SYSML17-185 Resolution Document INITAL DRAFT

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1 Model Identification

Document generated using DocGen from:

- twc.openmbee.org::omg-org::SysML 1.x Specification
- branch = Annex D Update
- commit# 1129
- date 08 February 2022

2 Purpose

This document is intended to describe the proposed changes to Annex D (sample problem) intended to be incorporated into SysML 1.7. These changes are the result of developing, for the first time, and integrated model representing the sample problem.

3 Scope

This document is intended to provide a set of revised figures generated directly from the new integrated Annex D model, the status of each section of the model represented by the figures, comments on why or how the figure was changed from the previous (1.6) version, and linkage to any open JIRA issues that each figure in intended to address.

This document does not directly replace Annex D in the SysML 1.6 specification. An additional document will need to be generated for that purpose. This document is for review and understanding only.

4 Description of Sample Problem Integrated Model

4.1 Model Overview

This model is intended to illustrate a broad practical use of SysML. The subject of a Hybrid Sport Utility Vehicle has been continuously used and updated since SysML 1.0, and its use as an example problem still seems to be valid.

4.2 List of Figures in Annex D

Table 1. List of Figures in Annex D

Id	Text	Trace To	Status	Comments
1.7-D.41	Special Case of Internal Block Diagram Showing Reference to Specific Properties (serial numbers)		DONE. Used bdd (instance diagram), not ibd!! Cross check with instance table, or build new hierarchal instance table.	
1.7-D.40	Tabular Representation of Allocation from "Accelerate" Behavior Model to Power Subsystem (Table)		**DONE**. RTF determination to leave as is, a nominal example of normal table generation.	
1.7-D.39	Flow Allocation to Power Subsystem (Internal Block Diagram)		DONE .new CAN bus interfaces, more explicit allocation. review & hide comments.	
1.7-D.38	Detailed Behavior Model for "Provide Power" (Activity Diagram)		DONE. use swimlane version. review & hide comments.	
1.7-D.37	Decomposition of "Accelerate" Function (Block Definition diagram)		**DONE**. review & hide comments.	
1.7-D.36	Behavior Model for "Accelerate" Function (Activity Diagram)		**DONE**. Note change in format. review & hide comments.	
1.7-D.35	Results of Maximum Acceleration Analysis (Timing Diagram)		**DONE.** This is not intended to be a SysML diagram of any kind.	
1.7-D.34	Defining Straight-Line Vehicle Dynamics Mathematical Constraints (Block Definition Diagram)		DONE. NEEDS REVIEW! review comments, cleanup layout.	
1.7-D.33	Straight Line Vehicle Dynamics Mathematical Model (Parametric Diagram)		**DONE**. review & hide comments.	
1.7-D.32	Establishing Mathematical Relationships for Fuel Economy Calculations (Parametric Diagram)		DONE. review & hide comments.	
1.7-D.31	Defining Measures of Effectiveness and Key Relationships (Parametric Diagram)		**DONE**. review & hide comments.	
1.7-D.30	The Requirements and VnV views with supporting views (Package Diagram)		**DONE.** Changed to hierarchical layout (bdd style)	
1.7-D.29	Requirements and VnV views exposing elements from the model (Package Diagram)		**DRAFT**. Updated to be consistent with model.	
1.7-D.28	Defining Requirements and VnV viewpoints (Package Diagram)		**DRAFT**. Minor update to be consistent with model.	
1.7-D.27	Performance View		**DRAFT**. New layout.	
1.7-D.26	Defining Analyses for Hybrid SUV Engineering Development (Block Definition Diagram)		**DONE**. minor issues, see comments.	
1.7-D.25	Detailed Internal Structure of Fuel Delivery Subsystem (Internal Block Diagram)		**DRAFT**	

