Modeling Structure with Blocks - Internal Block Diagrams (Part 1 – SysML Concepts)

Content Developer

OBJECT MANAGEMENT GROUP • CERTIFICATION PROGRAM • OMG

Section Objectives

- In this Section, you will learn:
  - How to model Internal Block Diagrams (IBD) in SysML

Overview

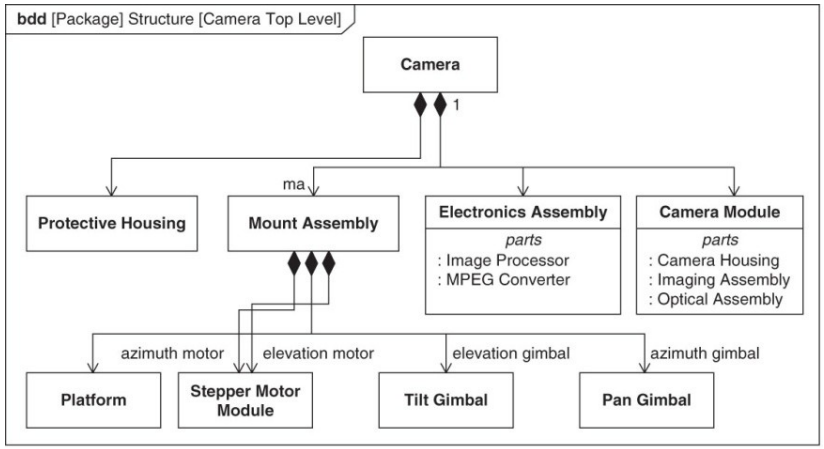
- This section will discuss:
  - Internal Block Diagram Concepts
    - Why Model Internal Block Diagrams
      - Modeling Parts and their Connectors on an IBD
      - Modeling Nested Parts and their Connectors on an IBD
      - Modeling References and their Connectors on an IBD
      - Modeling Flows between Parts on an IBD
      - Modeling Flow Ports and their Connectors on an IBD
      - Modeling Flows between Ports on an IBD
      - Modeling Standard Ports and their Connectors on an IBD
  - Modeling Internal Block Diagrams for In-Class Project

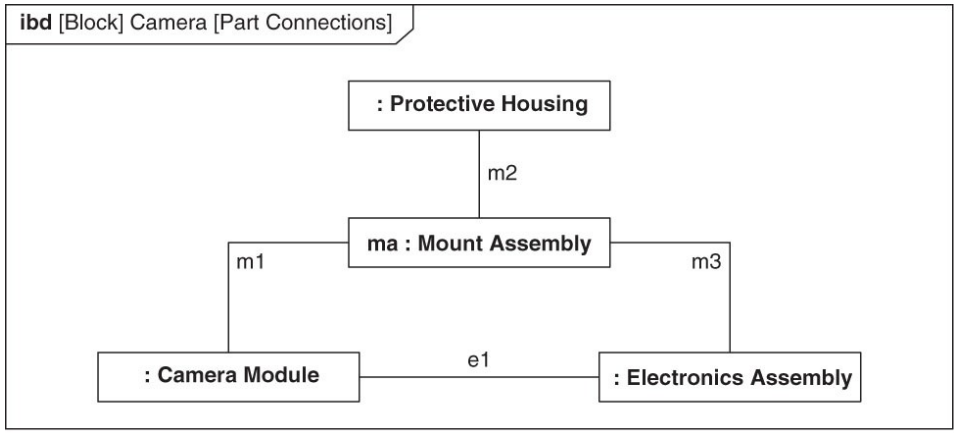
Why Model Internal Block Diagrams

- Internal Block Diagram – used to describe the internal structure of a block
  - Used to depict how parts and ports are connected
  - Used to depict what flows between parts and ports
- Note:
  - BDDs are used to define blocks
  - IBDs are used to depict usage of blocks in a context
  - Connections and flows are not depicted on BDDs but are on IBDs

