

# SysEng 6542

## Model Based Systems Engineering

MBSE Example: Residential Security System

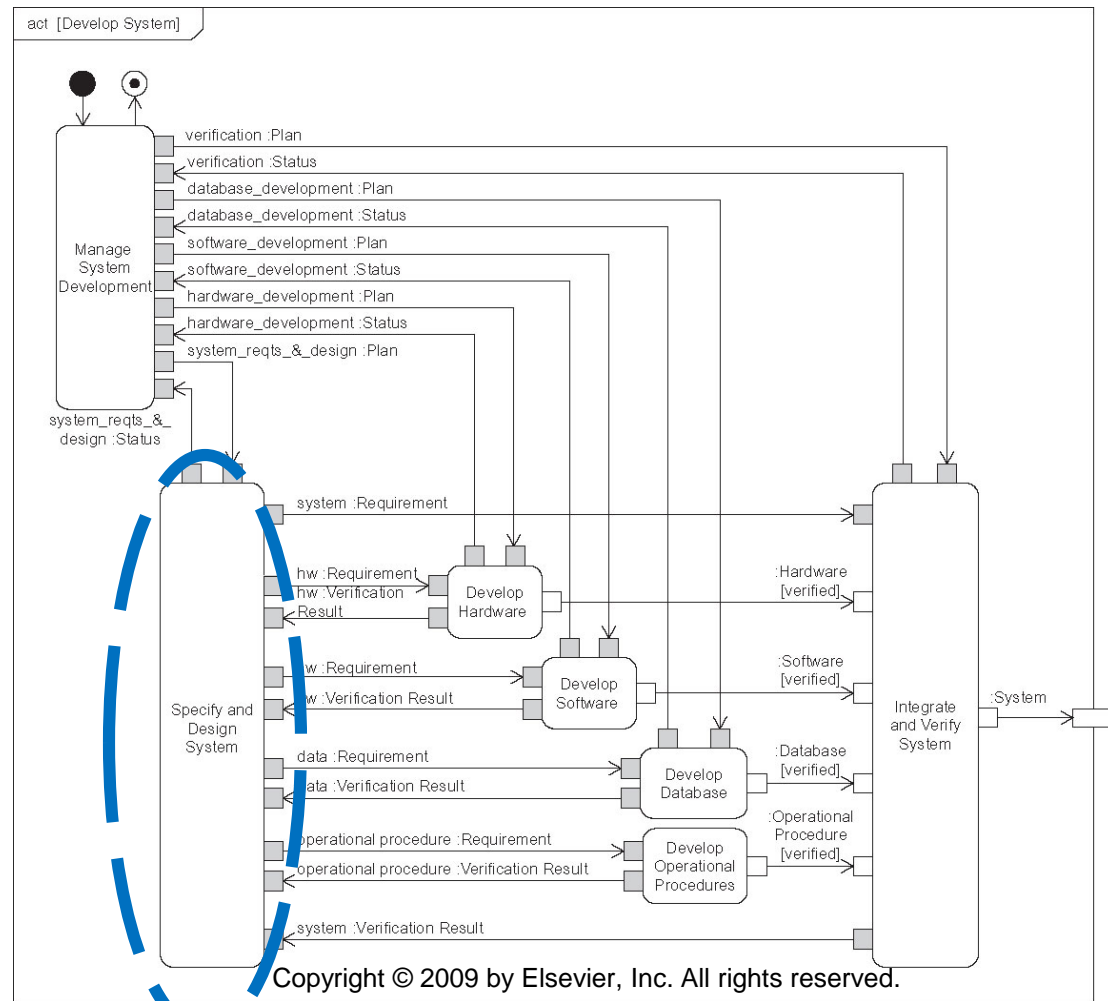
Dr Quoc Do

# Overview

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

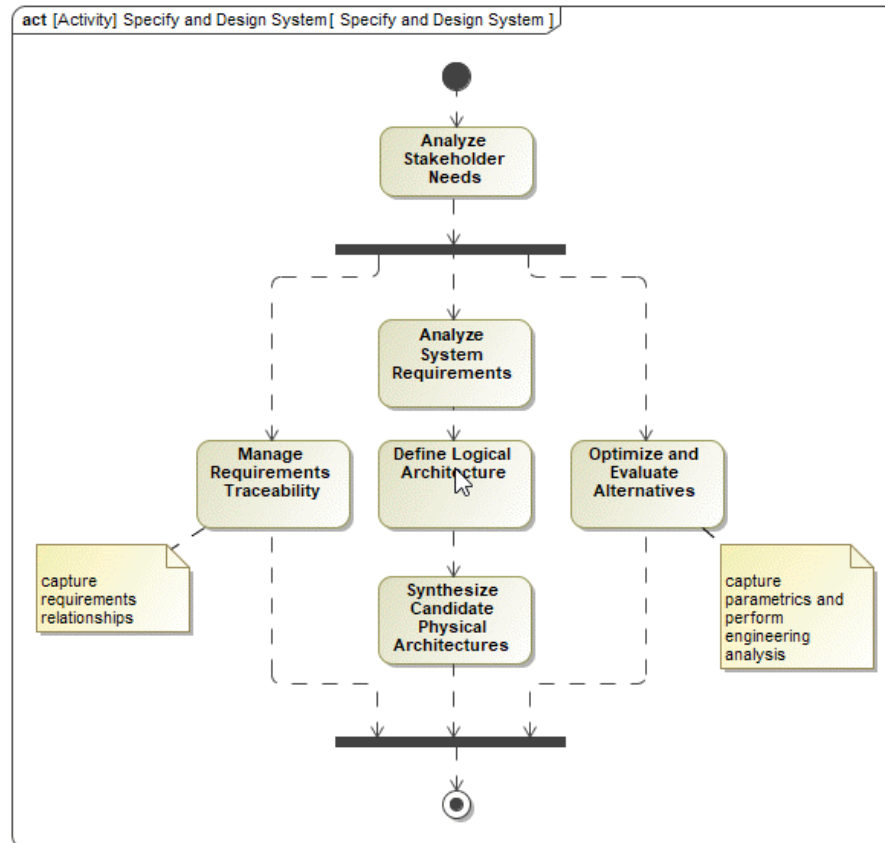
# Object-Oriented Systems Engineering Methodology (OOSEM)

- 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.

