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# Model Based Systems Engineering in Warehouse Analysis and Design

Felix Friemann, Manuel Klennert,  
Leon McGinnis

June 7<sup>th</sup>, 2010



# Objectives

- Generic model template for unit load warehouses supporting the integration of analysis and design, both conceptually and computationally
- Providing a platform for integrating description and analysis
- Concise, precise, and readily accessible description of both the structure and behavior of the warehouse



# Benefit

- Definition of a coherent language for describing structure and behavior of warehouses
- Easily extendable structure by elaborating modules
- Provides platform for knowledge integration

Generic model as basis for analysis tools for different warehouse types



# Milestones

- 1) **Formal description of a unit load based warehouse**
- 2) Model extensions to various technologies and warehouse applications
- 3) Development of analysis tools for generic warehouse models



# Generic model

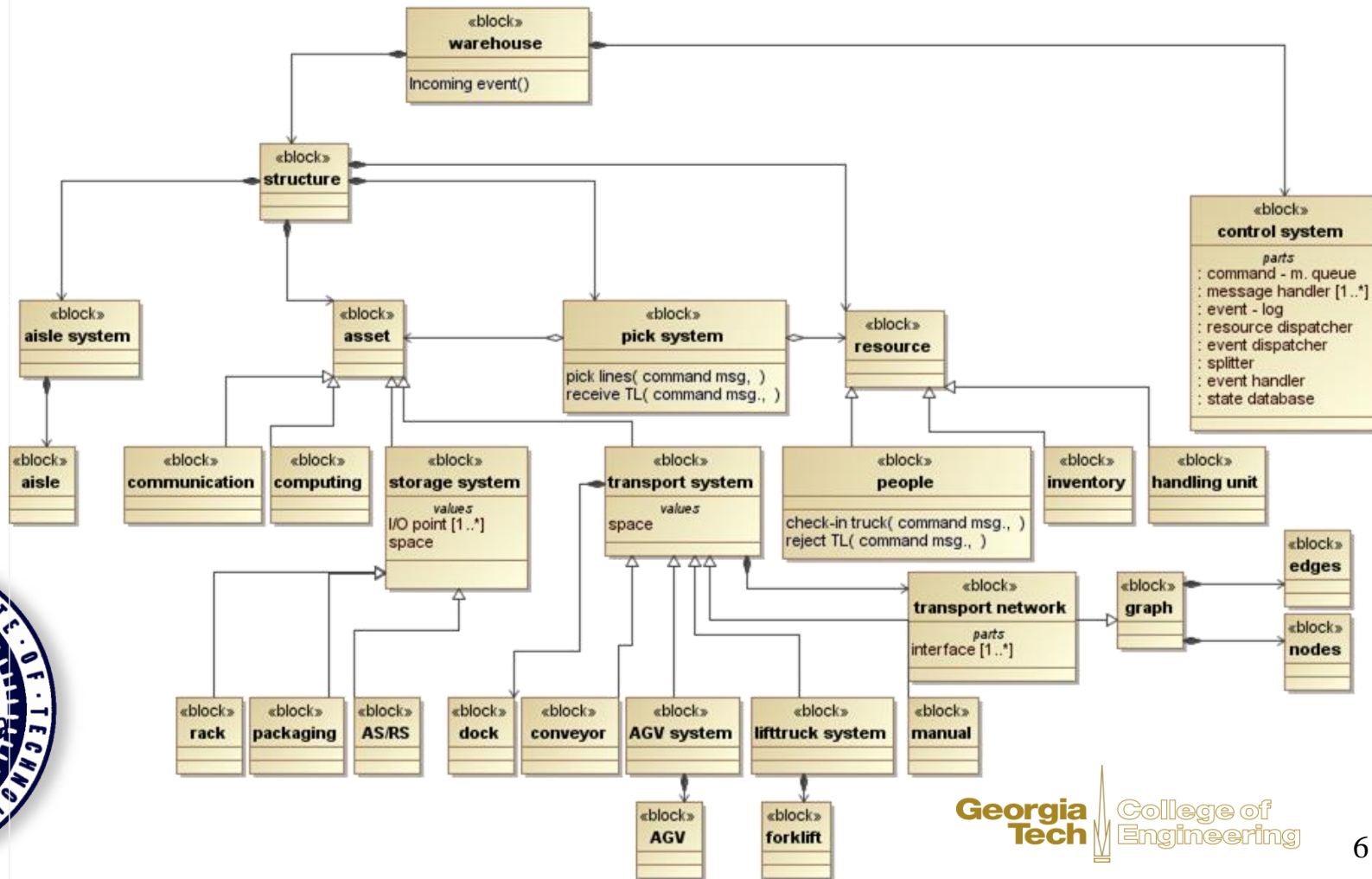


- 1) Structure
  - General
  - Control system
- 2) S/B Interaction
- 3) Behavior
- 4) Examples