Modeling Parts and their Connectors on an IBD

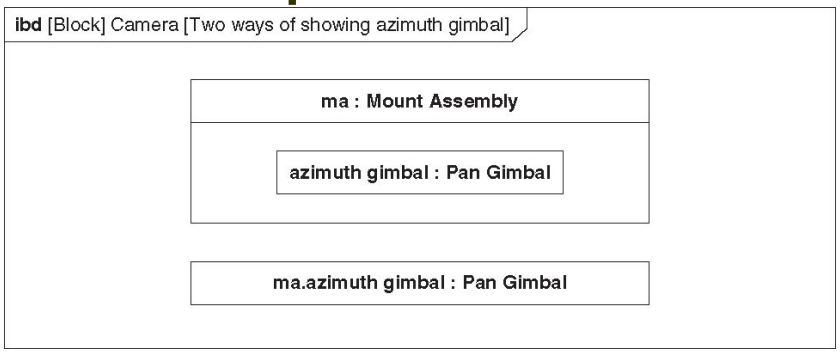
- Depicts the parts that comprise a block (corresponds to composite association on Block Definition Diagram)
- Frame of IBD represents enclosing block
- Depicts the connections between the parts of a block
- Ends of the connector may include multiplicity (default is 1)
- Connectors can be named to depict the type of connection



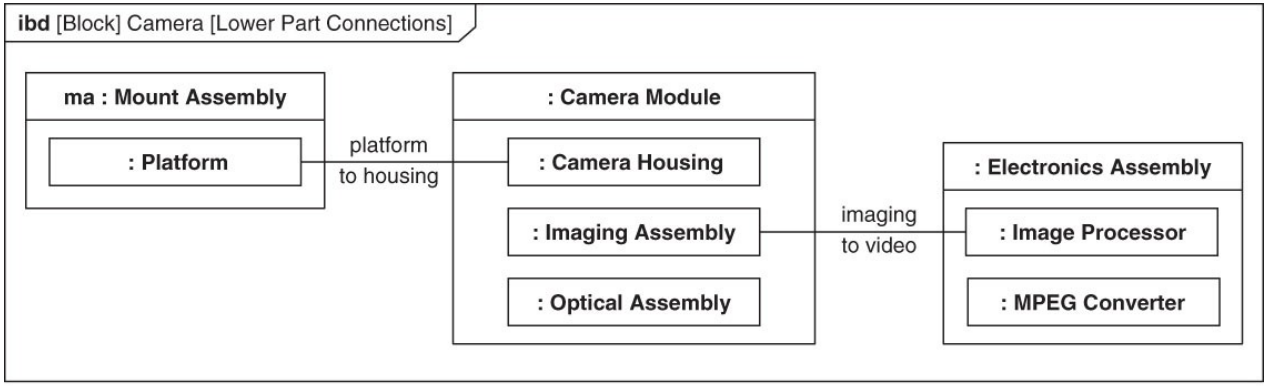


Modeling Nested Parts and their Connectors on an IBD

- Nested parts can be depicted with parts symbols within other parts
- Nested parts can also be depicted using 'dot' notation
  - Each level of nesting of the part is separated by a 'dot'
- Connectors can connect parts at different levels of nesting

