Modeling Cross-Cutting Relationships with Allocations (Part 1 – SysML Concepts)

Section Objectives

- In this Section, you will learn:
  - Modeling Logical and Physical Systems Allocations with SysML

Overview

- This section will cover:
  - Overview of Using Allocation Relationships to Map Model Elements to Other Model Elements to Support Behavioral, Structural, and Other Forms of Allocation.
  - Notations with SysML to Represent the Allocation of One Model Element to Another.
  - Types of Allocation (Requirements, Behavior, Flow, Structure, and Properties).

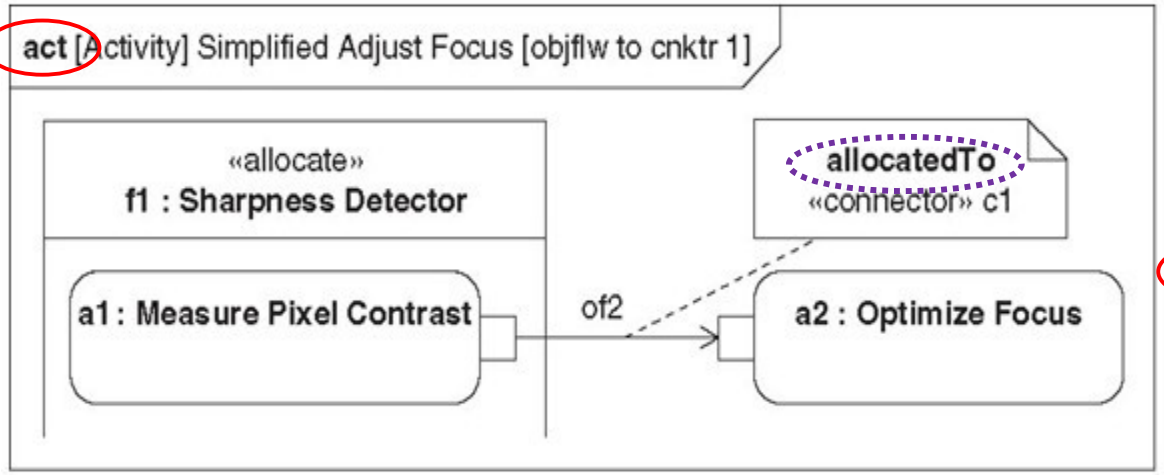
Why Model Allocations?

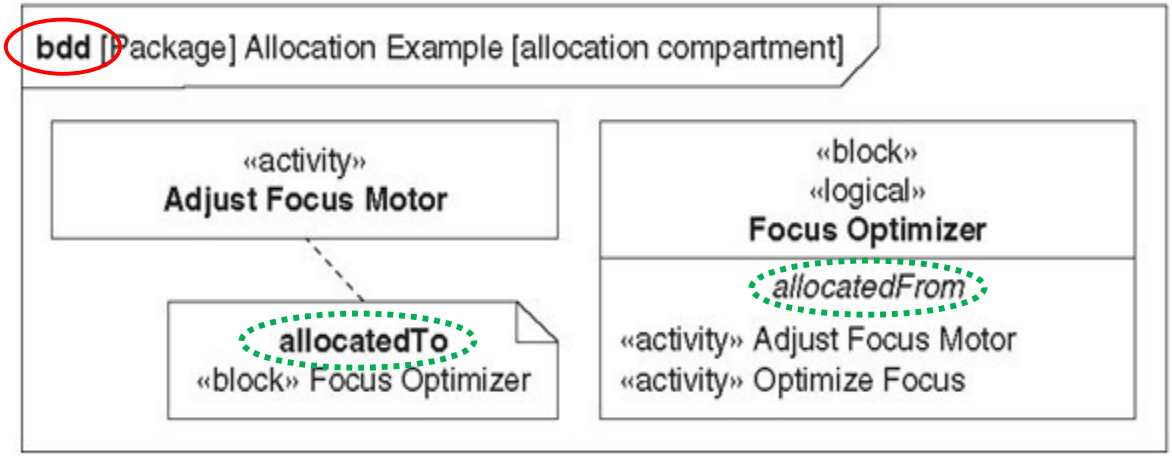
- Allocation can be used early on in MBSE to clearly and graphically represent mapping of system functions (logical structure) to system components (physical structure), including hardware to software.
- By applying Allocation between any pair of model elements, system designers can establish and enforce consistency between system logical and physical structures.
- SysML Allocation Tables capture and record for immediate analysis many kinds of Allocations
  - Requirements Allocation, Functional Allocation, Structural Allocation
  - Facilitates computer-assisted Independent Verification and Validation (IV&V) and Gap Analysis.