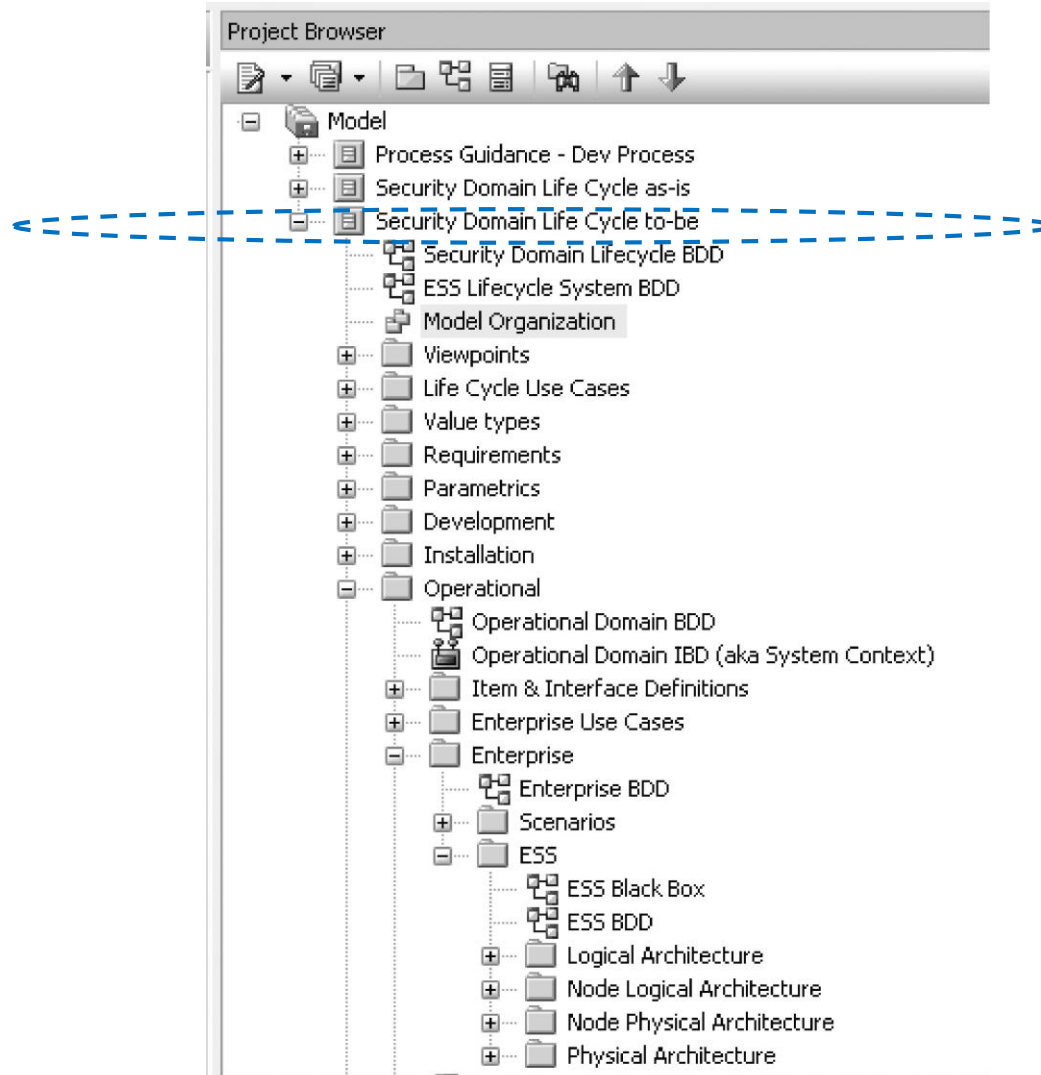
# ESS - SEIT

- 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

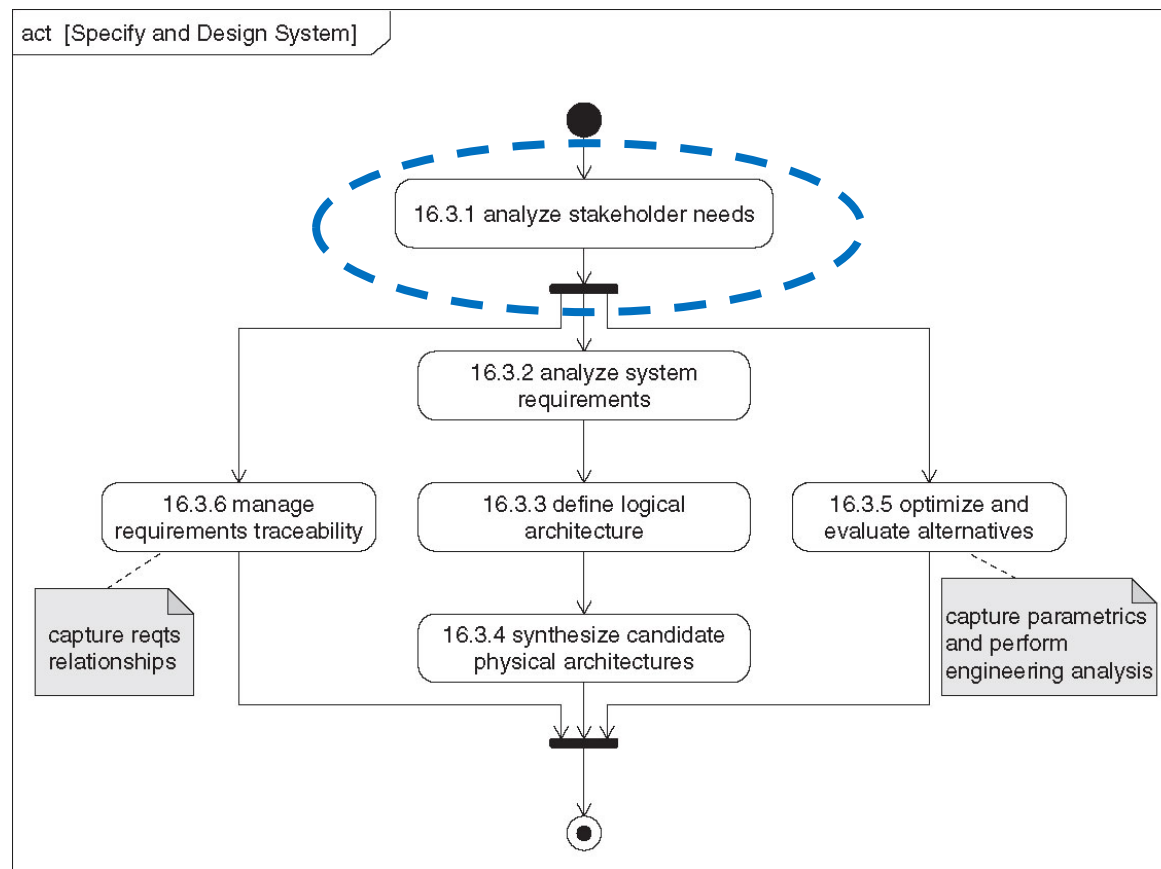




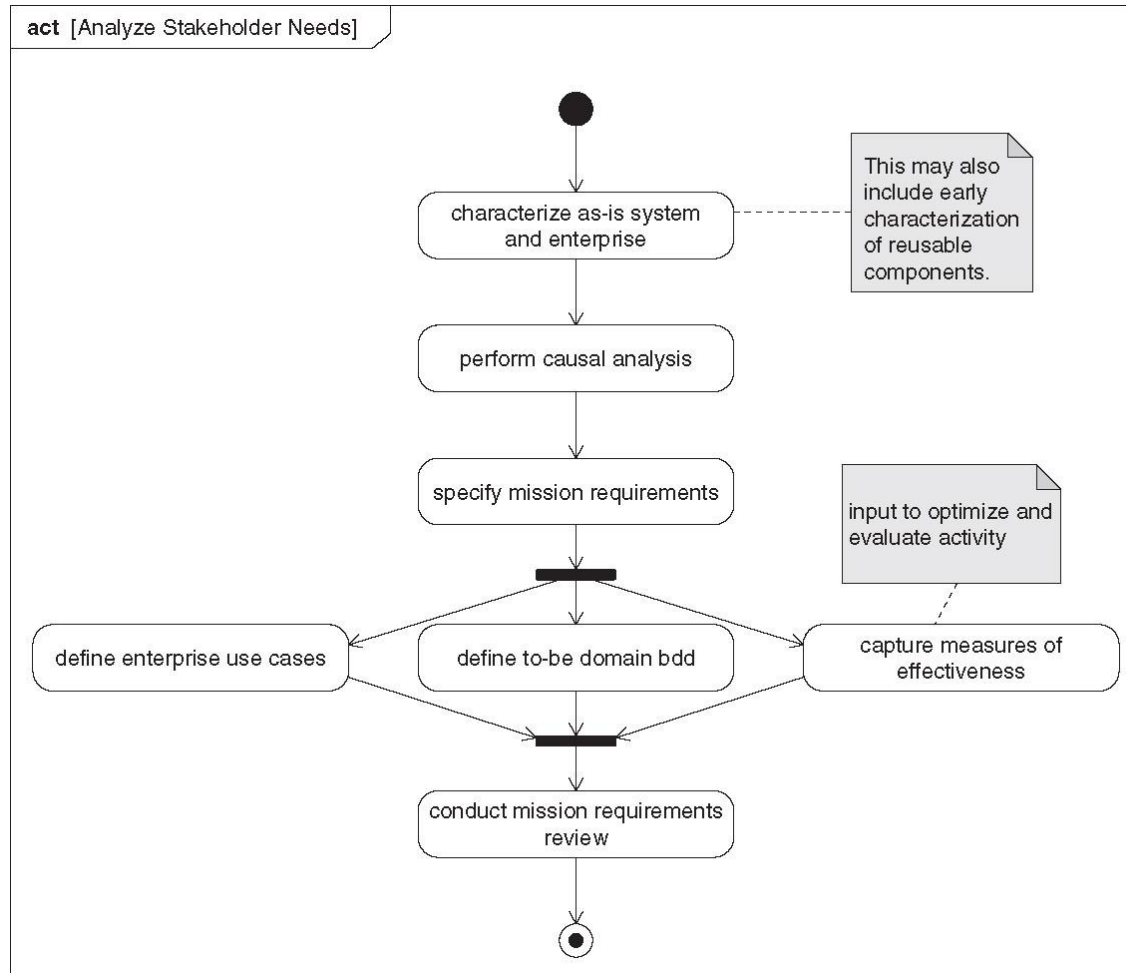
# Security Domain Lifecycle “To-Be”