Id	Text	Trace To	Status	Comments
1.7-D.24	Defining Fuel Flow Constraints (Parametric Diagram)		**DRAFT**. Changed fuel tank flow rate value property to better context.	
1.7-D.23	Elaborating Definition of Fuel Flow. (Block Definition Diagram)		**Done**. Added new Petroleum which inherits from the fuel block. Question on Fuel Flow Direction & Proxy Port P1. Turn off redundant symbology, refine layout.	
1.7-D.22	Consolidating Connectors into the CAN Bus. (Internal Block Diagram)		**DONE**. Changed to incorporate updated CAN bus interface definition.	
1.7-D.21	Initially Defining Port Types with Flow Properties for the CAN Bus (Block Definition Diagram)		**DRAFT**. MAJOR CHANGE/update focused on CAN interface spec, based on SAE & ISO references.	
1.7-D.20	Blocks Typing Ports in the Power Subsystem (Block Definition Diagram)		**DRAFT.** Deleted "lollipop" UML «interface» use, refocused on nested proxy ports (and conjugate proxy ports) with signals as flow properties. All related diagrams with "x" in name should be deleted, provided here only for continuity.	
1.7-D.19	Internal Structure of the Power Subsystem (Internal Block Diagram)		**DRAFT**: Removed UML «interface» from interface blocks typing PCU ports... see D.20 for details.	
1.7-D.18	Defining Structure of Power Subsystem (Block Definition Diagram)		**DONE.**	
1.7-D.17	Internal Structure of Hybrid SUV (Internal Block Diagram)		**DONE**.	
1.7-D.16	Defining Structure of the Hybrid SUV System (Block Definition Diagram)		**DONE**.	
1.7-D.15	Defining the Automotive Domain - (Block Definition Diagram)		**DONE**.	
1.7-D.14	Requirements Relationships Expressed in Tabular Format (Table)		**DONE.**	
1.7-D.13	Acceleration Requirement Relationships (Requirements Diagram)		**DONE**.	
1.7-D.12	Establishing Derived Requirements and Rationale from Lowest Tier of Requirements Hierarchy (Requirements Diagram)		**DONE.**	
1.7-D.11	Establishing HSUV Requirements Hierarchy (containment) - (Requirements Diagram)		**DONE**.	
1.7-D.10	White Box Interaction for “StartVehicle” (Sequence Diagram)		**DONE**.	
1.7-D.9	Black Box Interaction for “StartVehicle,” referencing White Box Interaction (Sequence Diagram)		**DONE**	
1.7-D.8	HSUVOperationalStates		**DONE**.	
1.7-D.7	Elaborating Black Box Behavior for the “Drive the Vehicle” Use Case (Sequence Diagram)		**DRAFT** Could use OCL review.	

Id	Text	Trace To	Status	Comments
1.7-D.6	Establishing Operational Use Cases for “Drive the Vehicle” (Use Case Diagram)		**DONE.**	
1.7-D.5	Establishing Top Level Use Cases for the Hybrid SUV (Use Case Diagram)		DONE.	
1.7-D.4	Establishing the Context of the Hybrid SUV System using a User-Defined Context Diagram. (Internal Block Diagram) Completeness of Diagram Noted in Diagram Description		**DONE.**	
1.7-D.3	Establishing Structure of the User Model using 916562e6-8766-439a-9911-22abb7bfed7c and Views (Package Diagram)		DONE. Updated for view/viewpoint modifications.	
1.7-D.2	Defining value Types and units to be used in the Sample Problem		DONE.	
1.7-D.1	Establishing the User Model by importing and applying SysML Profile & Model Library (Package Diagram)		DONE	

