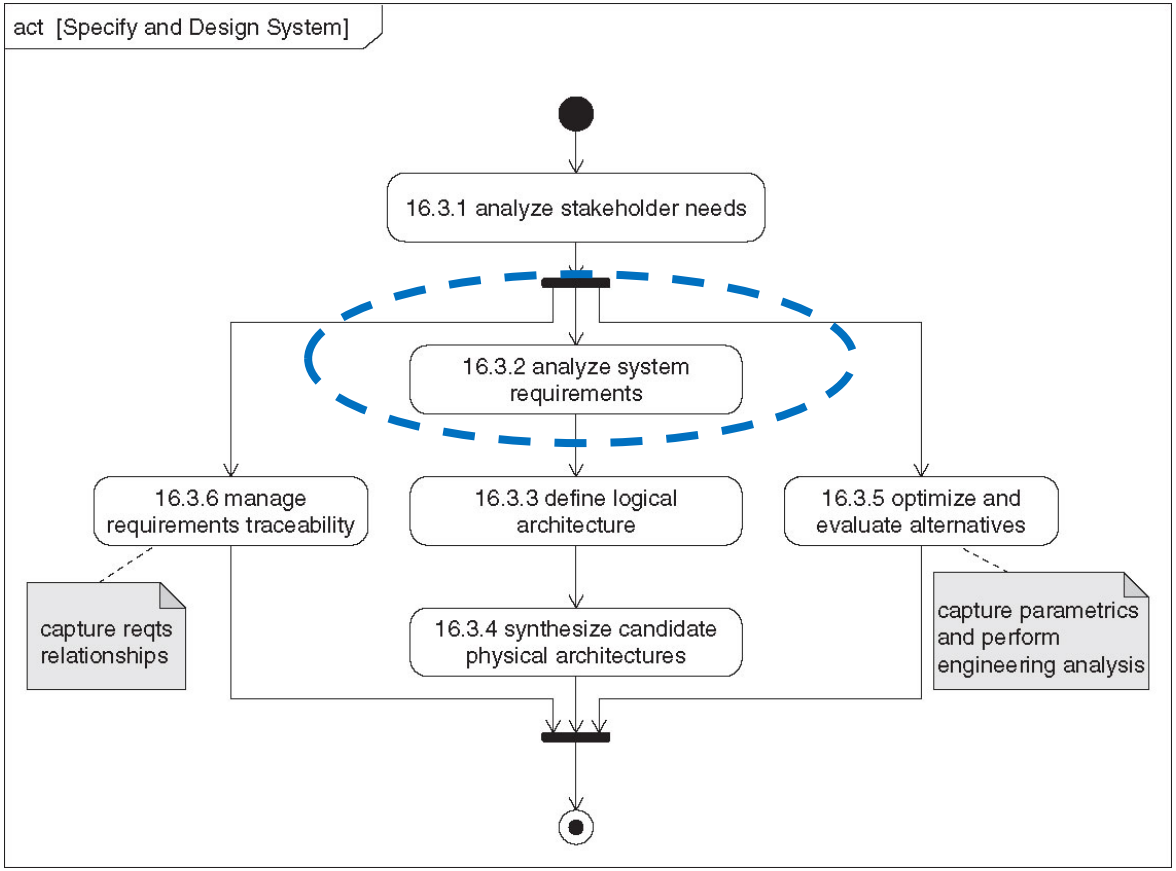


Analyze Stakeholder Needs

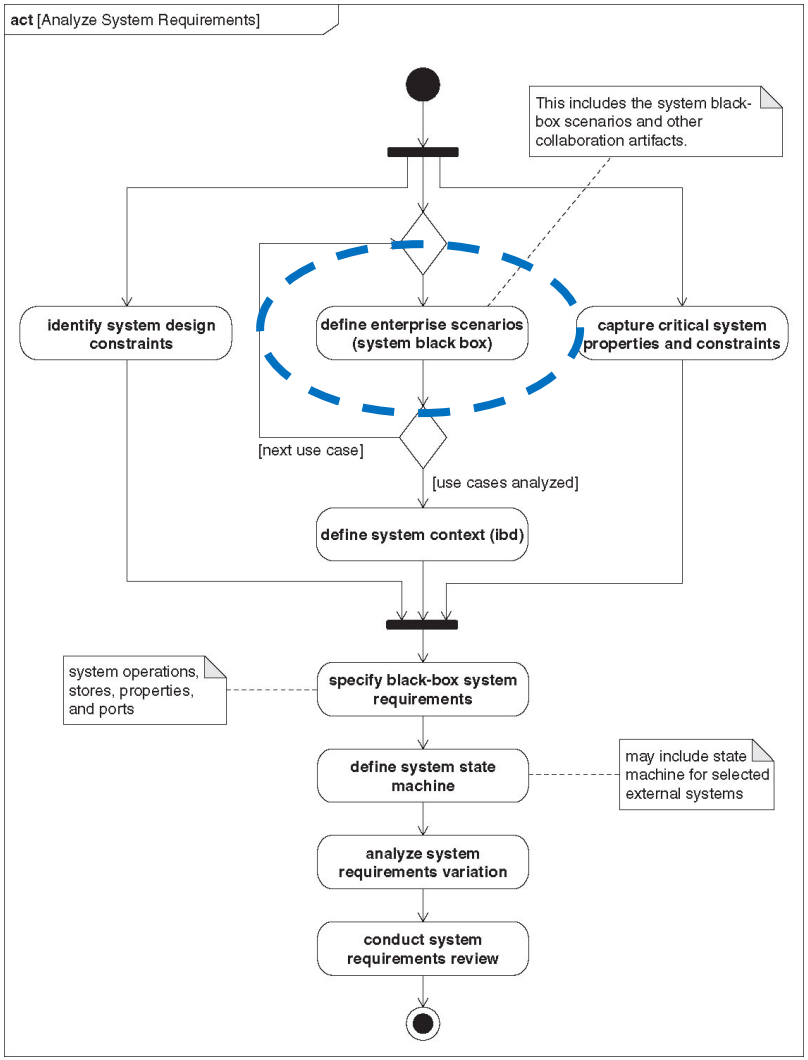
Define Enterprise Use Case