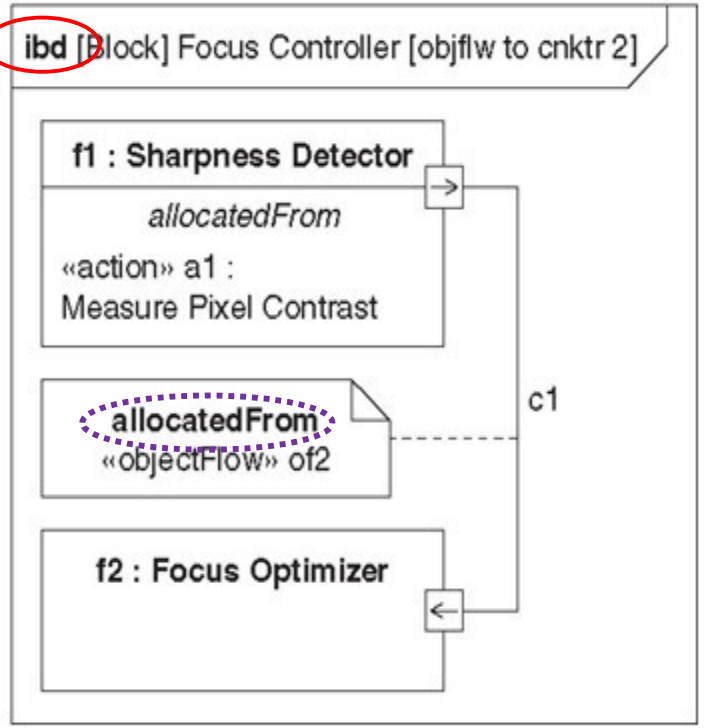
Allocation & Relationships

- Allocation: Relating/Mapping System Model Elements One to Another
- Allocation Relationships: Mapping Between Any Two Named Model Elements
- A Named Model Element is Allocated to (allocatedTo) or Allocated From (allocatedFrom) Other Model Elements.
  - May include user defined constraints
- Example: System Behavioral Allocation (or Functional Allocation)
  - Allocation of System Activities to Blocks
    - Each Block Implements a Particular Activity
  - Allocation of System Actions to Parts
    - Each Part Implements a Particular Action