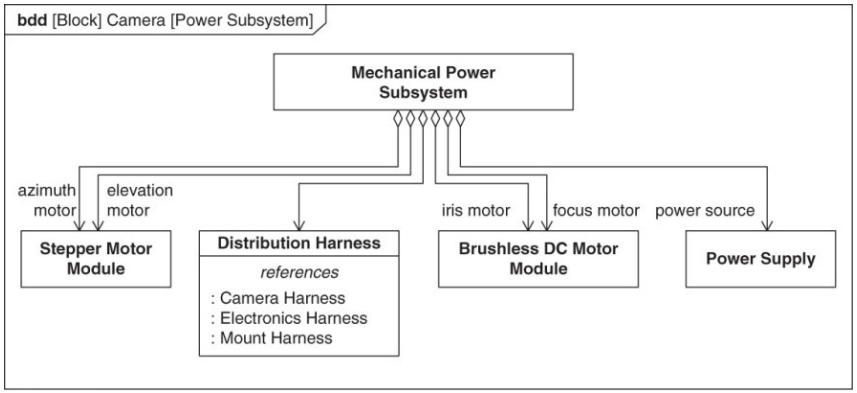


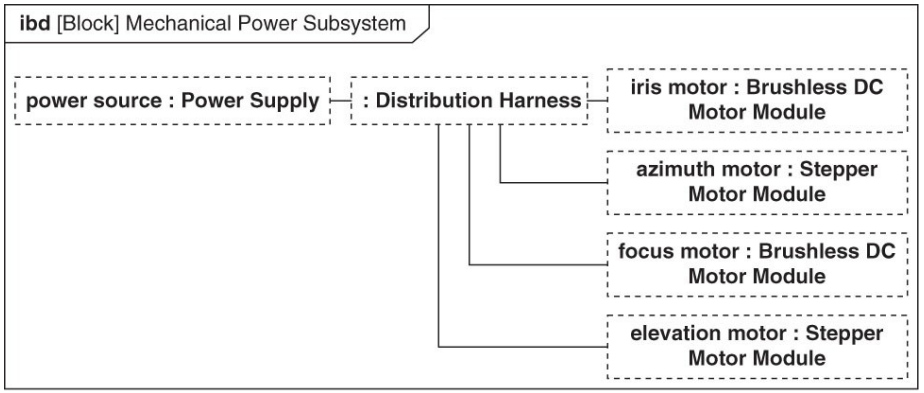
Note: This diagram demonstrates both a Nested rectangle and a Dot Notation to represent how the same part could be depicted to show a nested relationship. In practice, only one of these representations is needed.



Modeling References and their Connectors on an IBD

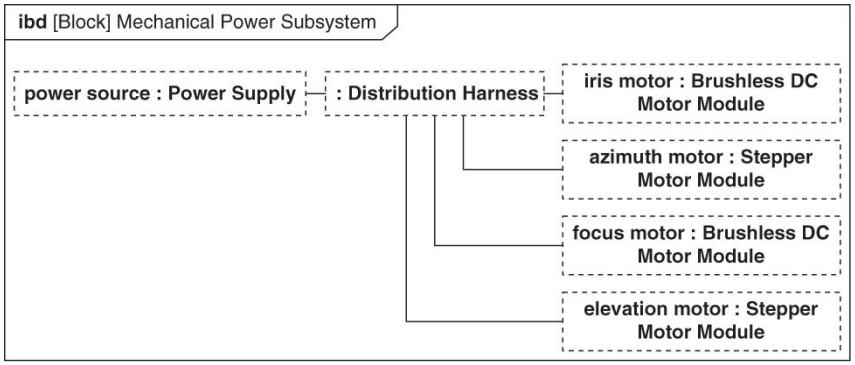
- Corresponds to Shared Association on Block Definition Diagram
- Frame of IBD represents enclosing block
- Reference properties are depicted with dashed boxes on an IBD