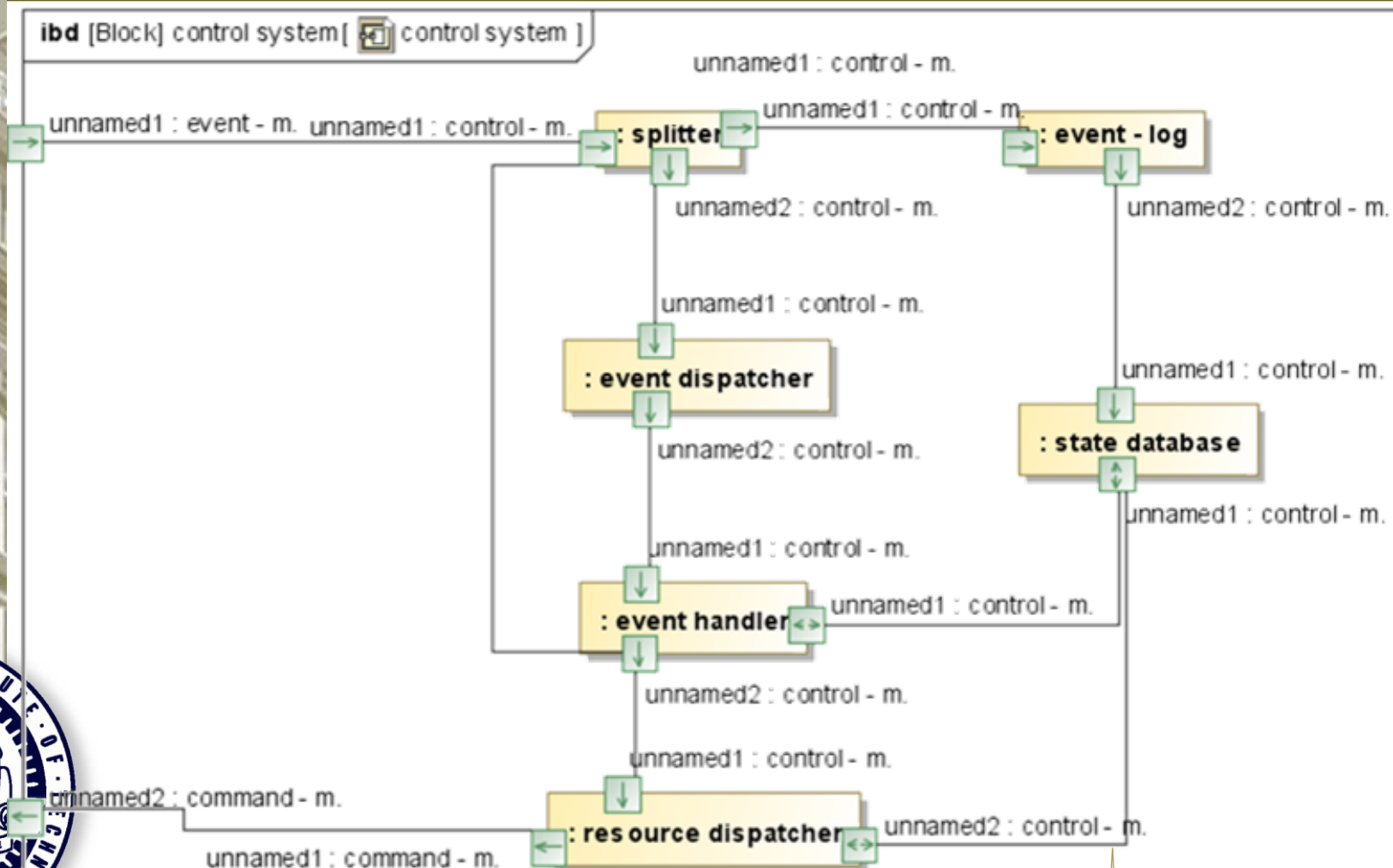


# Structure

bdd [Block] warehouse [ structure ]

