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Systems *Engineering: Design and Development*

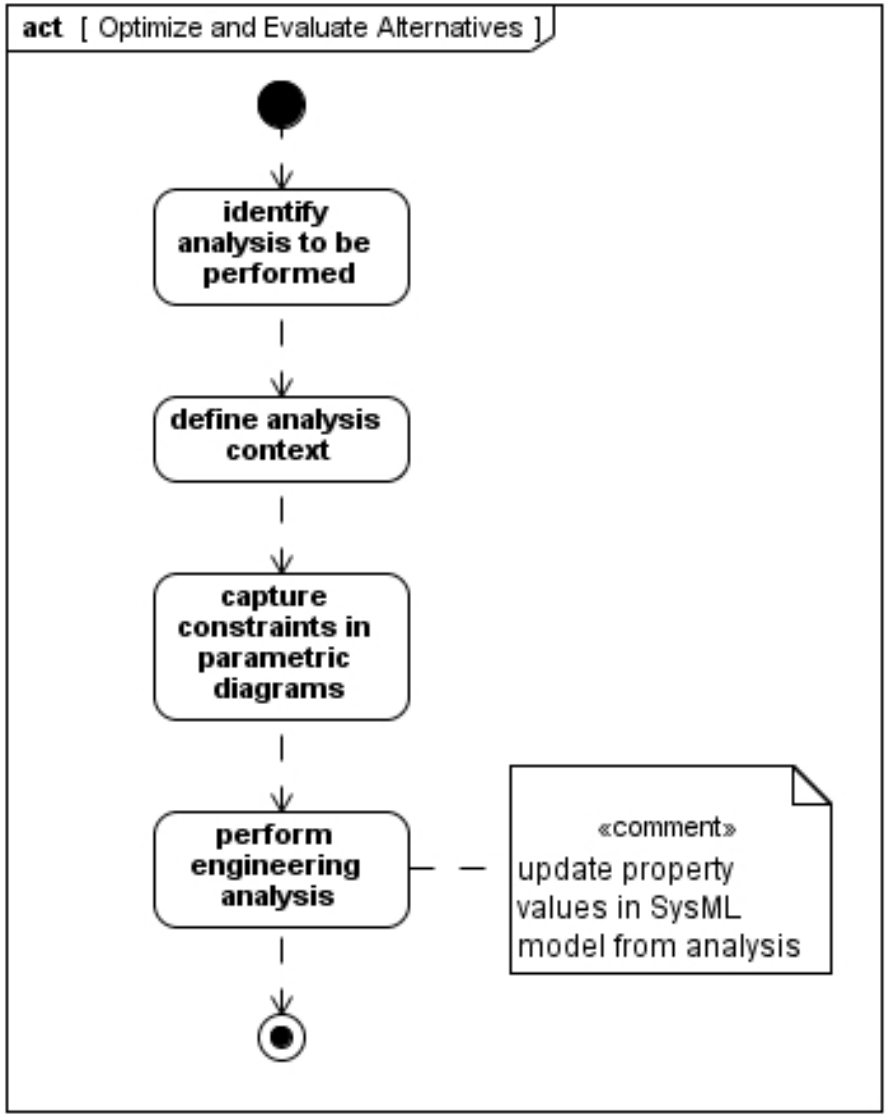
ENGR 387

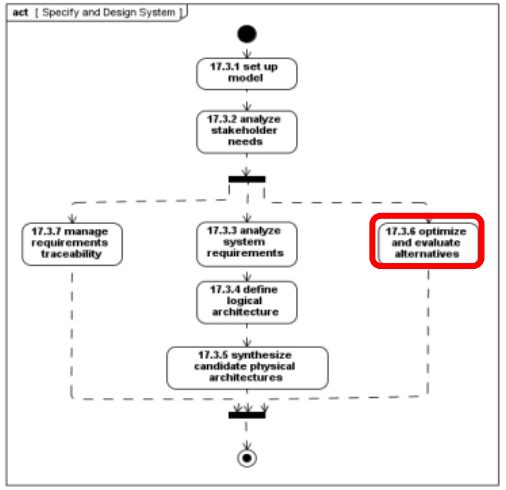
Agenda

- **An Introduction to the Optimize and Evaluate Alternatives activity in the OOSEM method**

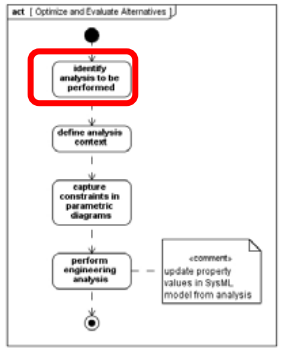
Optimize and Evaluate Alternatives

- Invoked throughout the processPerforms engineering analysis that supports system design trade studies and design optimization
- Steps include:Identifying the analysis that is needed
- Defining the analysis context
- Capturing the constraints in a parametric diagram
- Performing the engineering analysis