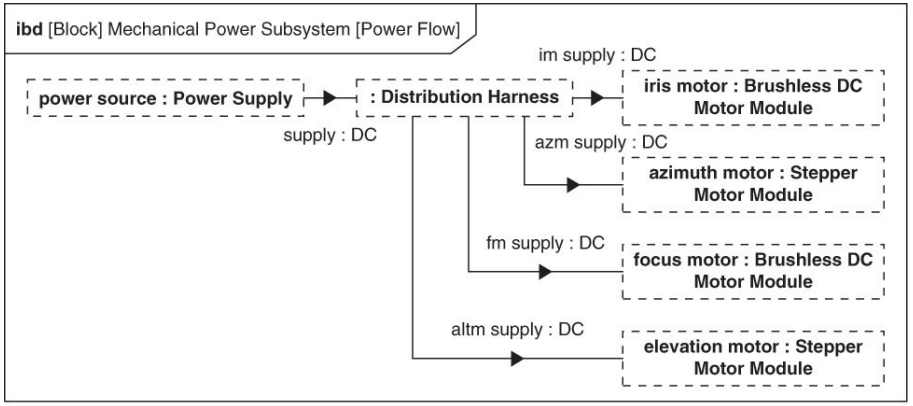




Modeling Flows between Parts on an IBD

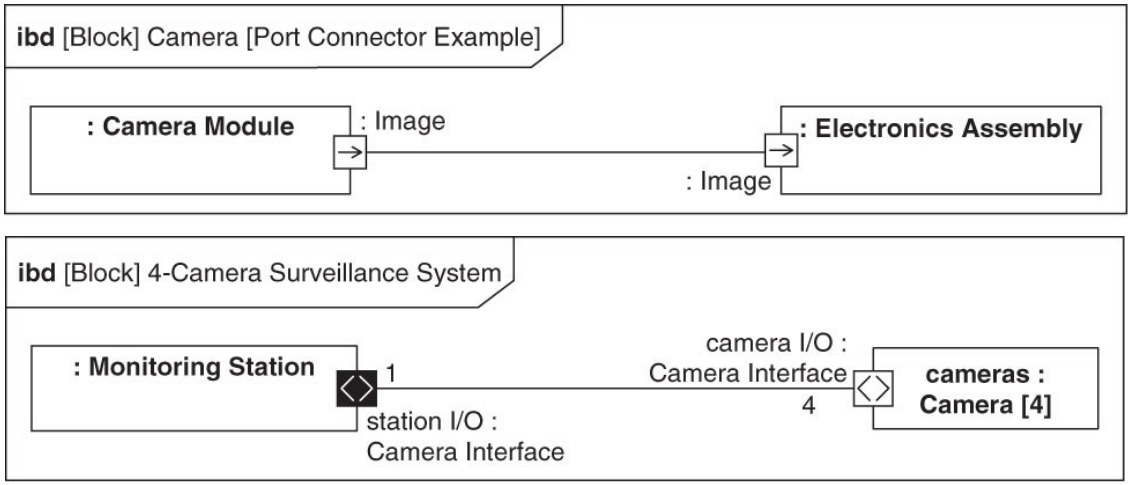
- An Item Flow is used to depict the items that flow across a connector
- Item Flows specify the type of item flowing and the direction and an optional item property to represent a particular usage of the type





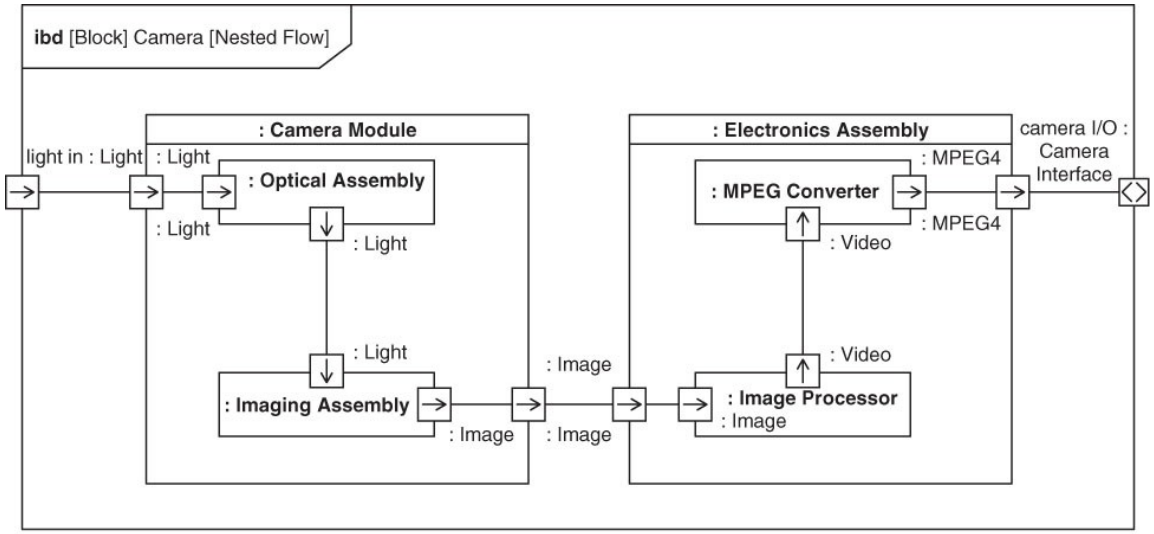
Modeling Flow Ports and their Connectors on an IBD