4.3 List of Related Open Issues against SysML 1.7

Table 2. List of Related Issues

Name	Diagram Number	Summary	Resolved?	Description
SYSML17-12	1.7-D.27	Sample problem: Parts are added directly into package	true	Parts are added directly into package. B27 - > element that is a part is displayed inside of a package >
SYSML17-21	1.7-D.27	Annex B / Figure B27	true	Figure B.27: > Package "steals ownership" of MOEs, Actor, UseCase and Requirement Severity Critical since there is currently no sensible way to implement > in tools ! In Figure B.27 - Establishing a Performance View of the User Model It is not at all clear how the MOEs, Actor, UseCase and requirement should be shown as directly within the view without the view package "stealing ownership". Appears to break constraint: '7.3.2.4 View [1] A view can only own element import, package import, comment, and constraint elements.' See also example images in Magicdraw UML SysML Plugin at: «web reference deleted» «web reference deleted» Note that this relates to:: Issue 11500: > as Package extension is very bad idea (sysml-rtf), No Magic, Inc. (Mr. Nerijus Jankevicius, nerijus@magicdraw.com nerijus@nomagic.com) ' > as Package extension is very bad idea. Package is used for ownership, so it is not possible to show the same elements in different packages (as different point of view)'
SYSML17-22	1.7-D.36	Annex B / Figure B.35	true	Figure B.35: prefer > pins over contrived placement of ObjectNodes on border of swimlanes Placement of ObjectNodes on boundaries of swimlanes is contrived and graphically unstable. Prefer typed output/input Pin pairs on CallBehaviorActions corresponding to Parameters. TODO: alternative diagram with pins for resolution. See also: «web reference deleted» «web reference deleted»

Name	Diagram Number	Summary	Resolved?	Description
SYSML17-23	1.7-D.18 1.7-D.41	Annex B / Figure B.38	false	Figure B.38: property names of p:[PowerSubsystem] inconsistent w.r.t. other figures Figure B.38 gives p:[PowerSubsystem] with parts: em: [ElectricMotor] t: [Transmission] ice: [InternalCombustionEngine] Figure 9.3 shows PowerSubsystem with parts: trsm: Transmission ice: InternalCombustionEngine (ecu:PowerControlUnit) (epc: ElectricalPowerController) Figure 9.6 IBD shows PowerSubsystem with parts: trsm: Transmission ice: InternalCombustionEngine (ecu:PowerControlUnit) (epc: ElectricalPowerController) Figure 15.10 IBD shows PowerSubsystem with parts: trsm: Transmission ice: InternalCombustionEngine emg:ElectricalMotorGenerator (ecu:PowerControlUnit) (epc: ElectricalPowerController) (can:CAN_Bus) Figure B.18 BDD shows PowerSubsystem with parts: trsm: Transmission ice: InternalCombustionEngine em: ElectricalMotorGenerator pcu:PowerControlUnit (epc: ElectricalPowerController) .. For consistency Figure B.38 should show p:[PowerSubsystem] with parts: emg: [ElectricMotor] (not 'em') trsm: [Transmission] (not 't') ice: [InternalCombustionEngine] Also, Figure B.18 should show PowerSubsystem with part: ecu:PowerControlUnit Visit also analysis at: http://school.nomagicasia.com/node/149 Update 03/25/2019: Added newlines for readability
SYSML17-24	1.7-D.32 1.7-D.26	Annex B, Figure B.29	true	In Figure B.29 'delta-t' is shown with solid-line (AggregationKind 'composite'), it should be shown with a dashed line (AggregationKind 'none') to be consistent with Figure B.26 BDD for EconomyContext.
SYSML17-25	1.7-D.37 1.7-D.38	Figure B.34 and Figure B.35	true	FigureB34 shows an Activity decomposition with: * an «activity» ControlElectricPower owning part Property 'elecDrivePower:ElecPower'. * an «activity» ProvideElectricPower without any owned part Properties. FigureB35 shows: * an Action 'a3:ControlElectricPower' with outgoing ObjectFlow to ObjectNode '«continuous» driveCurrent' * an Action 'a4:ProvideElectricPower' with outgoing ObjectFlow to ObjectNode '«continuous» elecDrivPower' The translation of ObjectFlows in FigureB35 to part Properties in the Activity decomposition FigureB34 is thus inconsistent. Update: 03/25/2019, added newlines for easier reading
SYSML17-60	1.7-D.4	Where have stereotypes been defined?	true	in some figures of the examples provided in Annex, some stereotypes are displayed: >, >, >, … and so on. Can someone tell me where these stereotypes have been defined?
SYSML17-61	1.7-D.33 1.7-D.34	parameter of the constraint block StraightLineVehicleDynamics shown in figure B.31 seems to be incomplete	true	the parameter of the constraint block StraightLineVehicleDynamics shown in figure B.31 seems to be incomplete w.r.t. to figure B.30. Is it ok?