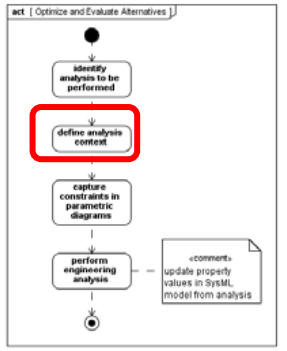


Identify Analyses to be Performed

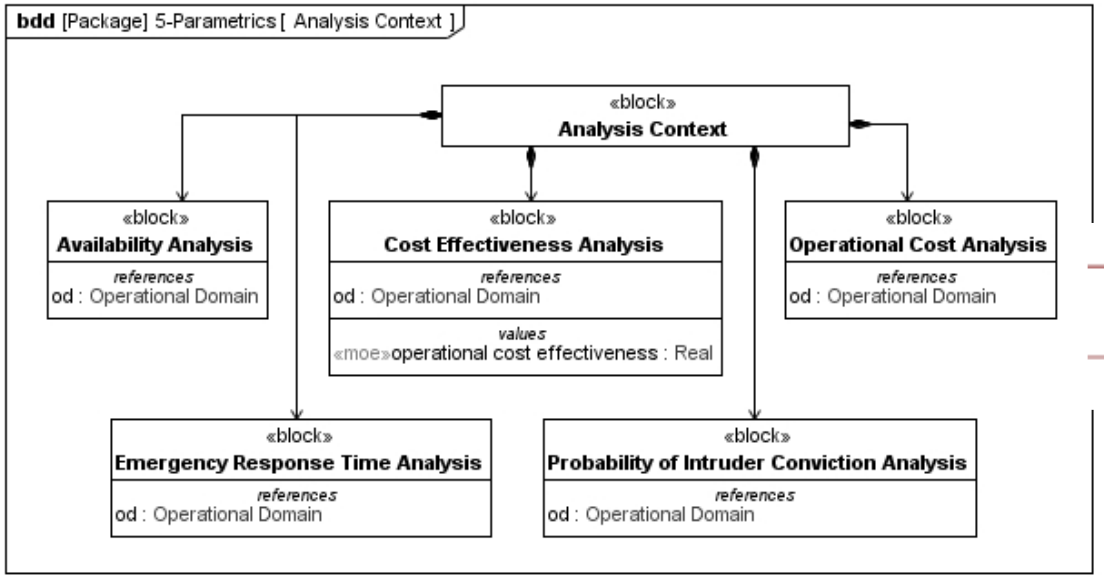


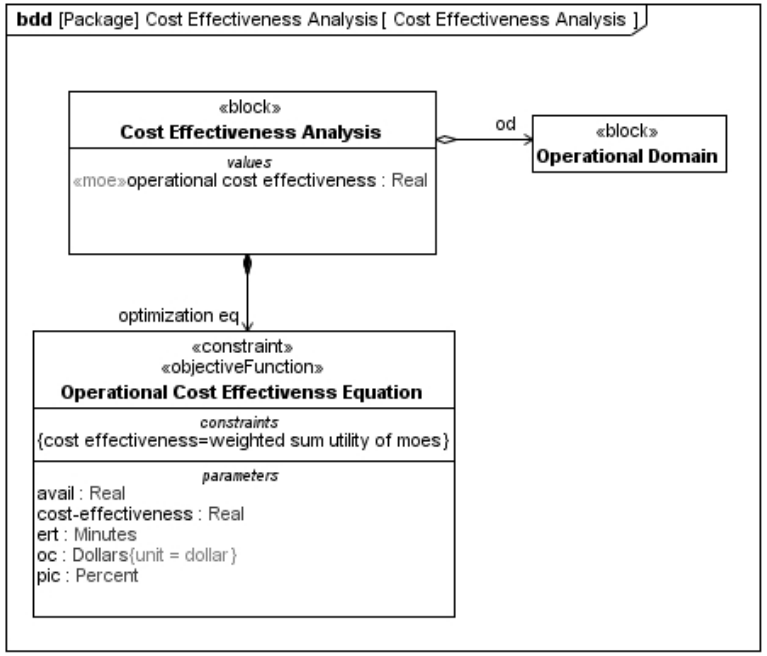
- Support specific analysis objectives, that may include:
  - Characterize or predict some aspect of the system, such as performance, reliability, mass properties, or cost
  - Optimize the design through sensitivity analysis
  - Evaluate and select a preferred solution from alternative designs
  - Verify a design using analysis
  - Support Risk Analysis