- Flow Ports are connection points that can relay flows
- Flow Ports must be compatible in type and direction in order to be connected:
  - Atomic flow ports must have matching types and the direction of one port is 'in' and the other is 'out', or both are 'inout'
  - Nonatomic flow ports must have matching flow specifications and one flow port is the conjugate of the other



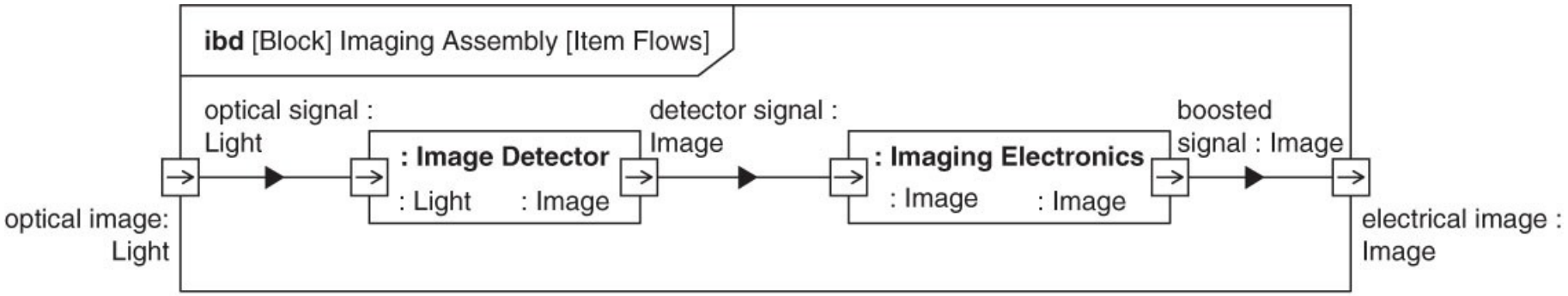
Modeling Ports and their Connectors on an IBD (cont'd)

- Delegation Ports: used when a block delegates the port interactions to a part
- Delegation Ports are connected on an IBD with a Delegation connector
- Delegation Ports must be compatible in type and direction in order to be connected:
  - Atomic flow ports must have matching types and their directions match
  - Nonatomic flow ports must have matching flow specifications and either both are conjugate or neither are conjugate



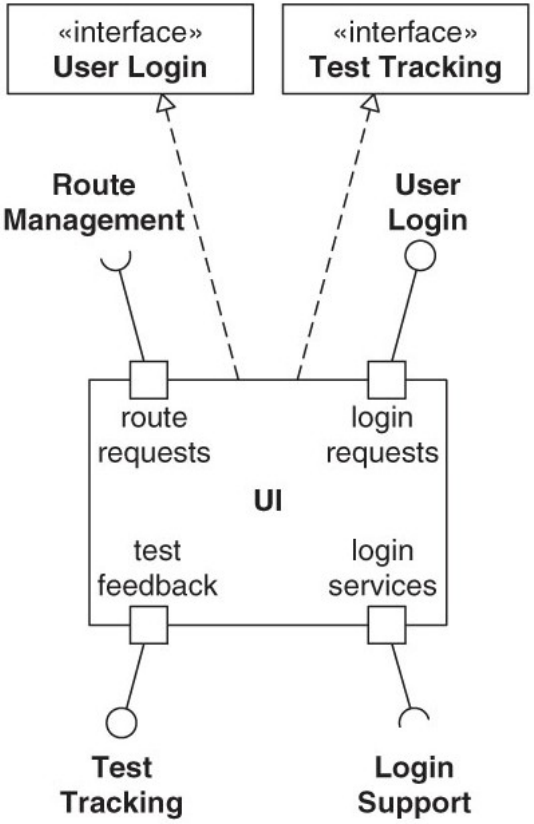
Modeling Flows between Ports on an IBD

- An Item Flow is also used to depict the items that flow across a connector between flow ports
- Item Flows must be compatible in type with the associated flow ports