Allocation & Relationships

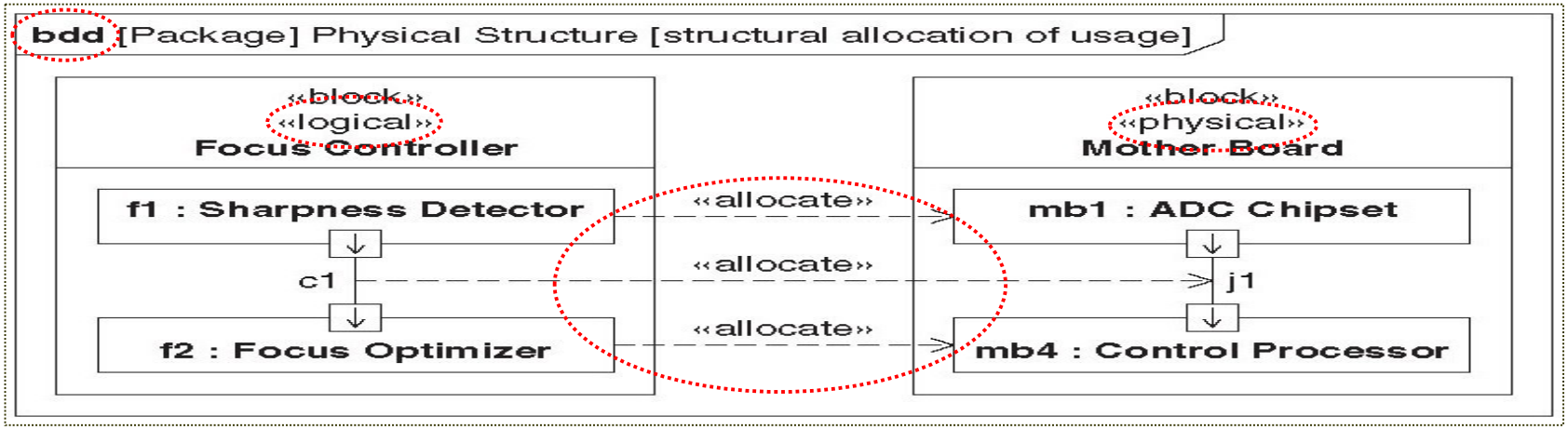






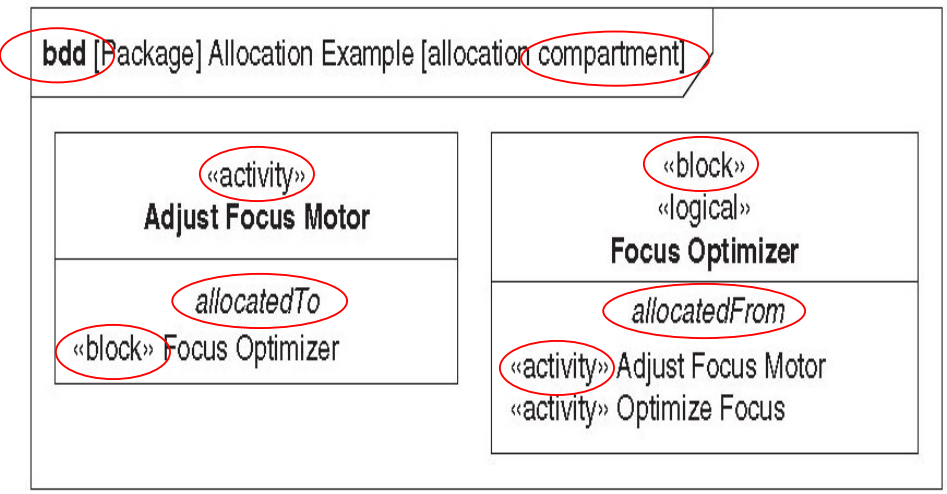
Allocation Notation

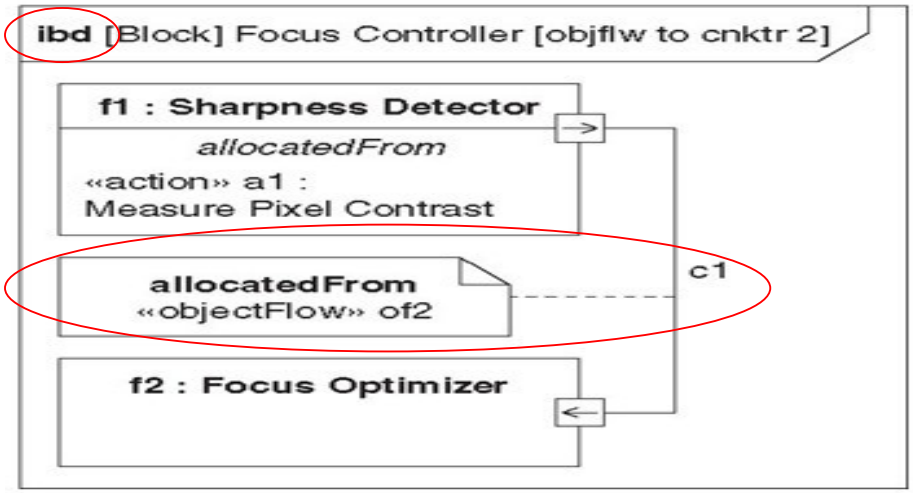
- Allocation Relationships Notation similar to Graphical and Tabular (Tables or Matrices) Notations for Requirements Relationships (Ch12)
- Graphical Allocation Relationships Notations:
  - Direct, Compartment, and Callout
- Graphical Allocation Relationships Direct Notation
  - Named Model Elements at both ends of Allocation Relationship can be shown on same diagram (ex. on same act, bdd, or ibd)