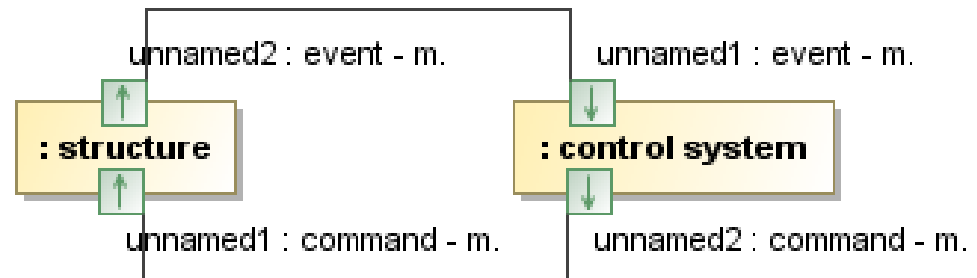


# Control system structure



# Structure – Behavior interaction

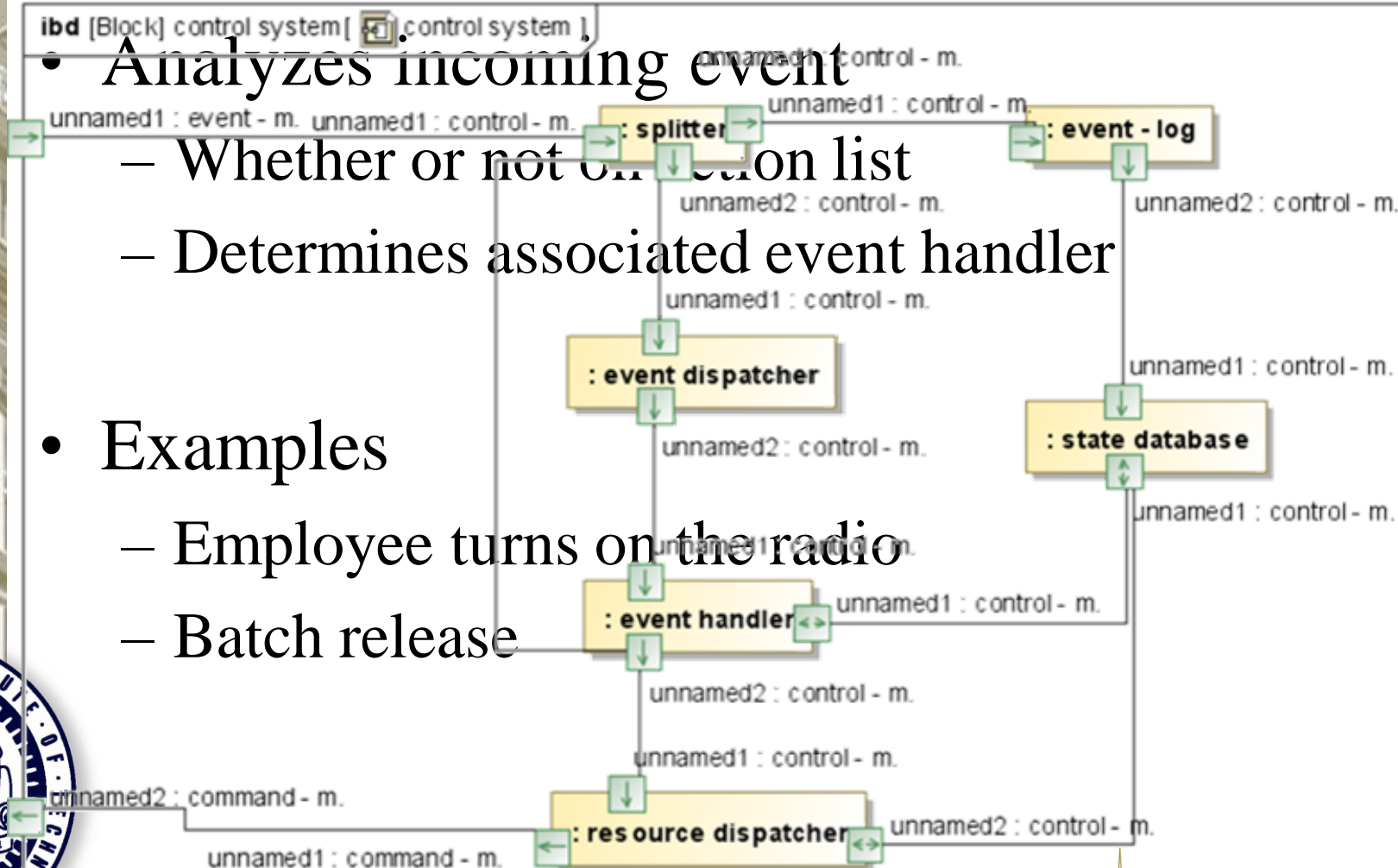
ibd [Block] warehouse [  warehouse ]





# Event dispatcher

- Analyzes incoming event
  - Whether or not on condition list
  - Determines associated event handler
- Examples
  - Employee turns on the radio
  - Batch release