# OOSSEM – Specification and Design of the ESS

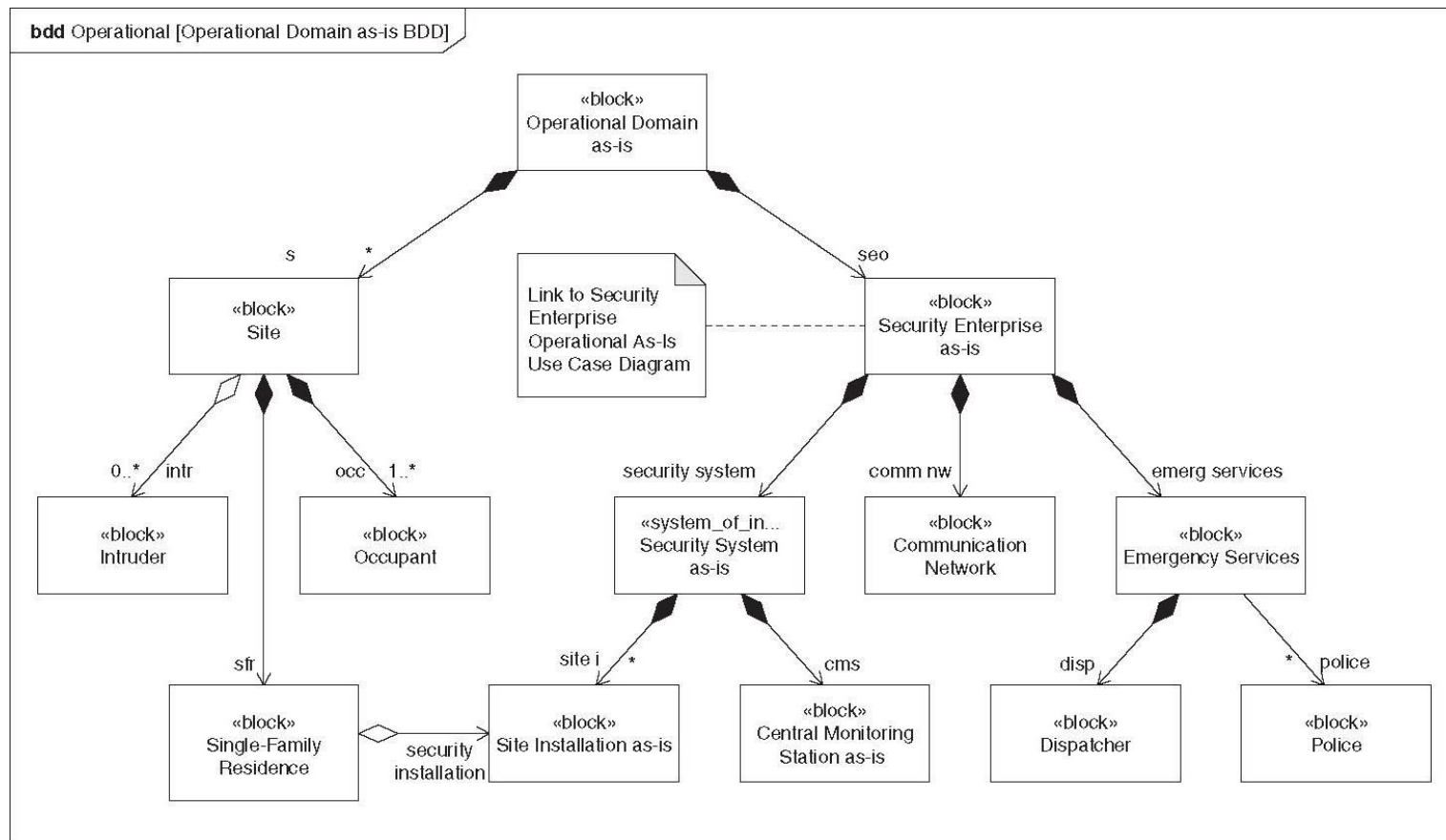


# ESS System – Analyze Stakeholder Needs



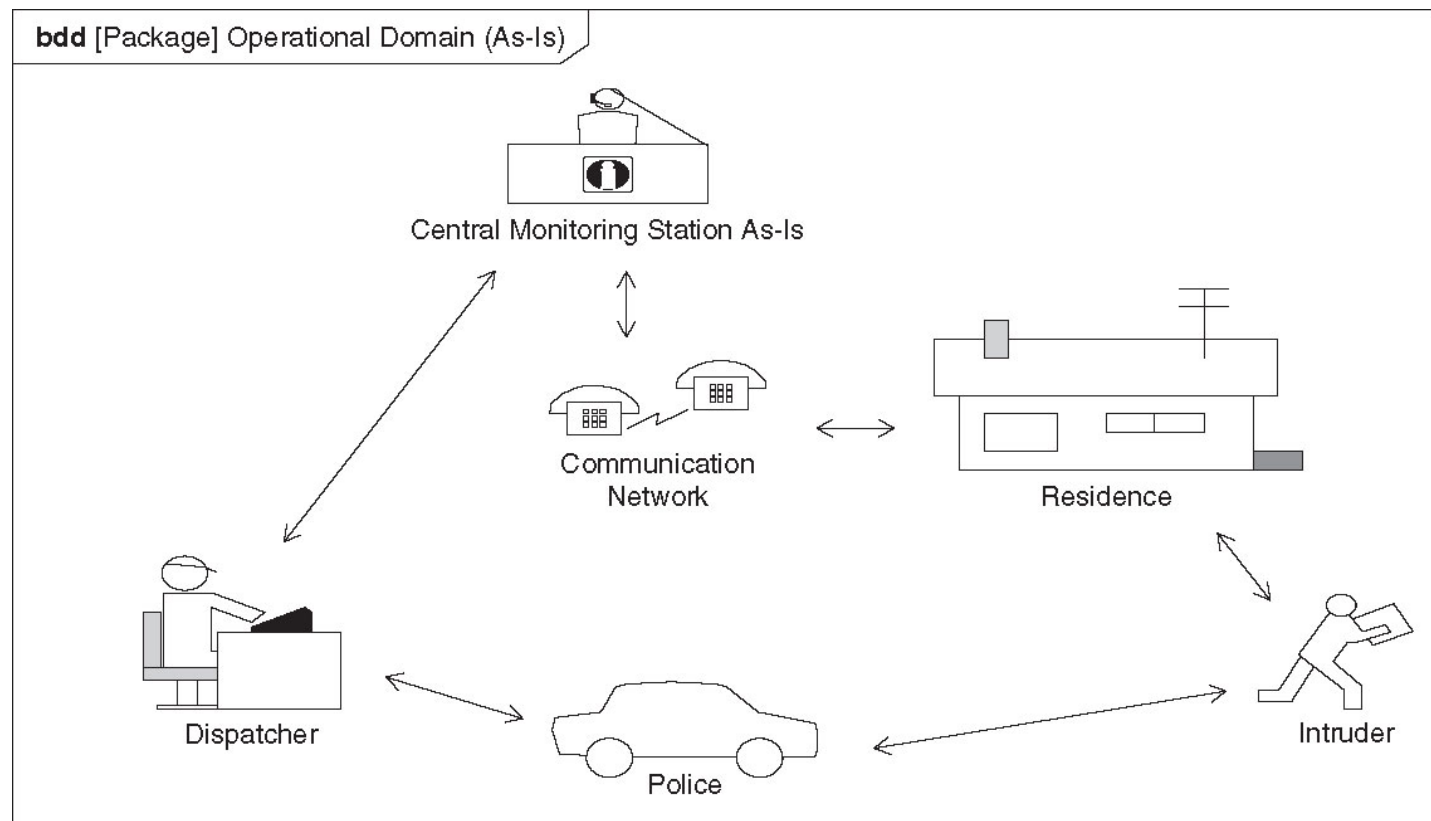
# Analyze Stakeholder Needs

- Characterise the “As Is” System