Allocation Notation

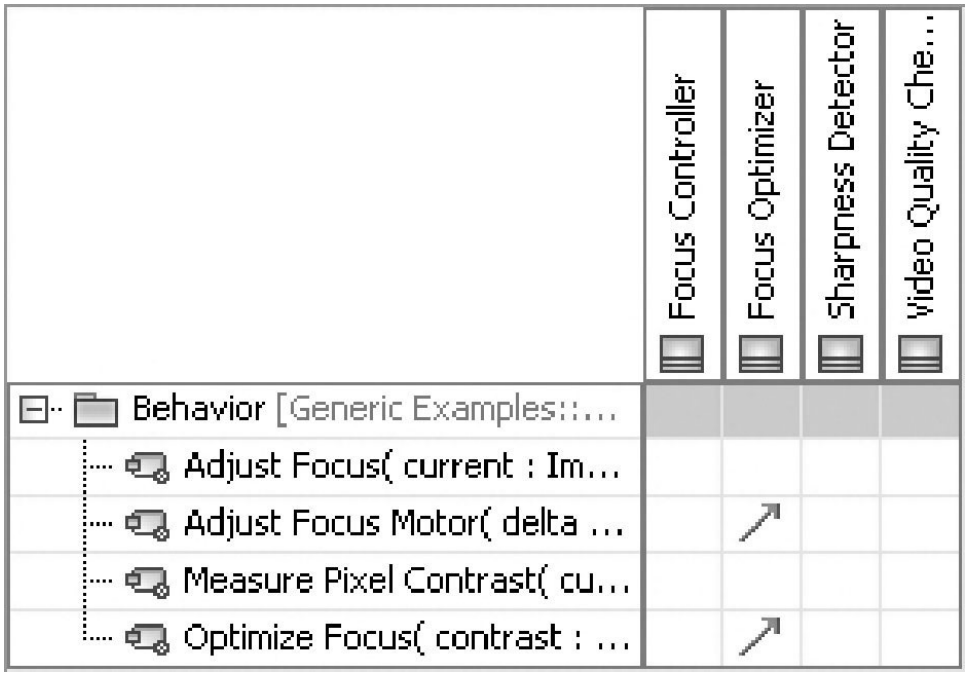
- Graphical Compartment Notation and Callout Notation
  - Used when Model Elements at either end of an Allocation Relationship are on different diagrams
    - Compartment Notation: Model Elements with compartments
      - Ex. Blocks and Parts – but not Connectors
    - Callout Notation: any Model Elements, including Connectors





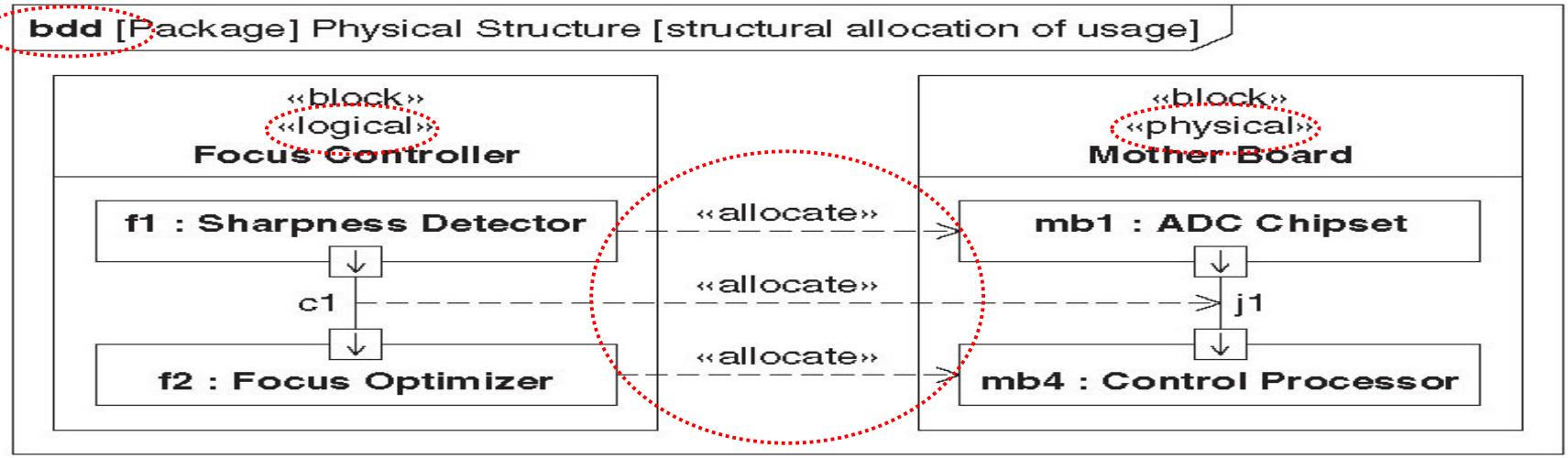
Allocation Notation

- Tabular (Table or Matrix) Notation: Multiple Allocation Relationships
  - Not specifically prescribed by SysML specification (Tools Vary)
  - Useful for concise, compact Allocations Representations