OOSSEM – Specification and Design of the ESS

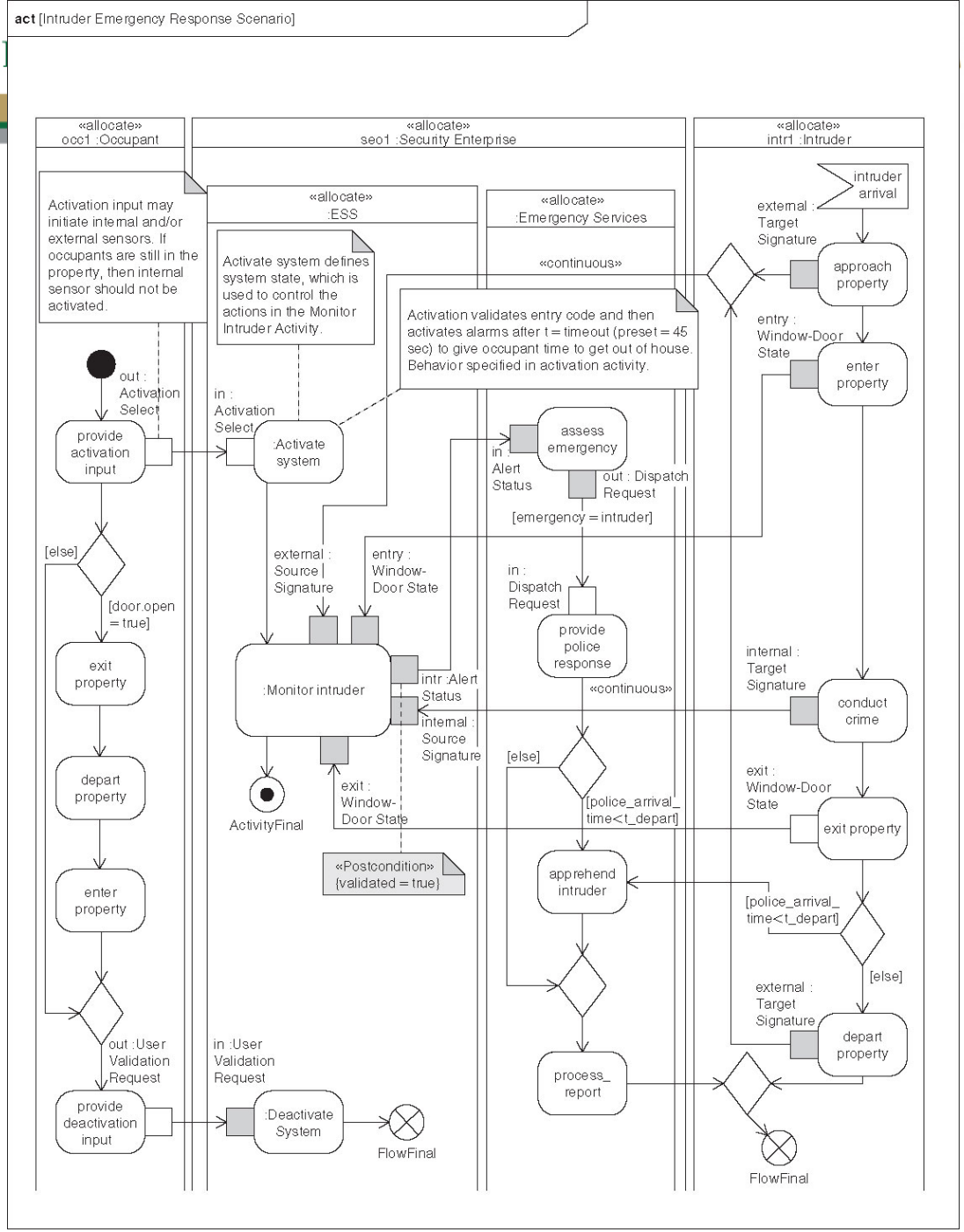


ESS – Analyze System Requirements