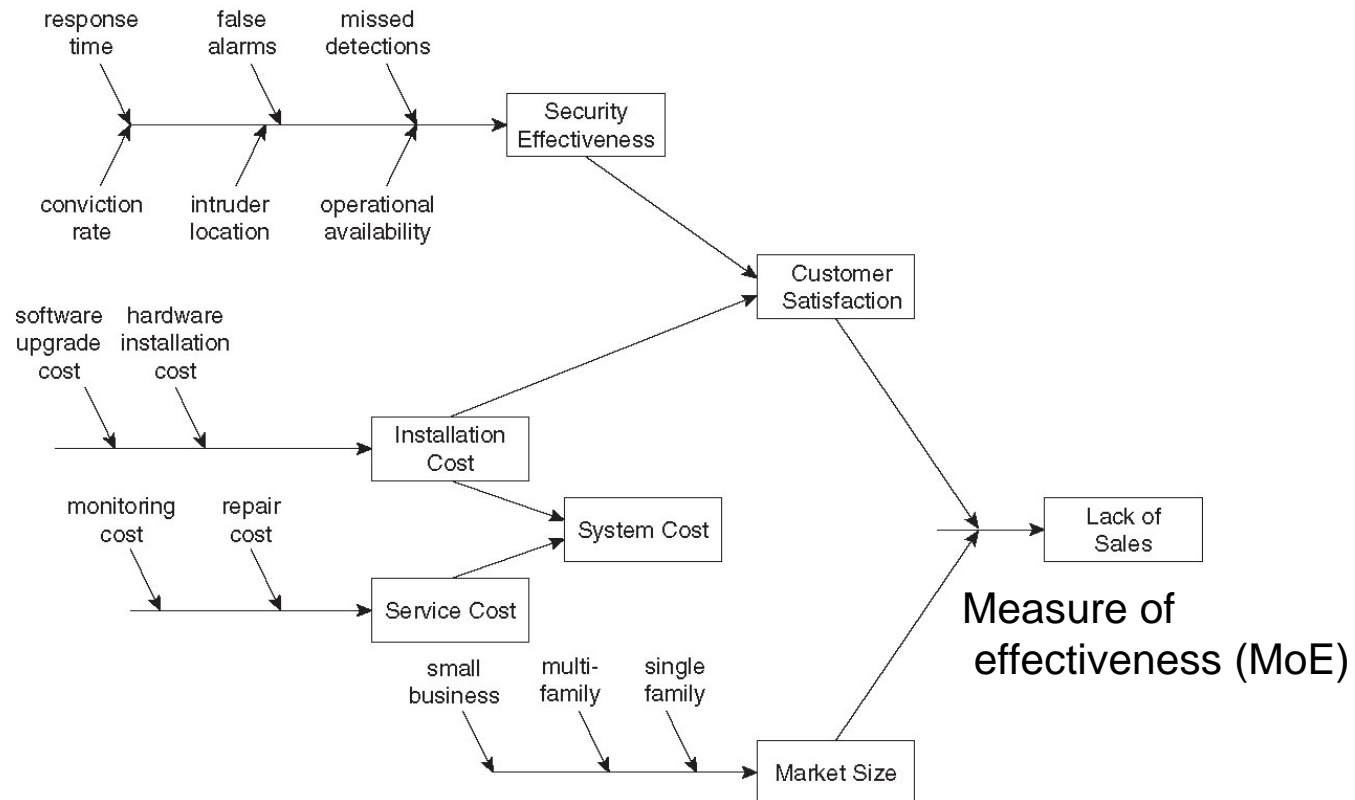
# Analyze Stakeholder Needs

Characterise the “As Is” System



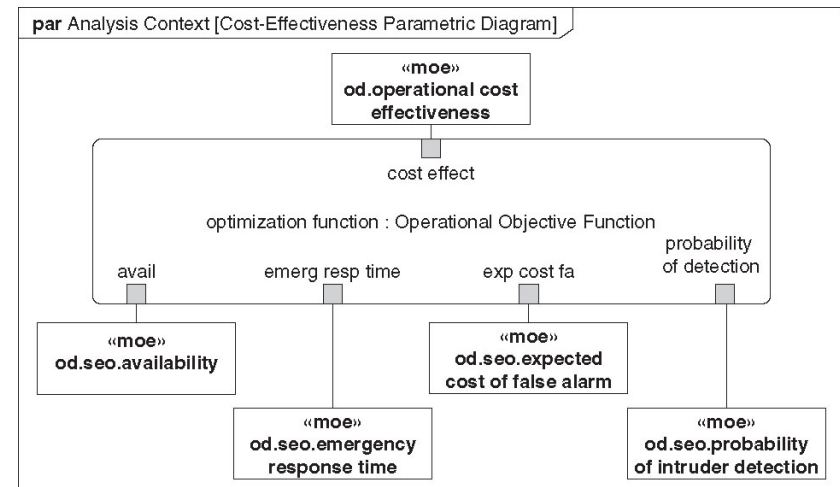
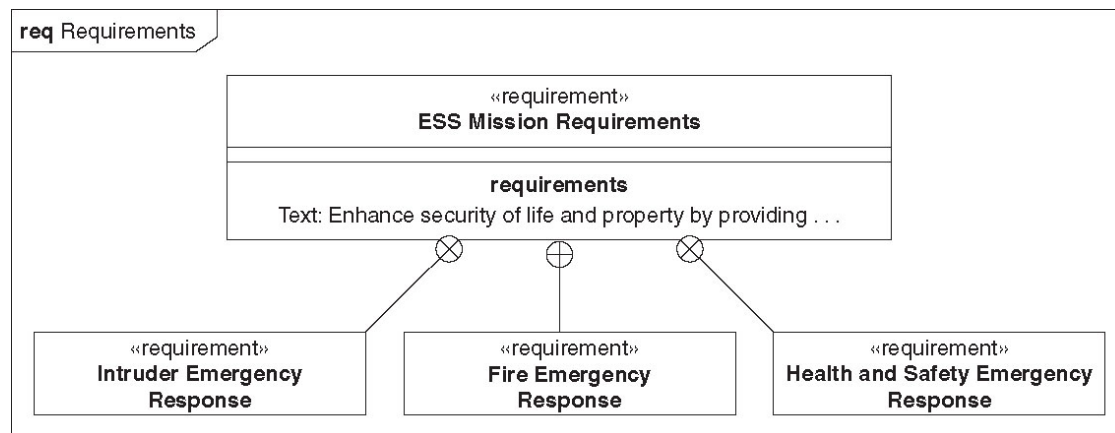
# Analyze Stakeholder Needs