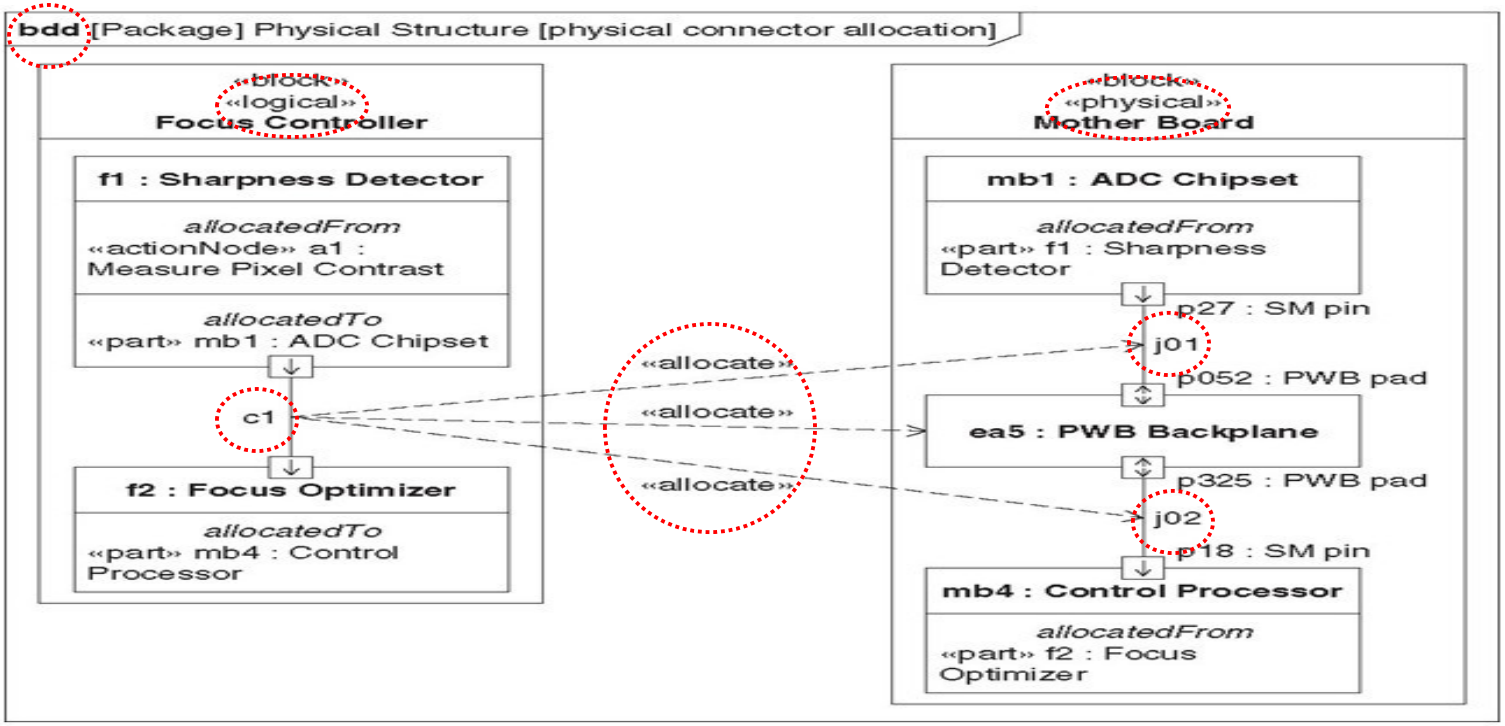
Modeling Allocation Between Independent Structural Hierarchies

- SysML provides a way to perform and analyze Allocations between Logical Structure Elements and Physical Structure Elements.
- This diagram shows the Parts and Connector of the logical block 'Focus Controller' allocated directly (i.e., all on same bdd) to the Parts and Connector of the physical block 'Mother Board'.