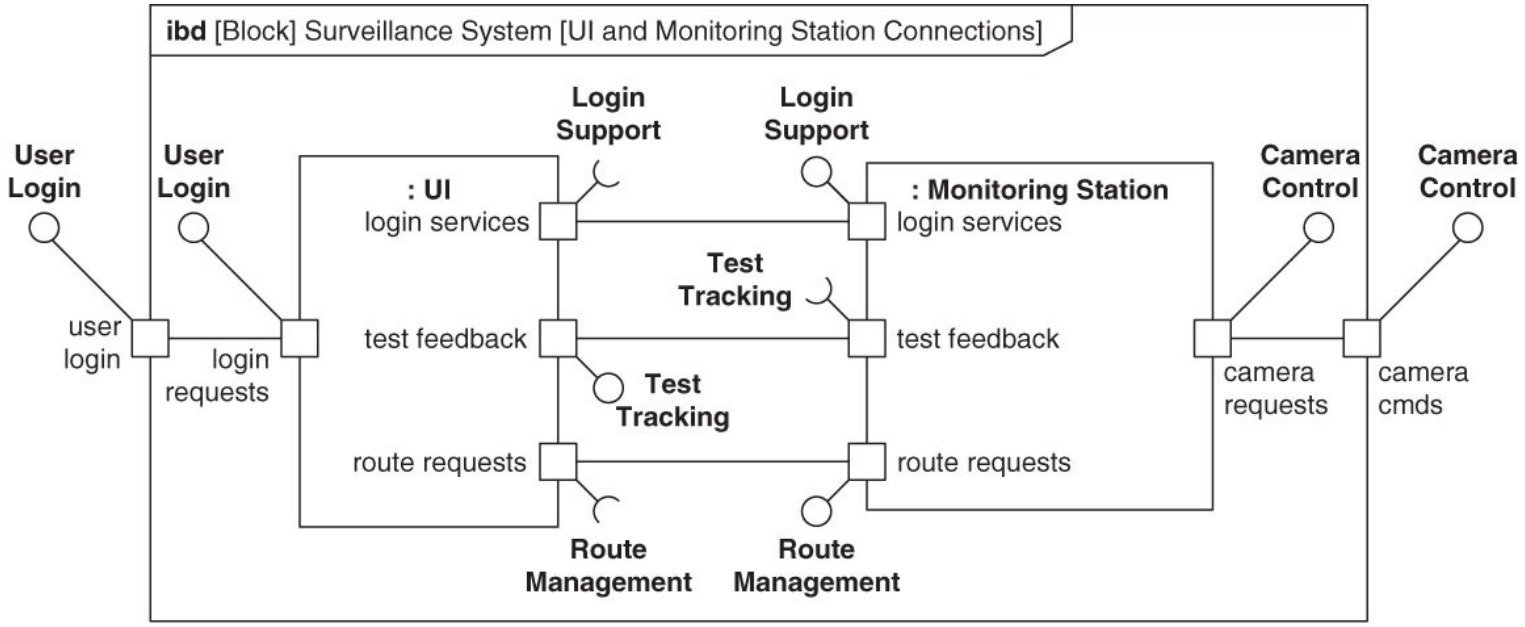
Standard Ports

- Standard Ports – depict interfaces that specify the behavioral features (services) that a block either provides or requires