Perform Causal Analysis using a “fishbone” diagram



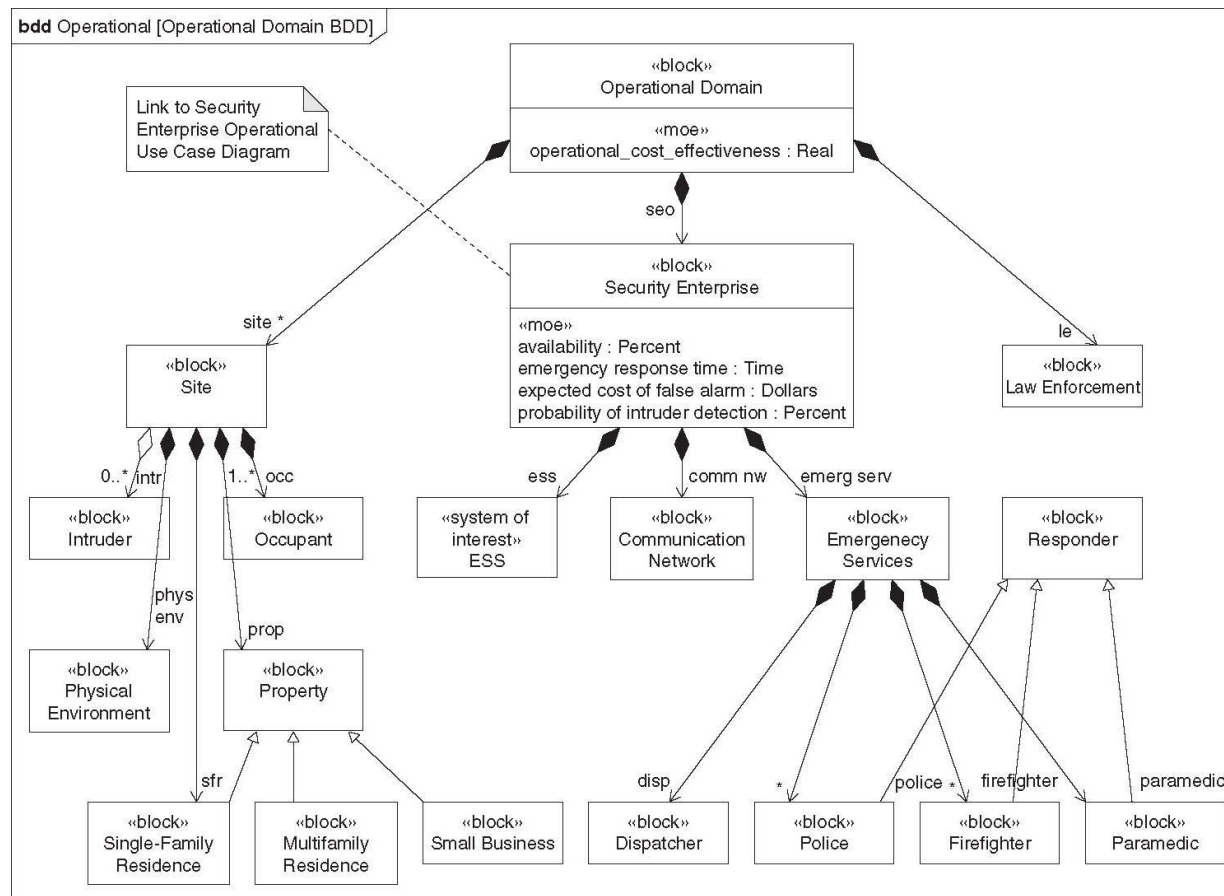
# Analyze Stakeholder Needs

## Specify Mission Requirements and MoEs



# Analyze Stakeholder Needs

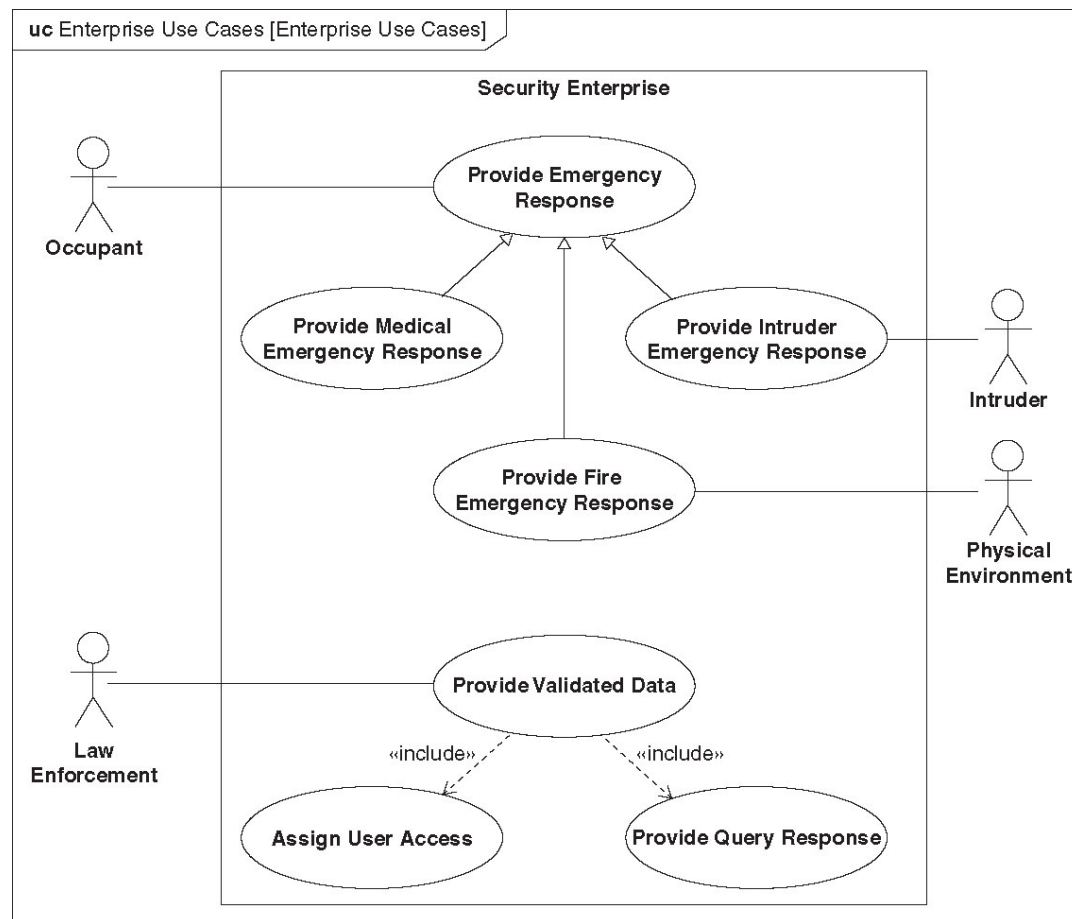