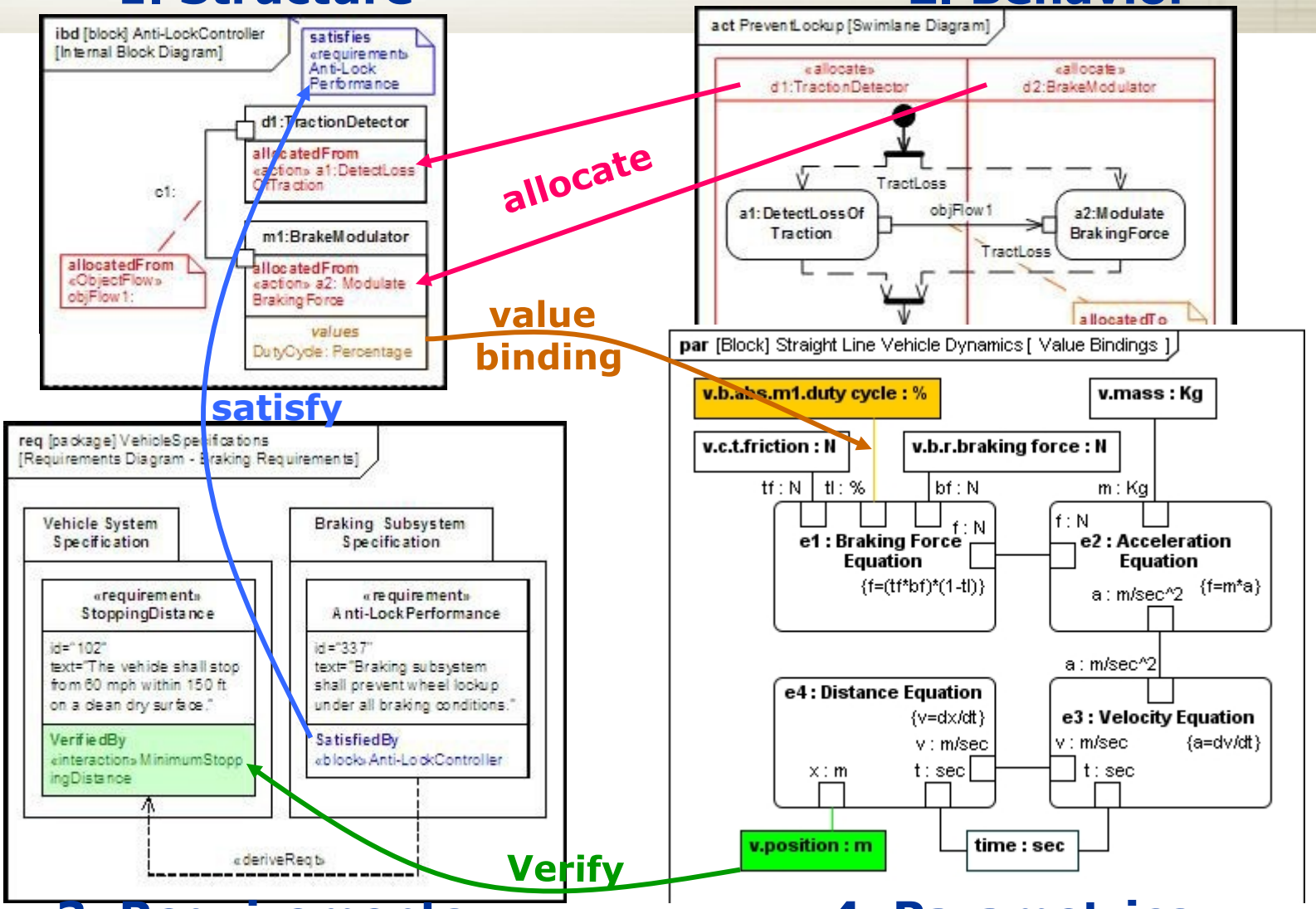


Allocating a Logical Connector to a Physical Structure

- A Part Connector depicted in a logical structure, may need to be allocated to multiple model elements in a system physical structure.
- SysML allows the Direct Allocation of a Connector in a logical structure (where implementation is not considered) to a physical Part, and its associated Connectors.