Modeling Standard Ports and their Connectors on an IBD

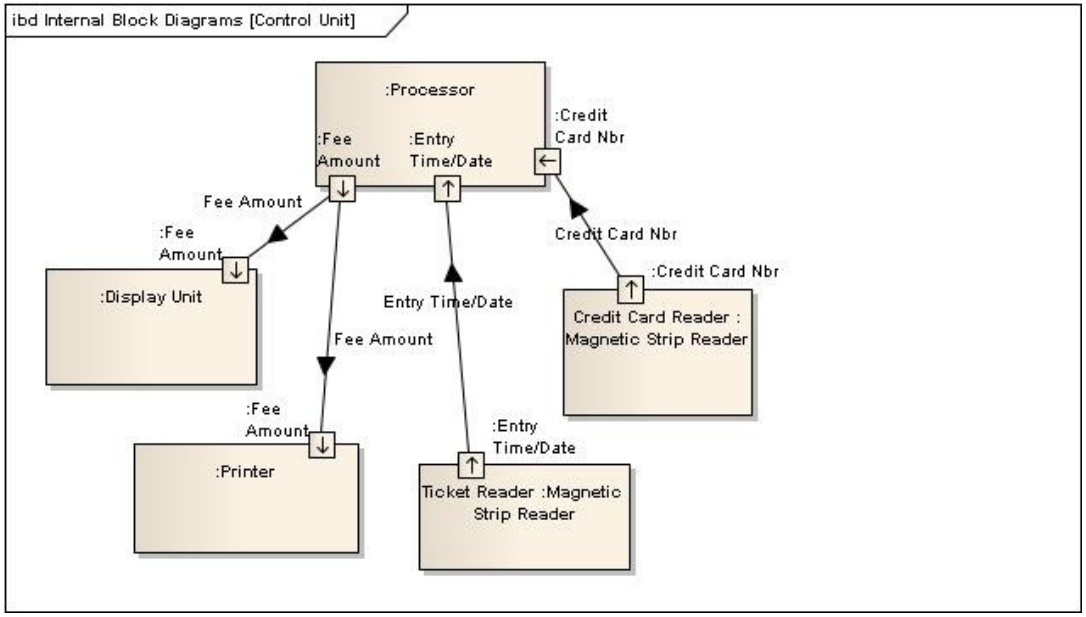
- Standard ports specify interactions as services
  - Required interface specifies requests for services (socket symbol)
  - Provided interface specifies provided services (ball symbol)

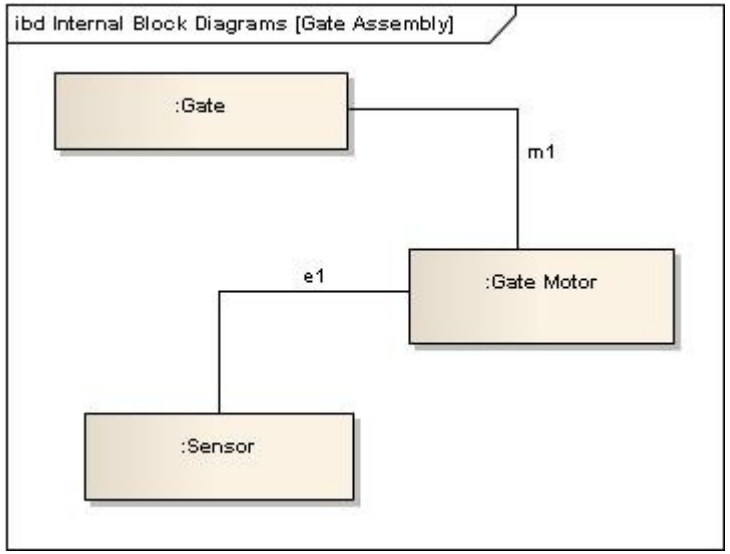


Modeling Structure for In-Class Project

- Create an Internal Block Diagram in EA for the Parking Garage Gate Project
  - Depict Parts in an IBD
  - Depict connectors between Parts
  - Depict Item Flows between Parts

Internal Block Diagram for Gate System





Summary

- Internal Block Diagrams are used to depict the internal structure of a block
- The Frame of an IBD represents the enclosing Block
- Internal Block Diagrams depict:
  - The usage of a block in a specific context
  - How parts are connected
  - How ports are connected
  - What flows between parts
  - What flows between ports
- Standard ports are used on an IBD to depict interfaces that specify the behavioral features (services) that a block either provides or requires