## Define the “To Be” ESS Domain Model



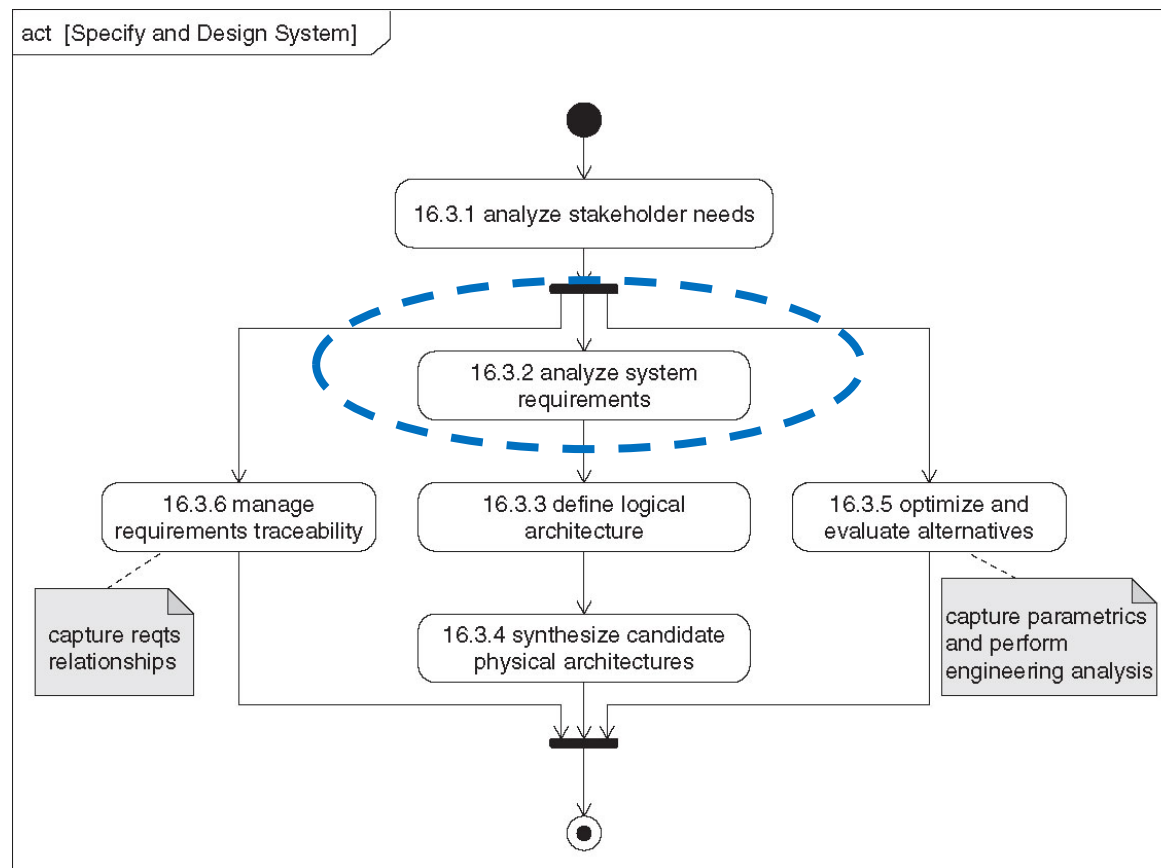


# Analyze Stakeholder Needs

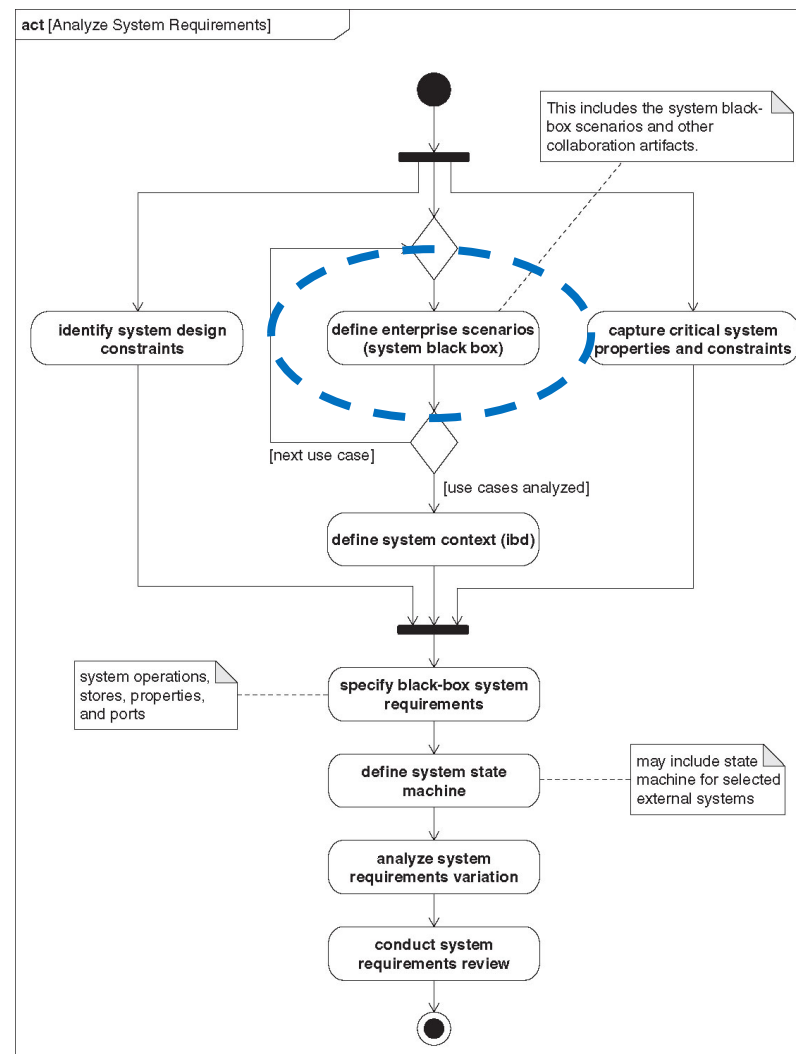
## Define Enterprise Use Case



# OOSSEM – Specification and Design of the ESS

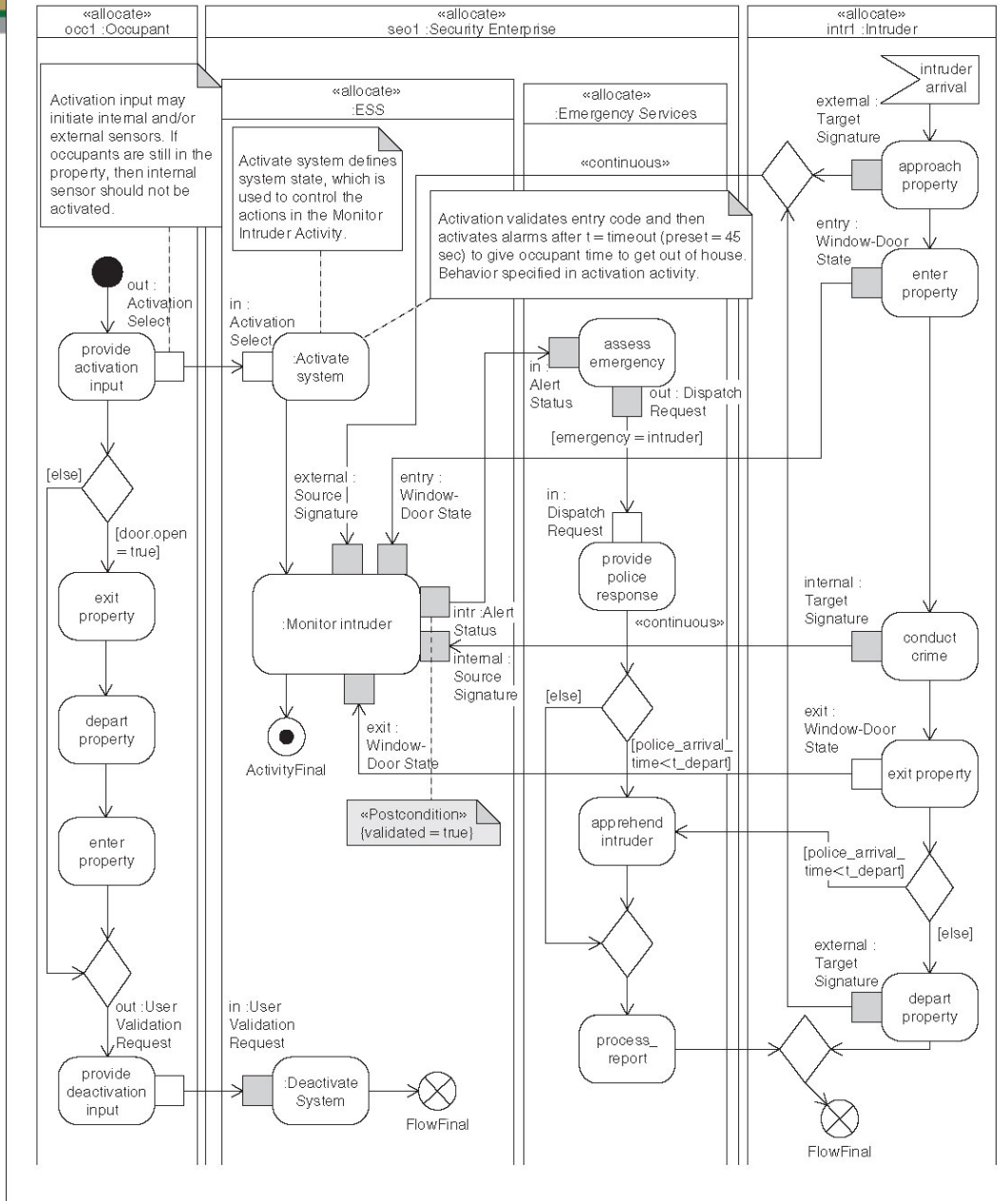