# Event handler

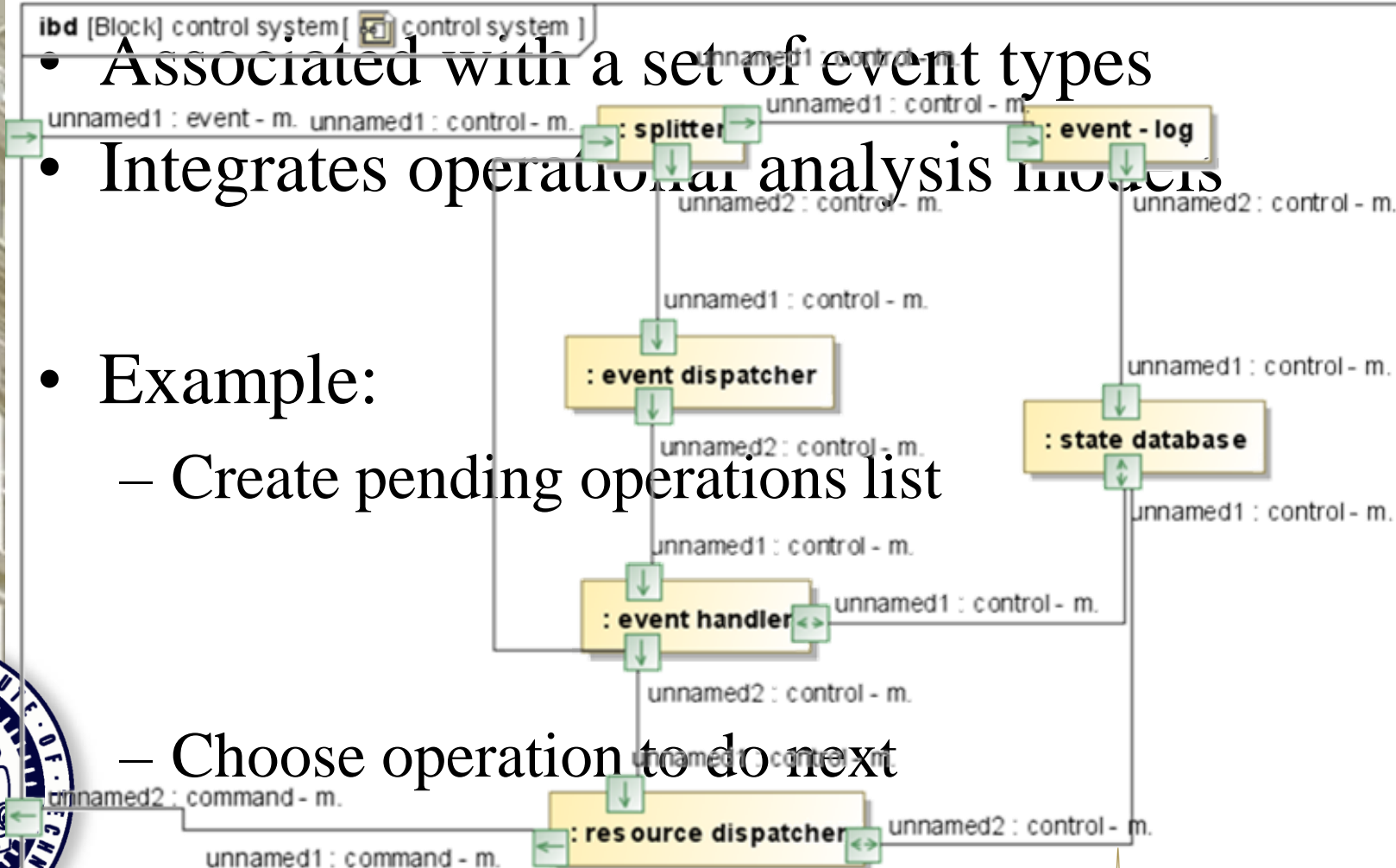
- Associated with a set of event types

- Integrates operational analysis models

- Example:

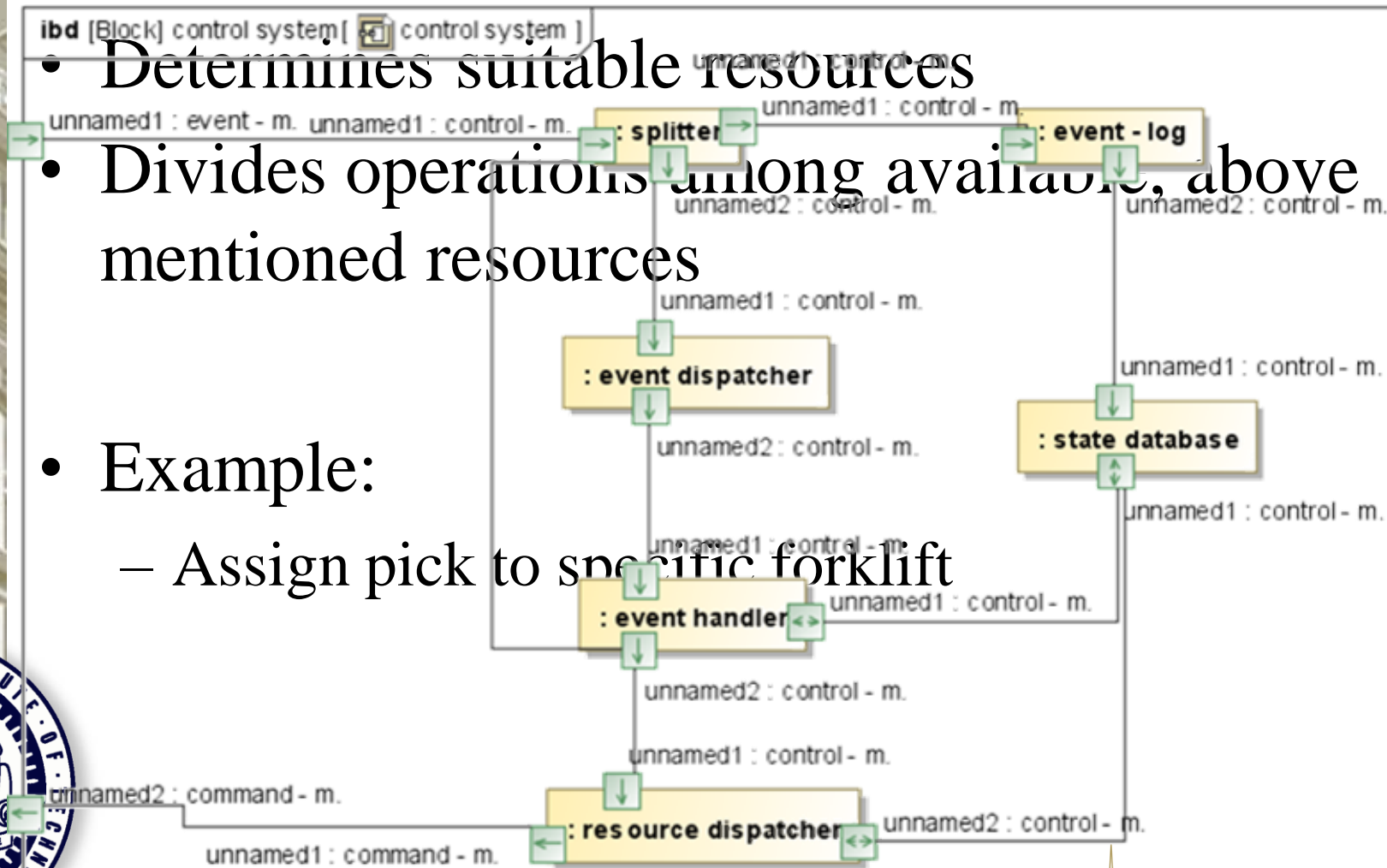
  - Create pending operations list

  - Choose operation to do next

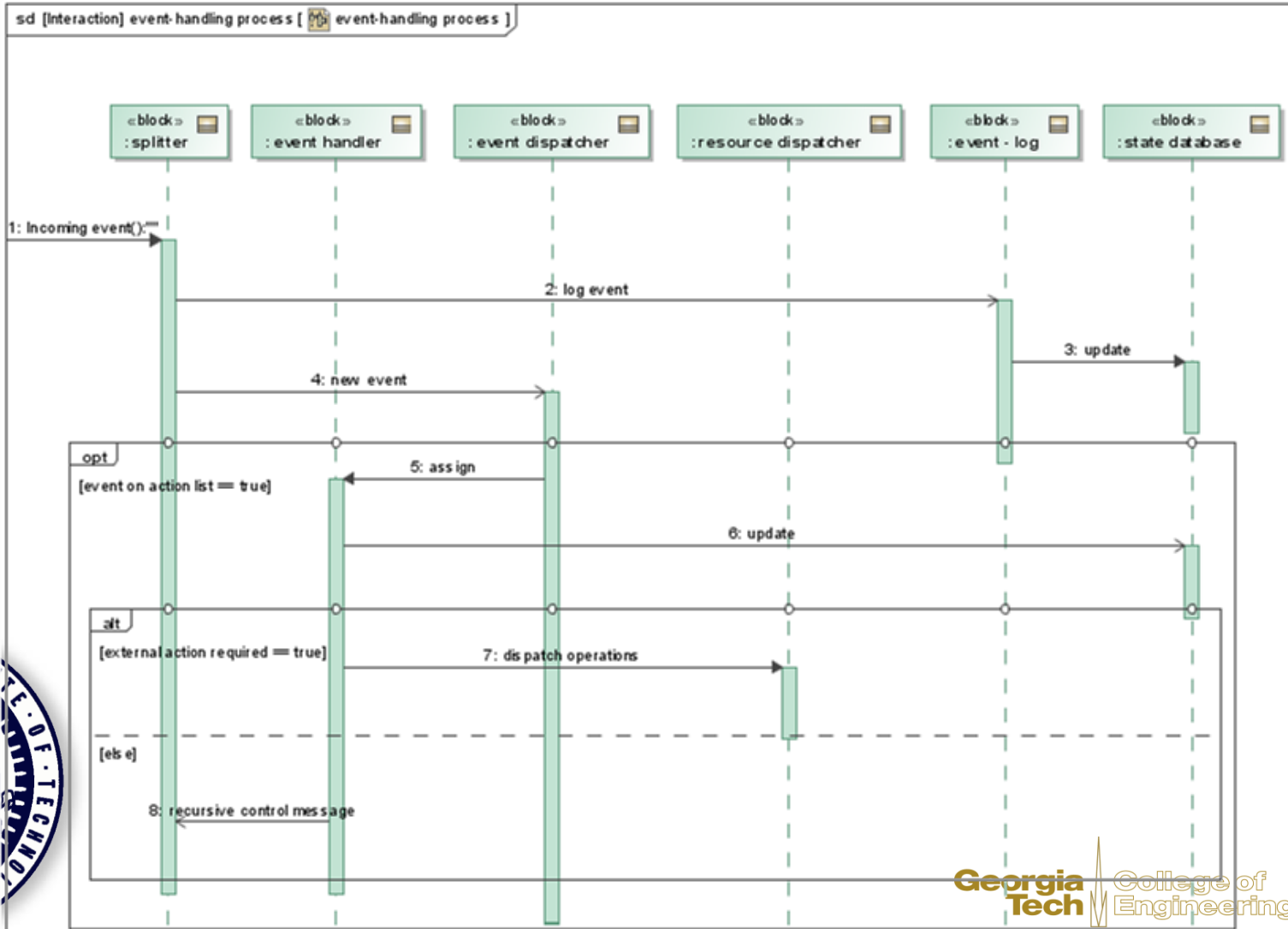


# Resource dispatcher