Define Analysis Context



- Represented by a BDD that defines the analysis blocks that are used to specify each engineering analysis
- Includes a Cost Effectiveness Analysis block for evaluating the overall value of the system





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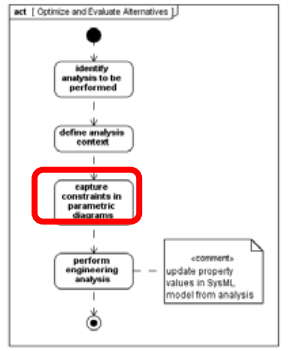
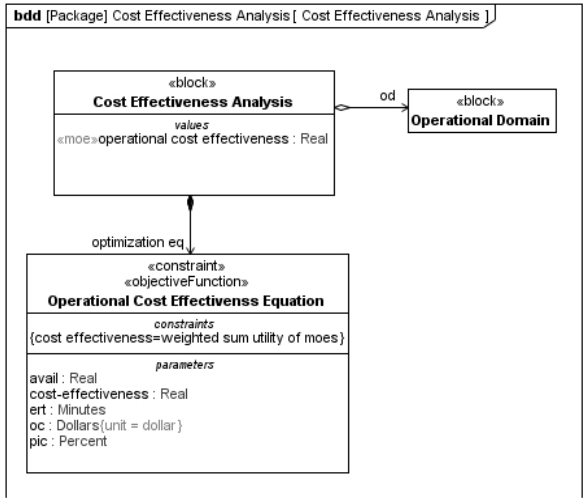
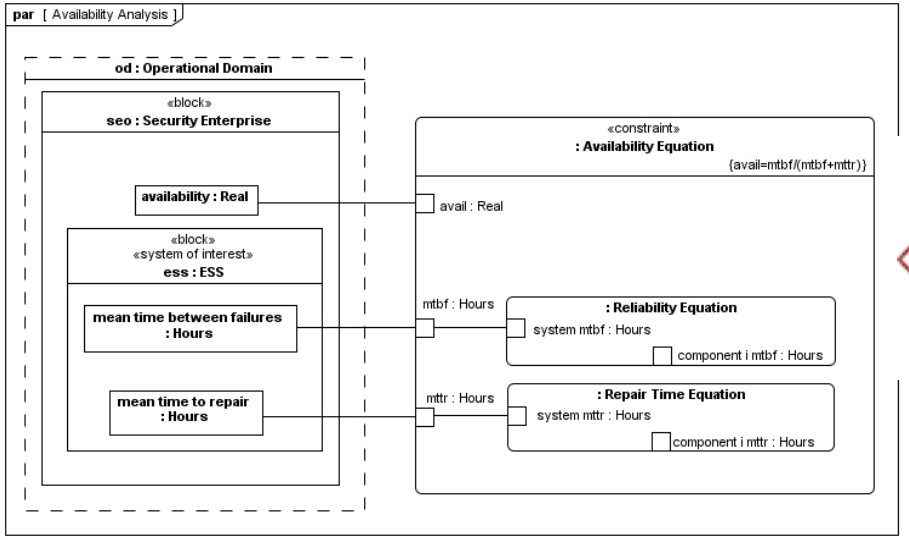
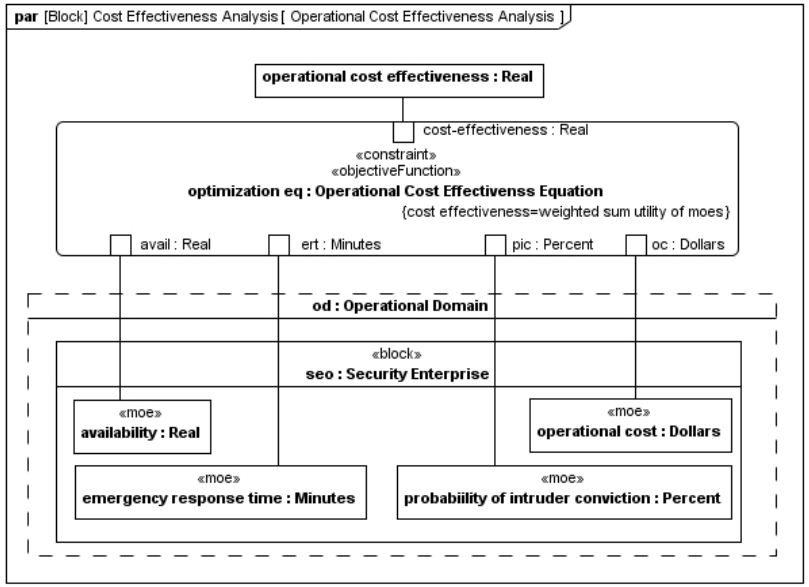
Capture Constraints in Parametric Diagram