ESS – Analyze System Requirements

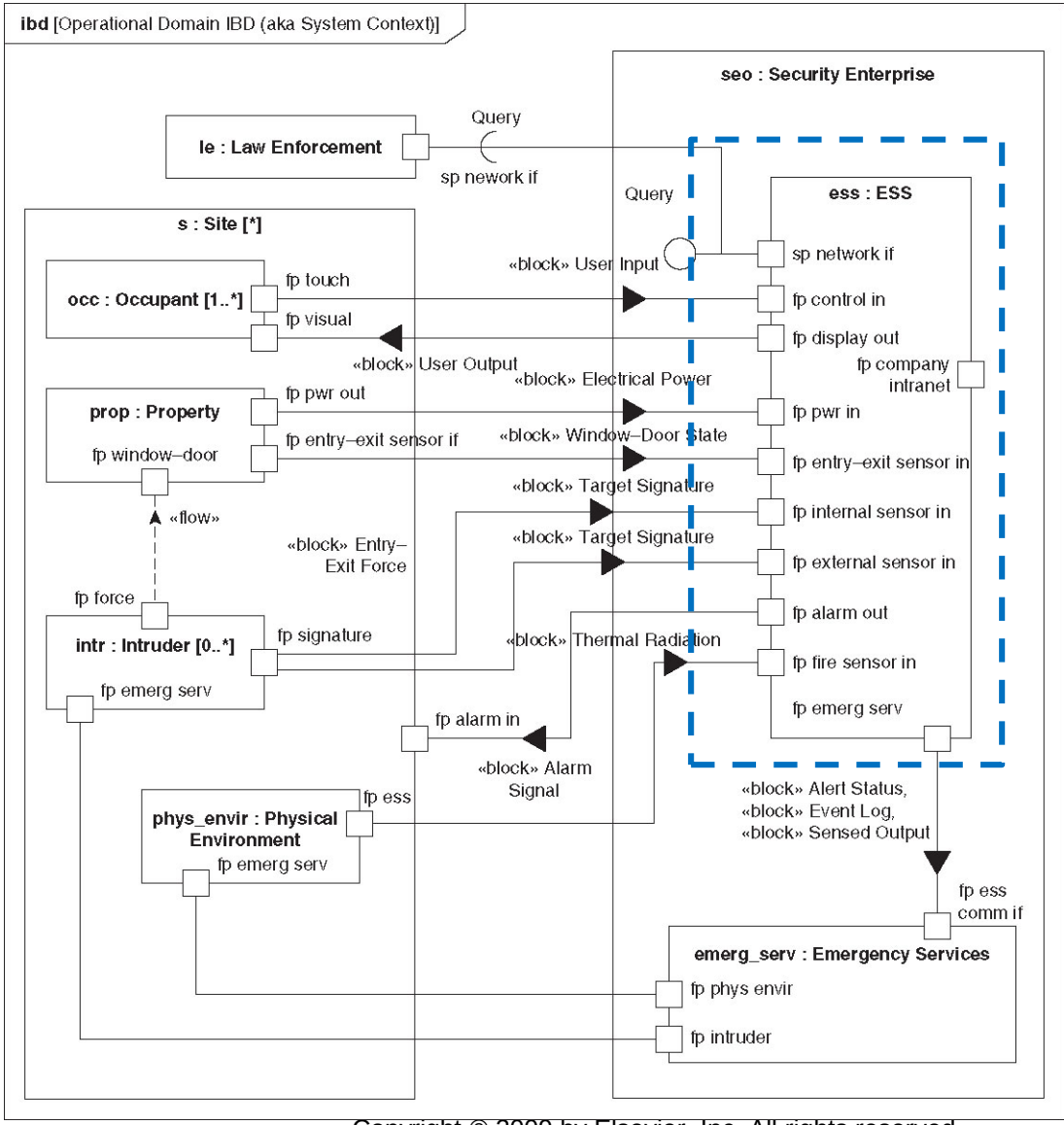
- Define Operation Scenarios