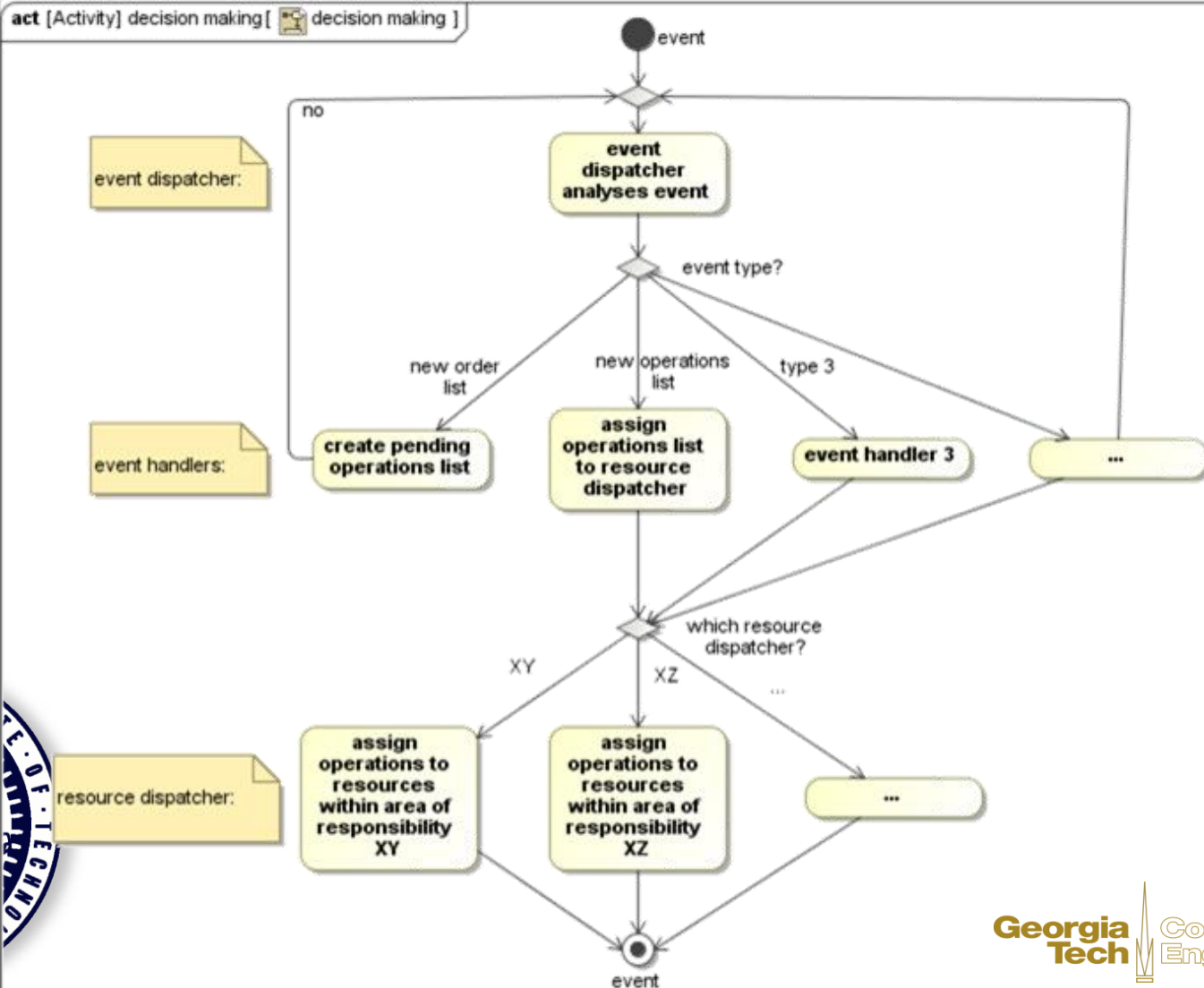
- Determines suitable resources
- Divides operations among available, above mentioned resources
- Example:
  - Assign pick to specific forklift