# ESS – Analyze System Requirements



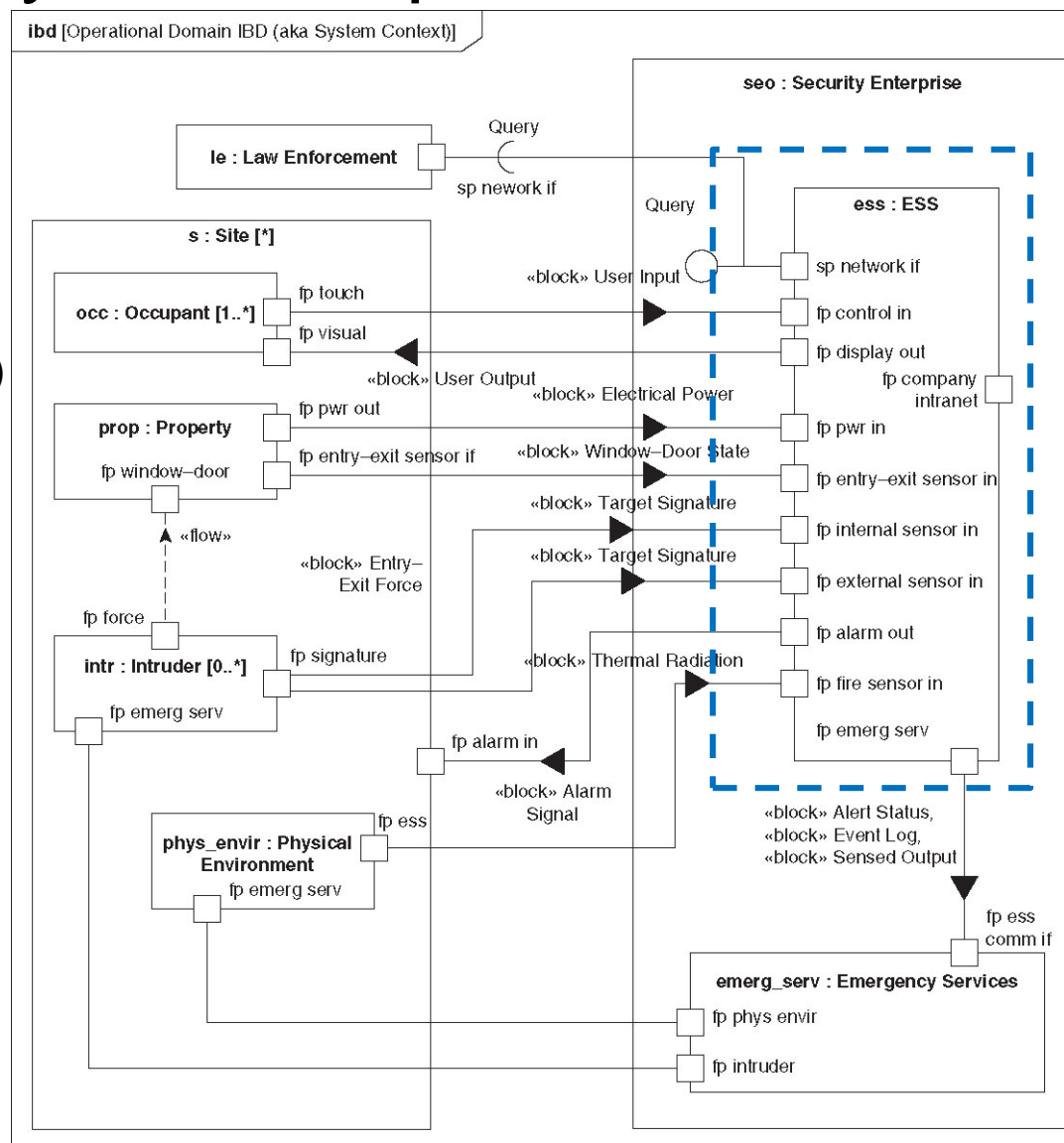
## ESS – Analyze System Requirements

- Define Operation Scenarios



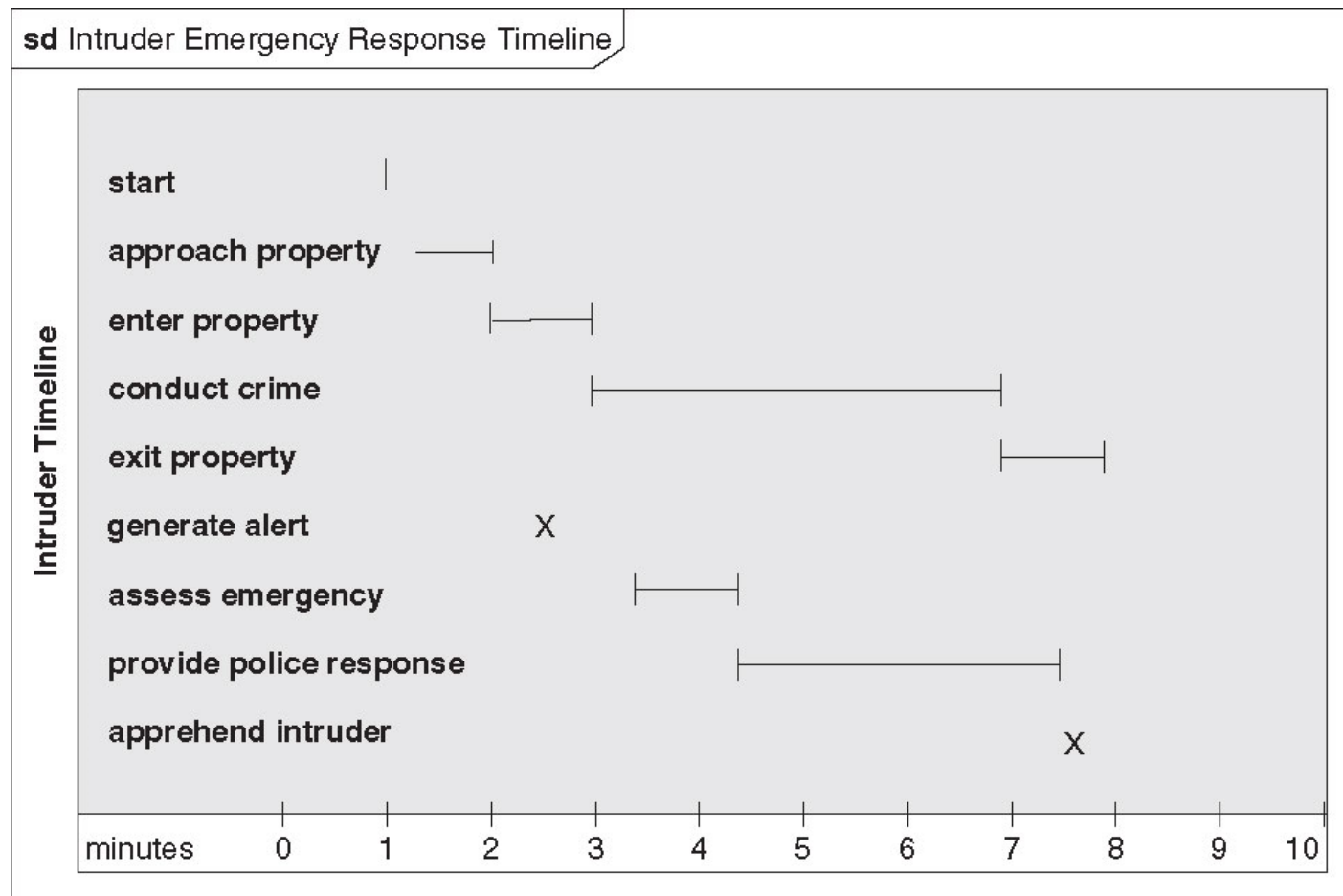
# ESS – Analyze System Requirements

- Define System Context  
(ESS and interfaces to external systems)