ESS – Analyze System Requirements

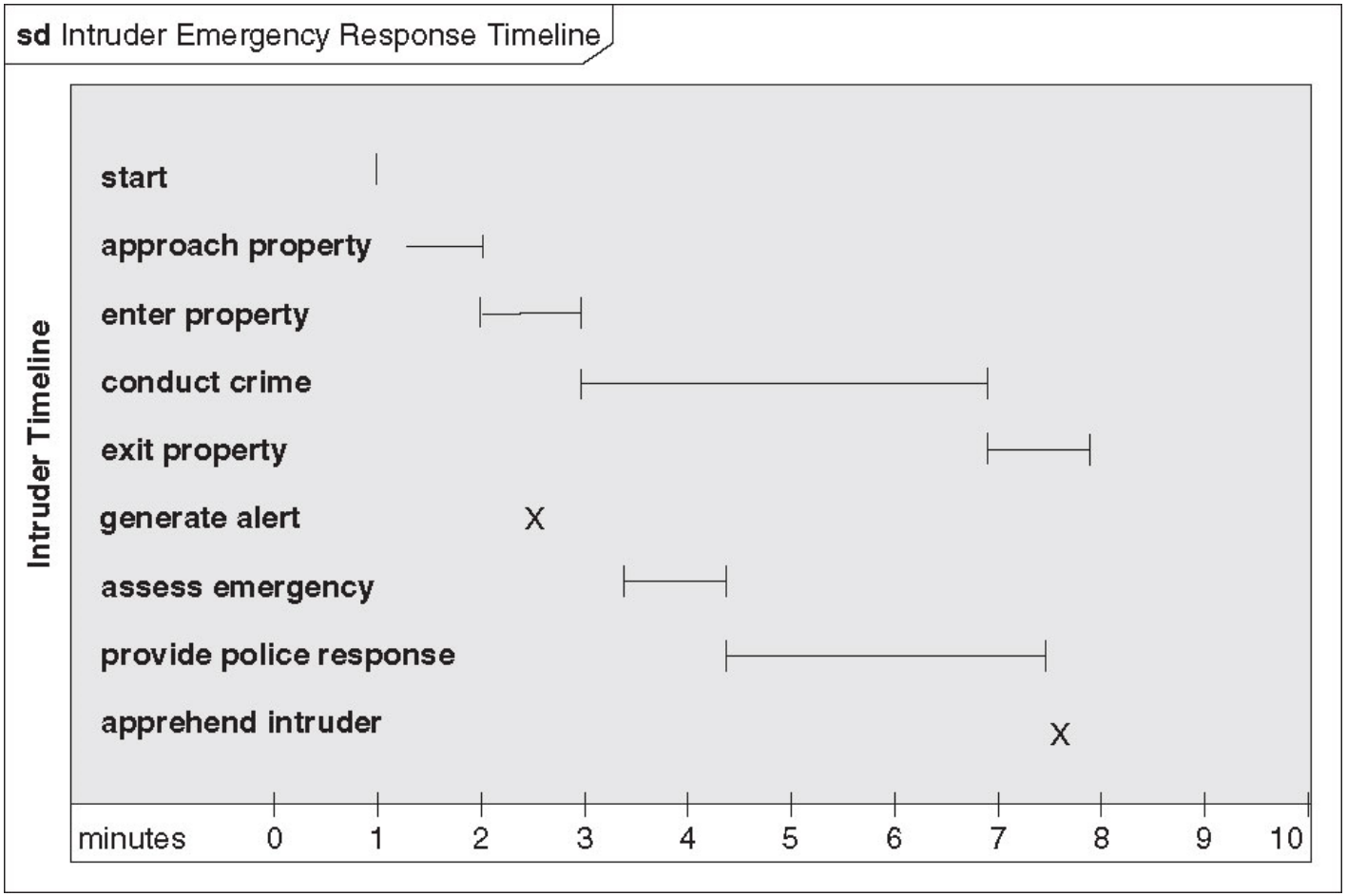
- Define System Context

(ESS and interfaces to external systems)