Cross Connecting Model Elements



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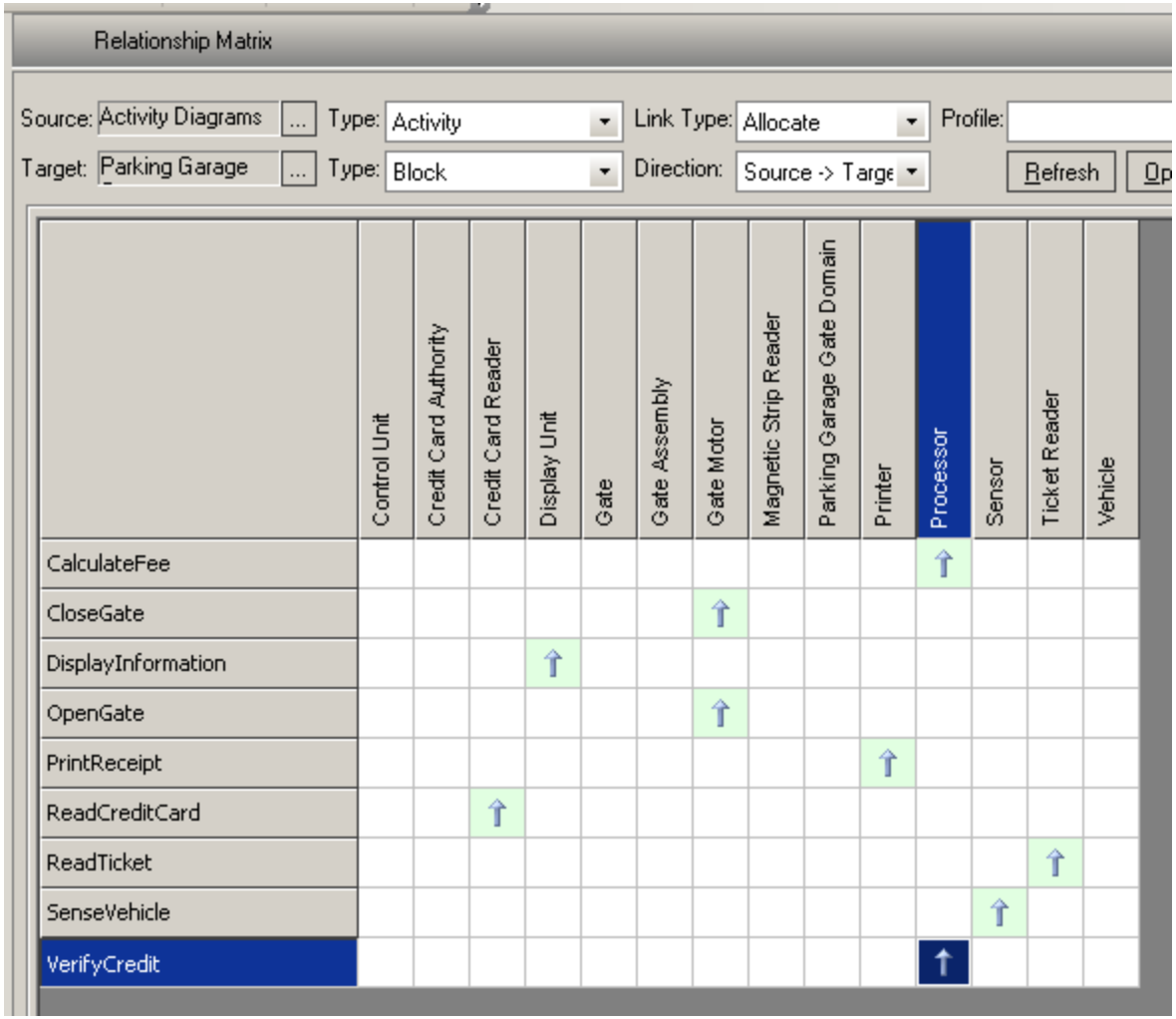
Functional Allocations for Parking Garage Gate



Summary

- Allocations are used to depict mapping of model elements to one another
- There are many types of allocation, including: behavior, structure, and properties
- Allocations allows:
  - Allocating activities to blocks
  - Allocating requirements to blocks
  - Allocating logical elements to physical elements
- Allocation can be represented graphically though the following notations: Direct, Compartment, and Callout
- Tabular representations offer a compact representation of multiple allocation relationships