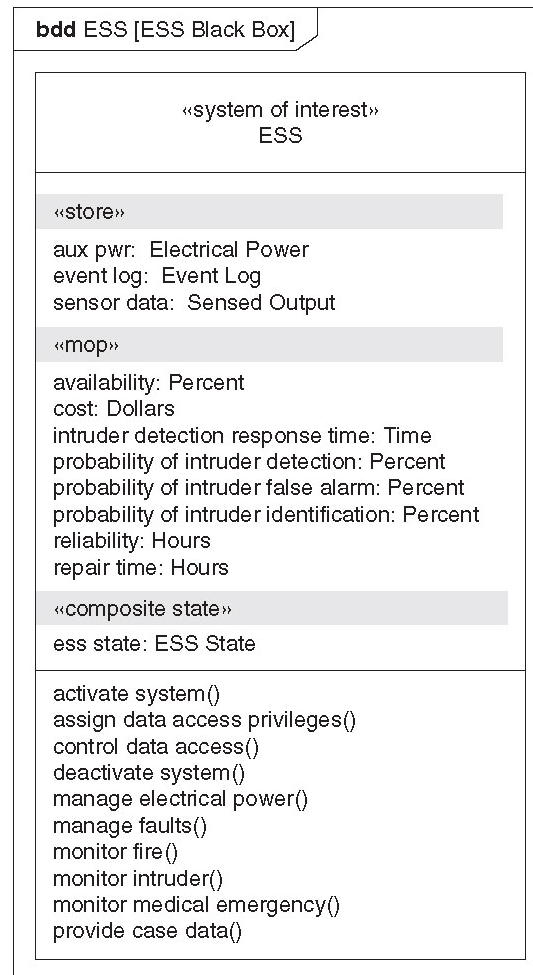
# ESS – Analyze System Requirements

- Capture Critical System Properties and Constraints



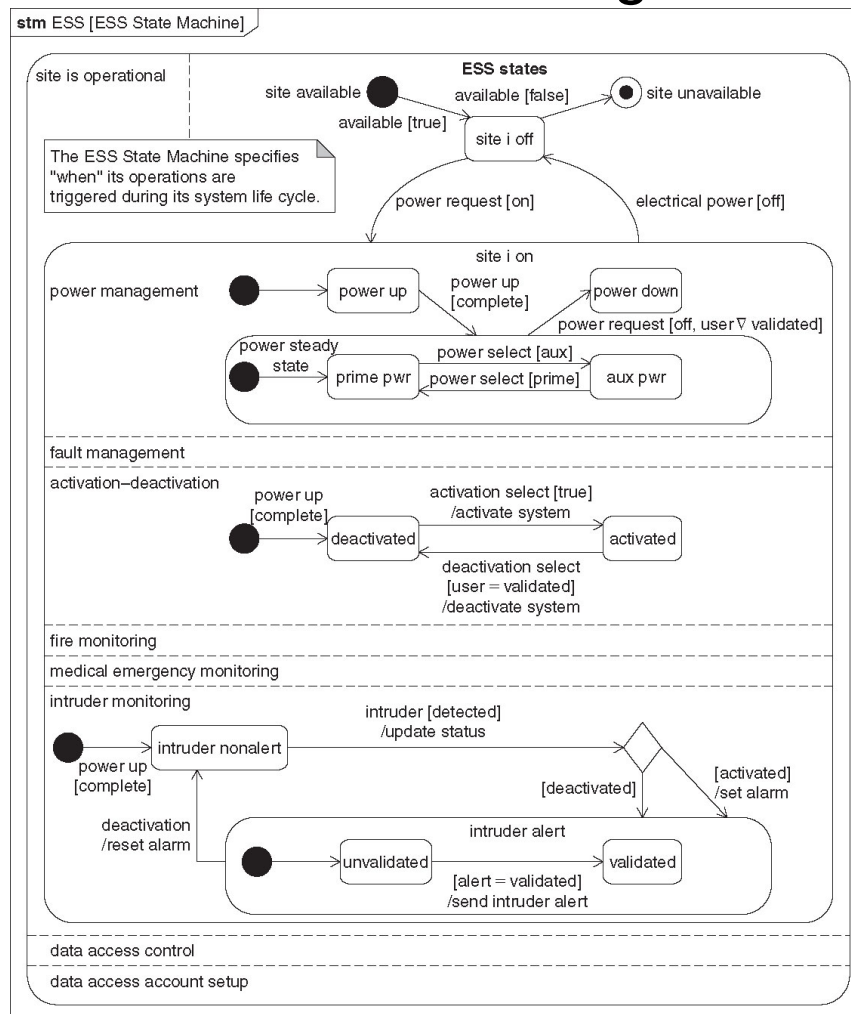
# ESS – Analyze System Requirements

- Specify “Black-Box” Systems Requirements



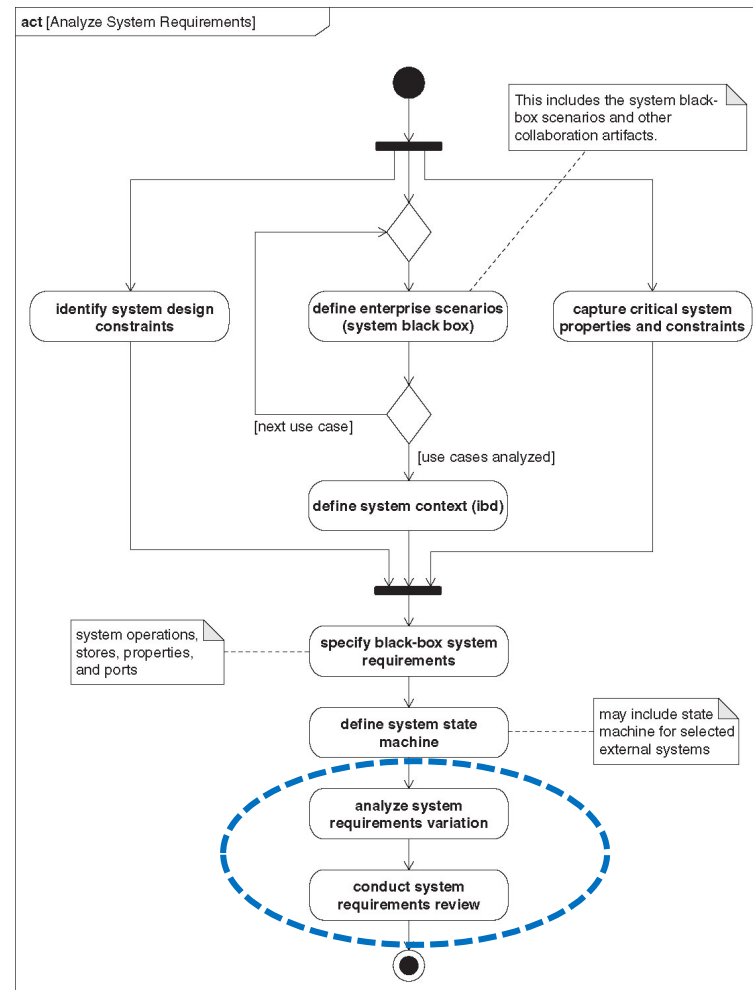
# ESS – Analyze System Requirements

- Define ESS State Machine Diagram



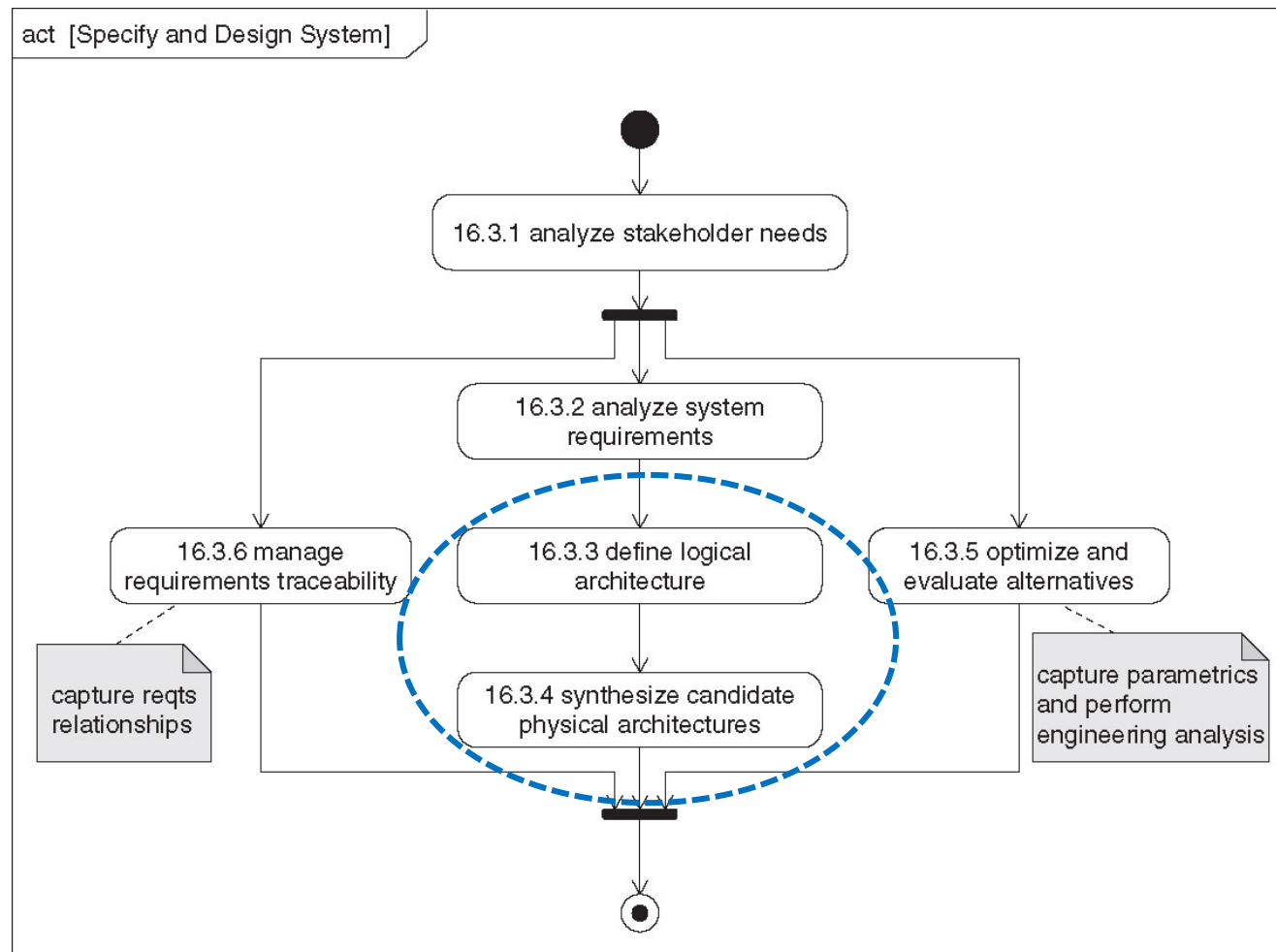


# ESS – Analyze System Requirements



# Next Lecture

## Specify and System Design Process



# *Program Completed*

Missouri University of Science &  
Technology