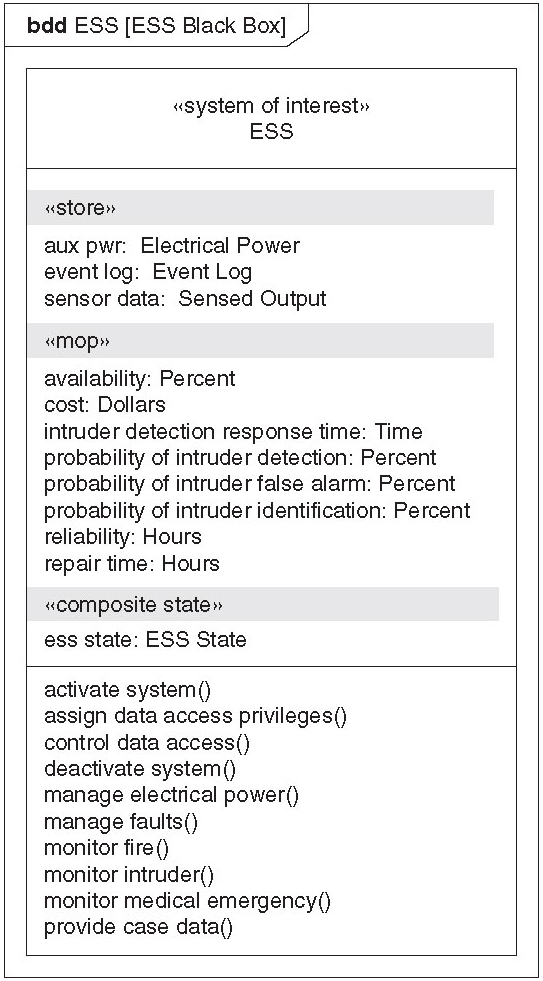
ESS – Analyze System Requirements

- Capture Critical System Properties and Constraints



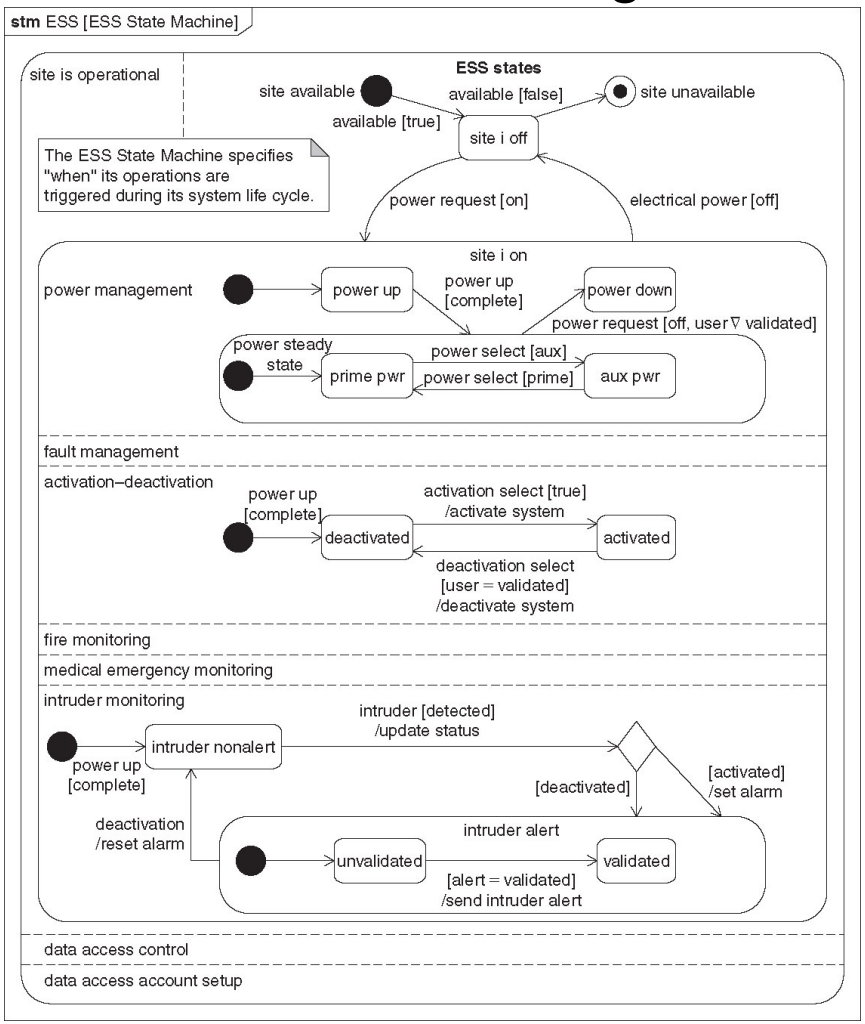