- Binds the parameters of the analysis equations to the properties of the system being analyzed
- Parametric diagrams provide a mechanism to establish relationships between the top-level MOEs and their flow down to critical system element and component properties

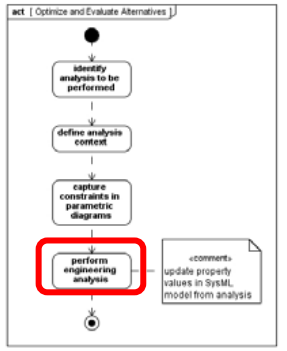




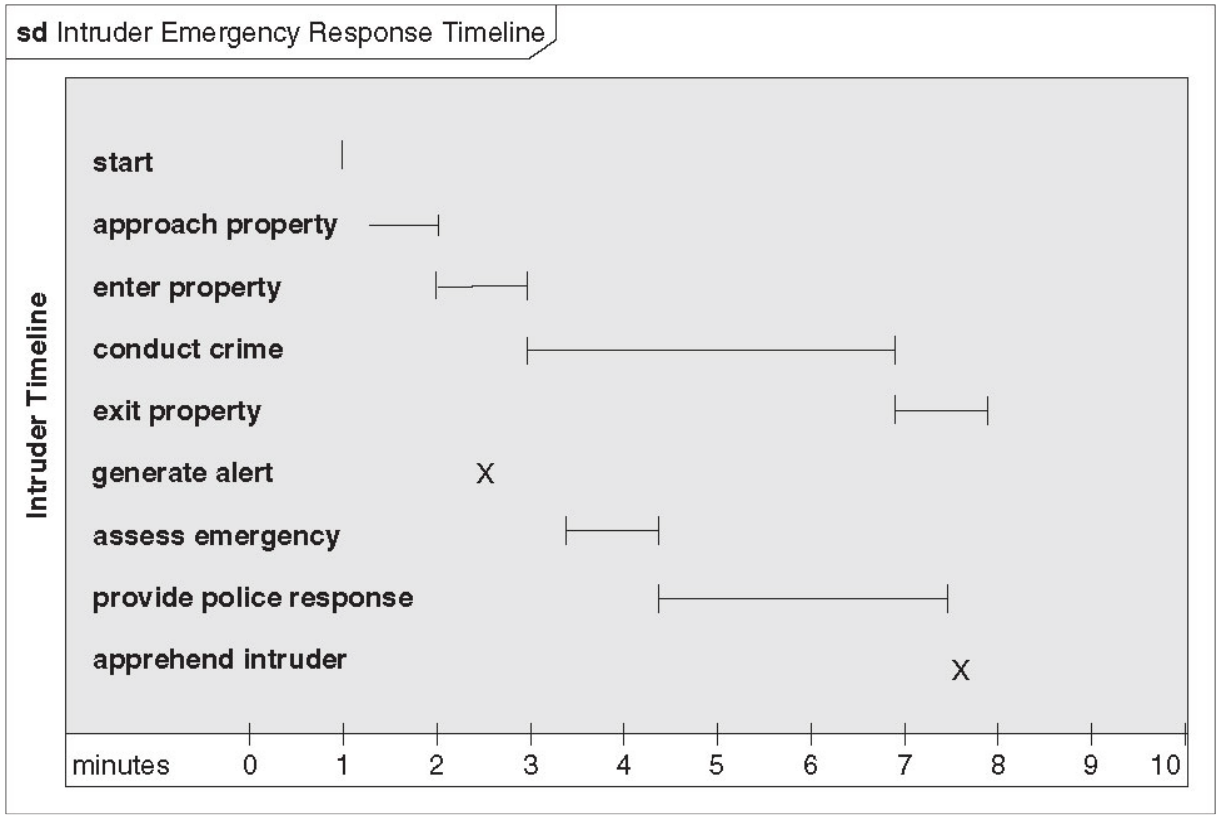




Capture Constraints in Parametric Diagram



- Use a computational capability to execute the equations in the parametric diagram
- Analysis results determine the specific values (or range of values) of the system properties that satisfy the constraints
- Values can be incorporated back into the system design model



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Questions

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Summary

- Optimize and Evaluate Alternatives is invoked throughout the design process to support architecture optimization
  - Modeling information is integrated between system requirements/design models, and the detailed analysis models
  - Requirements and design models provide specification of components, functions, interface, control, performance attributes, and stores to the analysis models
- Analysis models (including parametric diagrams) provide the parametric results and detailed supporting analysis to define and allocate the requirements
- Each analysis model can be captured using a Parametric diagram
- Parametric diagrams provide a mechanism to establish relationships between the top-level MOEs and their flow down to critical system element and component properties

References

Additional information can be obtained by reviewing:

- SysML Distilled (Delligatti)
- A Practical Guide to SysML (Friedenthal)
  - Section 16.3.5