# Behavior: Interaction




# Behavior: Decision making



# Practice example 1

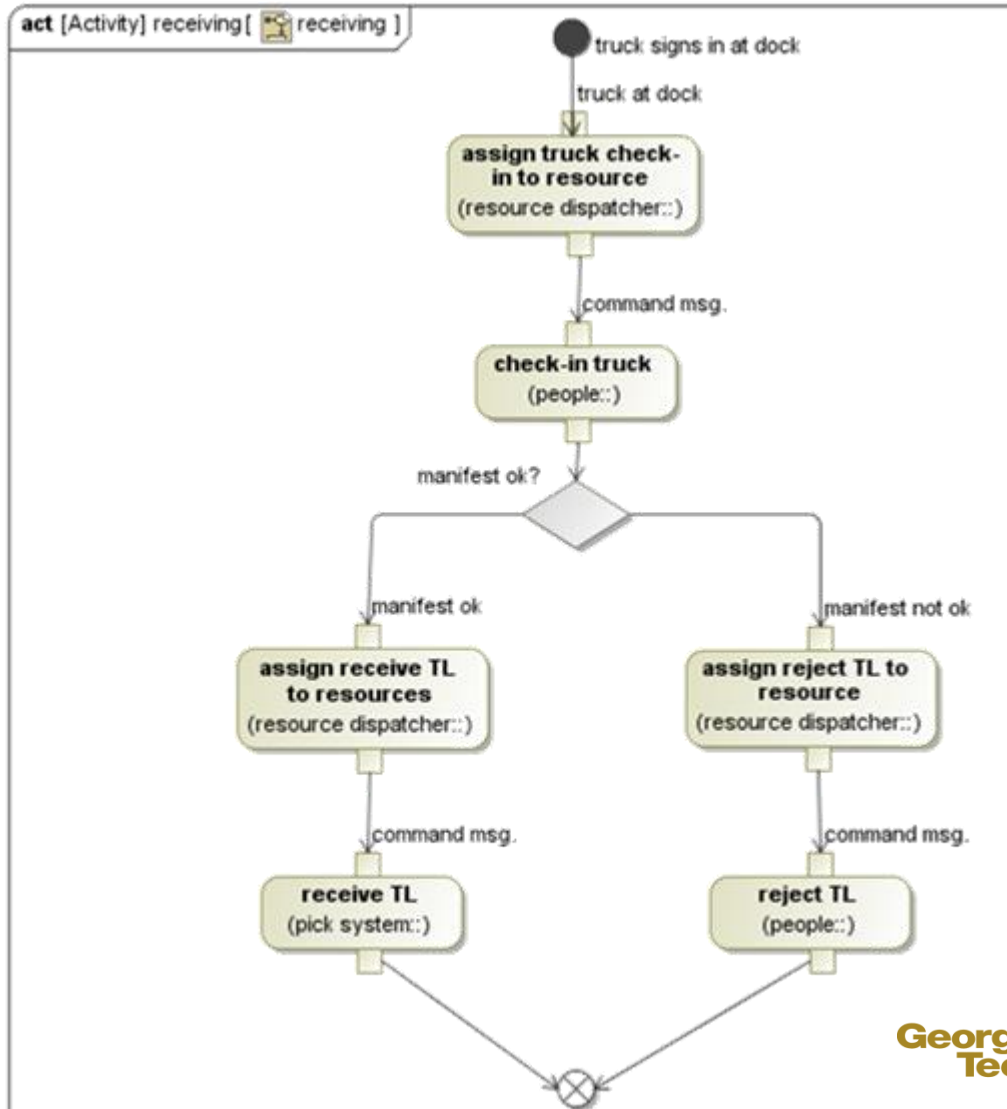
## -Picking-

act [Activity] picking [  picking ]



# Practice example 2

## -Receiving-



# Outlook (1/2)

- 1) Formal description of a unit load based warehouse
- 2) **Model extensions to various technologies and warehouse applications**
  - **Continuous improvement**
- 3) Development of analysis tools for generic warehouse models





# Outlook (2/2)

- 1) Formal description of a unit load based warehouse
- 2) Model extensions to various technologies and warehouse applications
- 3) **Development of analysis tools for generic warehouse models**
  - Analysis workflows
  - Adding specific analysis tools