ESS – Analyze System Requirements

- Specify "Black-Box" Systems Requirements

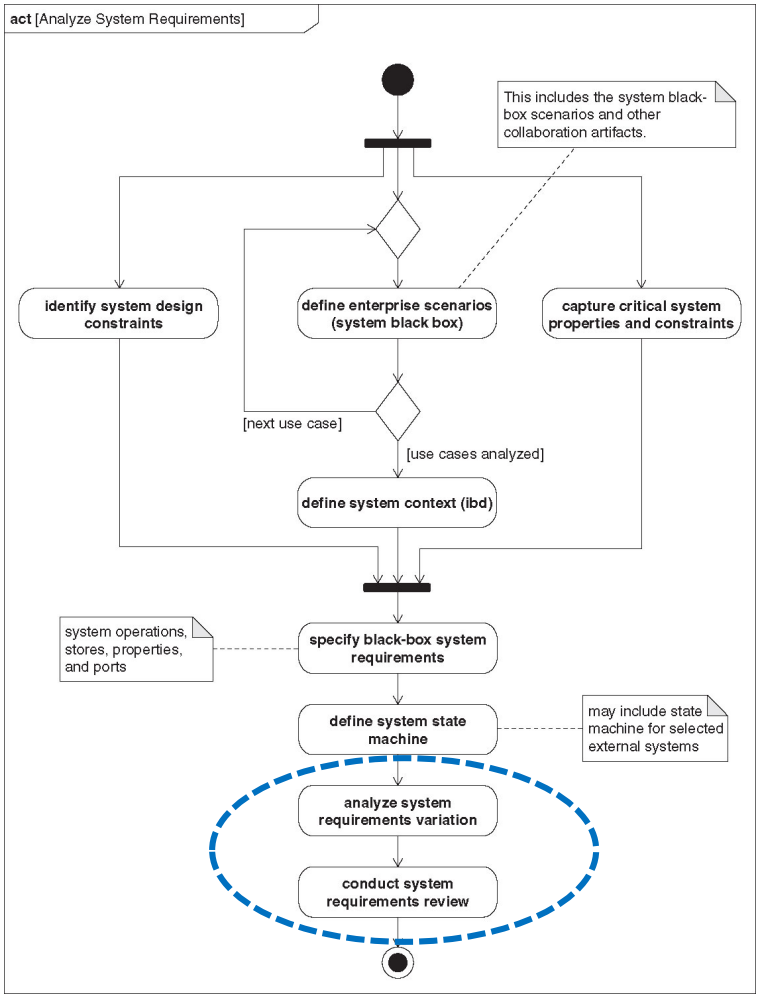


ESS – Analyze System Requirements

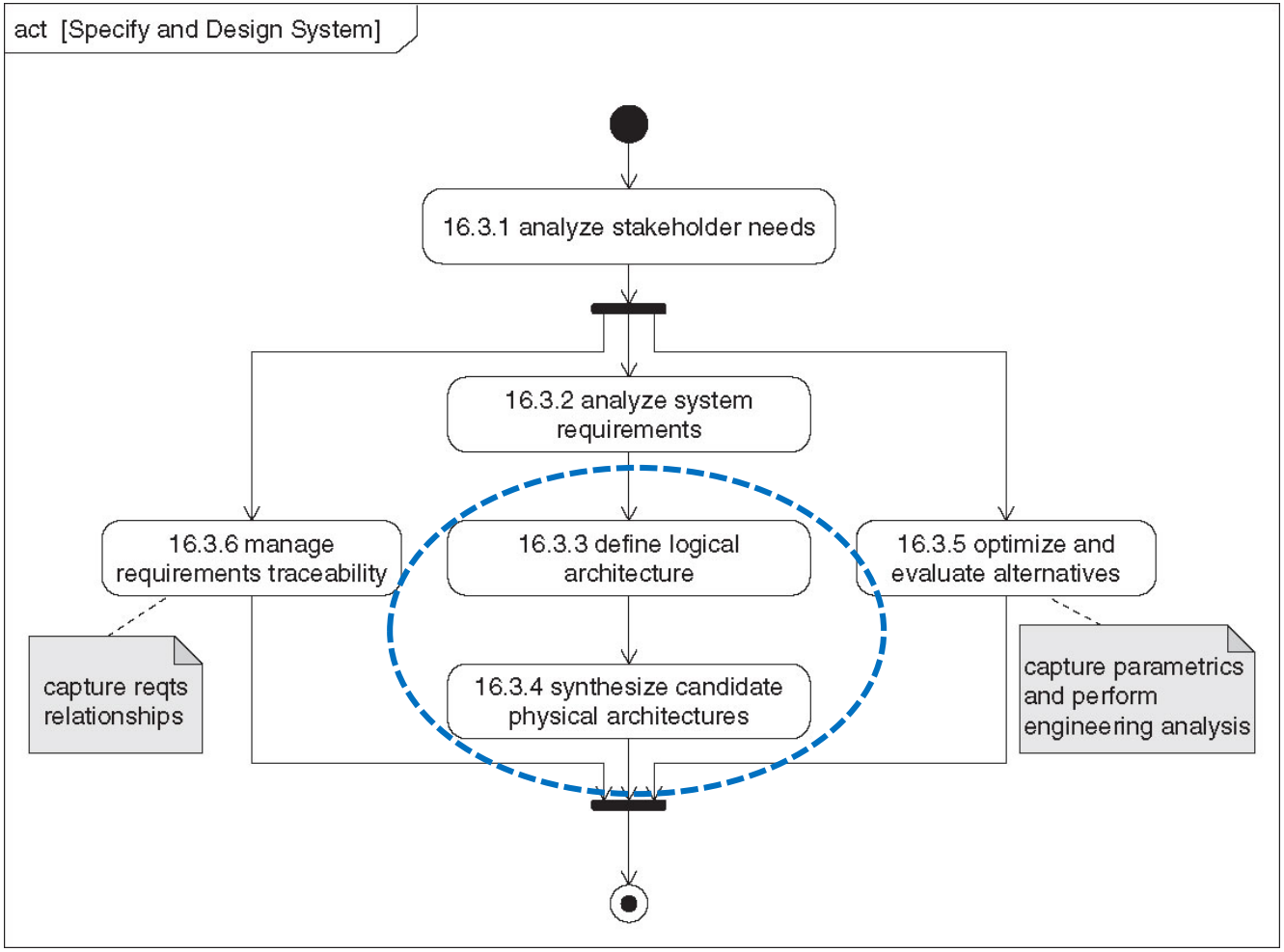
- Define ESS State Machine Diagram



ESS – Analyze System Requirements



Next Lecture
Specify and System Design Process



Program Completed

Missouri University of Science & Technology