# Comments/Questions



Thank you for your attention



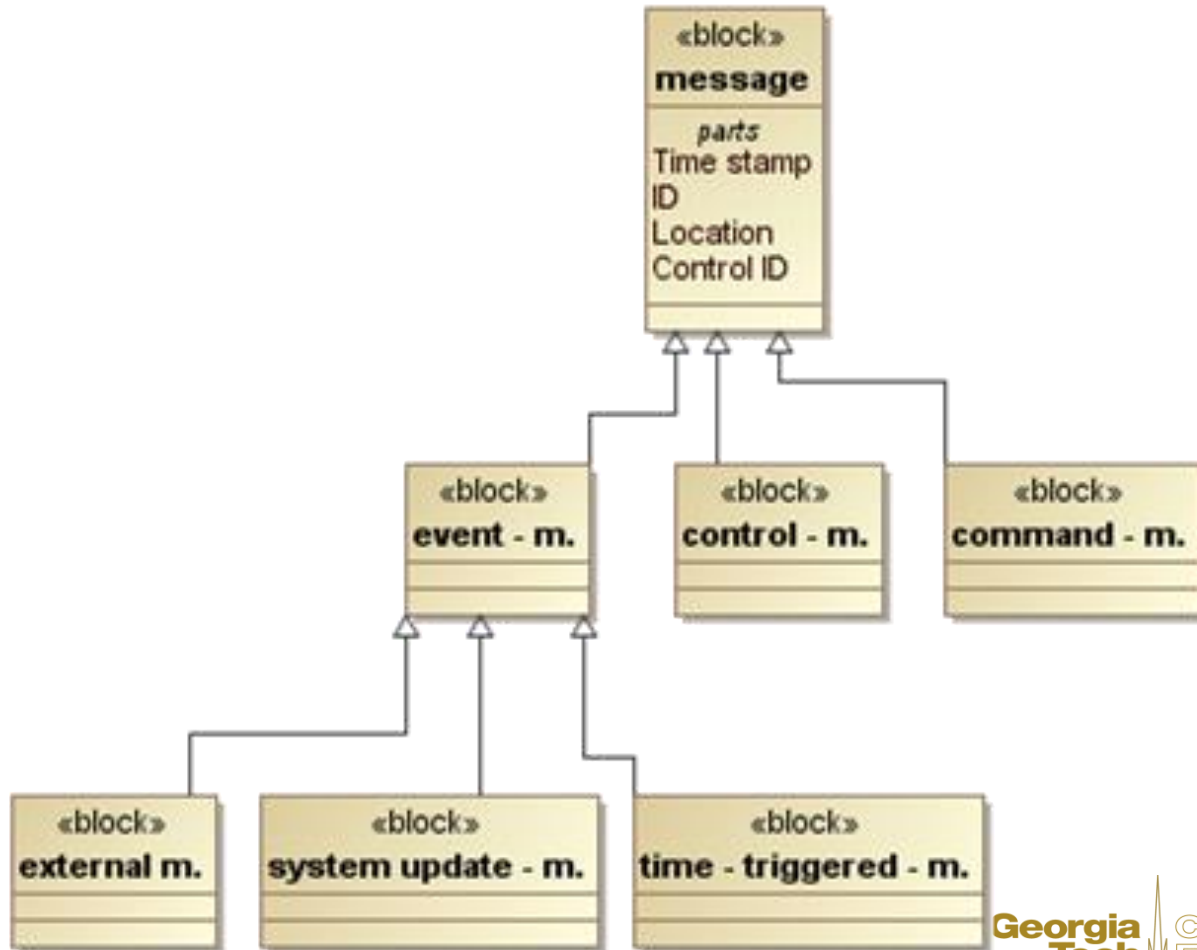
# Backup

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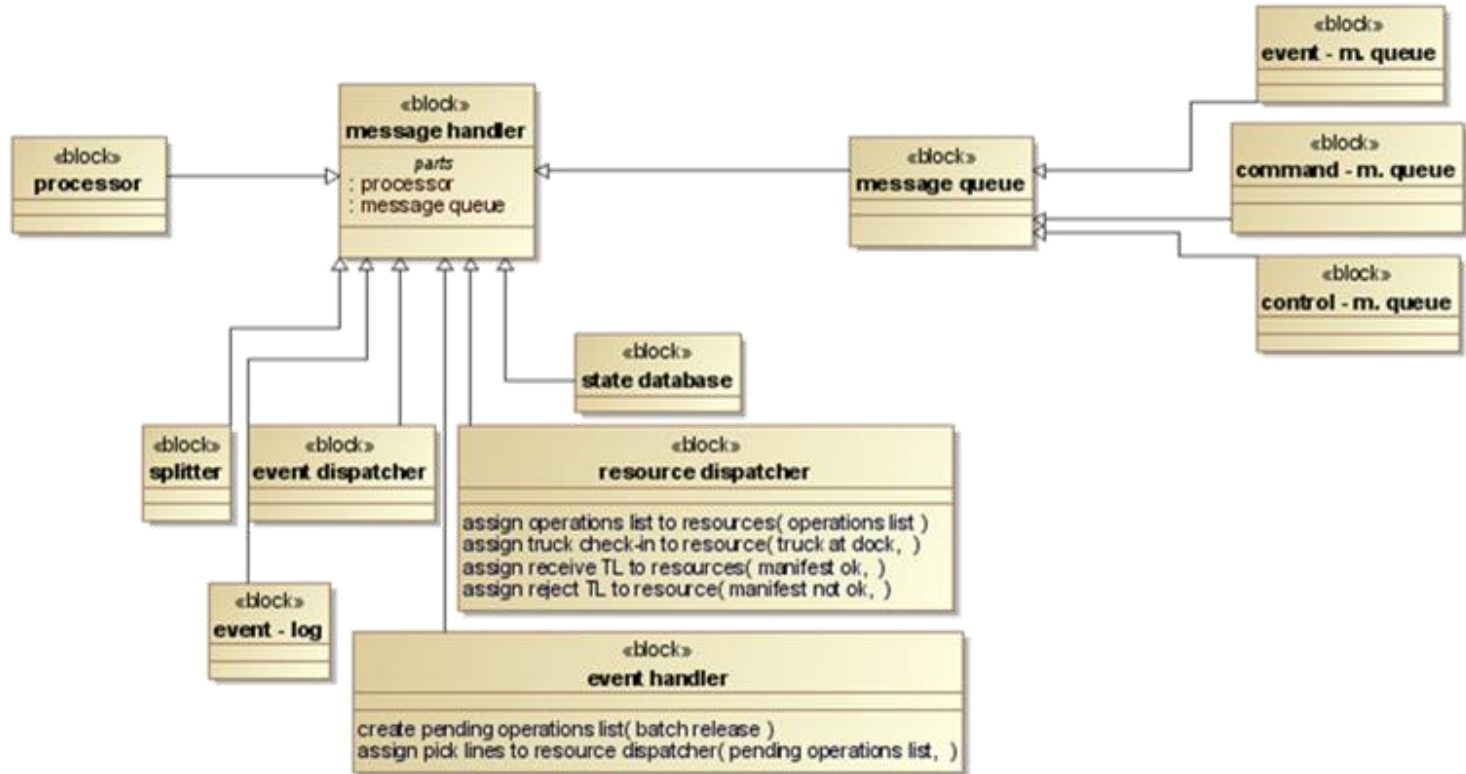
# Message

bdd [Block] message [  Message ]



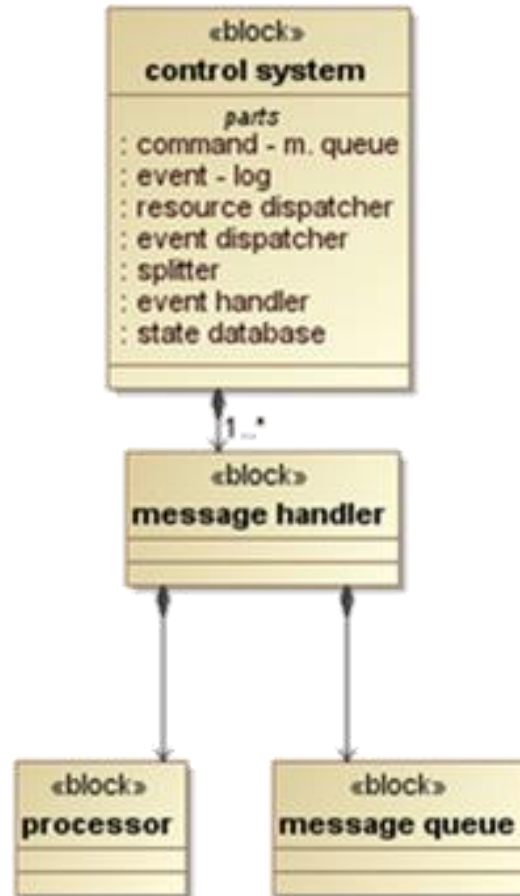
# Message handler

bdd [Block] control system[  message handler ]



# Control system

bdd [Block] control system [  control system ]



# Space

bdd [Model] Data [  Space ]