Name	Diagram Number	Summary	Resolved?	Description
SYSML17-63	1.7-D.13	TestCase should use PackageMerge	false	The stereotype «TestCase» is primarily specified in the UML Testing Profile (UTP) and should not be defined by SysML redundantly (or even inconsistently). Rather it should be separated in a dedicated package in SysML and a PackageMerge be specified. This would properly add the properties of a «TestCase» specified in SysML to the "base" «TestCase» specified in UTP.
SYSML17-93	1.7-D.40 1.7-D.38 1.7-D.39	Don't use the optional notation for Pins with Allocation	true	Figure C.35 uses the optional notation for Pins (i.e. ->[]-> instead of []->[]). The allocation callout note is anchored to the object node symbol which makes it ambiguous as to which dictionary item(s) are being allocated. It could be one of the following: + the origin and destination pins + the object flow + the common type of the pins Since it's unclear what is being allocated, it would make more sense to show the Pins on the diagram and link the callout note to the relevant item(s) (I believe it's supposed to go to the ObjectFlow).
SYSML17-94	1.7-D.40 1.7-D.39 1.7-D.38	Diagram show inconsistent data	true	Diagrams C.35, C.36 and C.37 show inconsistent allocation between the displayed items, yet the text would seem to imply that they're supposed to show the same relationships. In C.35, the allocation is from an ObjectNode symbol called "DriveCurrent" (which I believe equates to an ObjectFlow - name unknown) to an ItemFlow called "i1". In C.36, the allocation is from an ObjectNode called "DriveCurrent" to a Connector (name unknown). In C.37, the allocation is from an ObjectFlow called "o6" to a Connector called "epc-emg.1". There are a number of issues: 1. ObjectNode is an abstract specialization of ActivityNode and as such you can't have any instances of them in a model. Any reference to an ObjectNode should be removed. 2. The allocation should consistently be from ObjectFlow "o6" to either ItemFlow "i1" or Connector "epc-emg.1". 3. In order to make it clear that the same items are being related, the names of the ObjectFlow and the Connector/ItemFlow should be shown on all diagrams. Currently the ObjectFlow and the Connector names are not shown.
SYSML17-173	1.7-D.25	Combined call-out notation not allowed	true	Figure D.25 depicts a allocate call-out notation that represents more than one call-out relationship. I don't think that it is allowed.

Name	Diagram Number	Summary	Resolved?	Description
SYSML17-185	1.7-D.19 1.7-D.23 1.7-D.38 1.7-D.26 1.7-D.36 1.7-D.39 1.7-D.11 1.7-D.33 1.7-D.4 1.7-D.35 1.7-D.29 1.7-D.25 1.7-D.32 1.7-D.15 1.7-D.24 1.7-D.40 1.7-D.9 1.7-D.10 1.7-D.20 1.7-D.8 1.7-D.28 1.7-D.37 1.7-D.6 1.7-D.12 1.7-D.2 1.7-D.31 1.7-D.21 1.7-D.5 1.7-D.3 1.7-D.7 1.7-D.14 1.7-D.34 1.7-D.1 1.7-D.27 1.7-D.13 1.7-D.17 1.7-D.16 1.7-D.30 1.7-D.41 1.7-D.18 1.7-D.22	Sample problem diagrams are inconsistent, need to refactor from integrated model	true	The diagrams in Annex D are in many ways inconsistent with each other. Fixing existing issues with each individual diagram will tend to make this problem worse, instead of better. For consistency's sake, the set of diagrams in Annex D needs to be generated from an integrated model as existing issues are addressed.
SYSML17-225		SYSML17-94 Update diagrams based on integrated example model		(placeholder for Marlin Ballard to fill in details)
SYSML17-226		SYSML17-93 Update diagrams based on integrated example model		This issue will be resolved by SYSML17-225, the resolution to SYSML17-94. (Placeholder for Marlin Ballard)

5 Annex D Figures

5.1 Figure 01

5.1.1 Figure Number

1.7-D.1

5.1.2 Figure Name

Establishing the User Model by importing and applying SysML Profile & Model Library (Package Diagram)

5.1.3 Figure Diagram

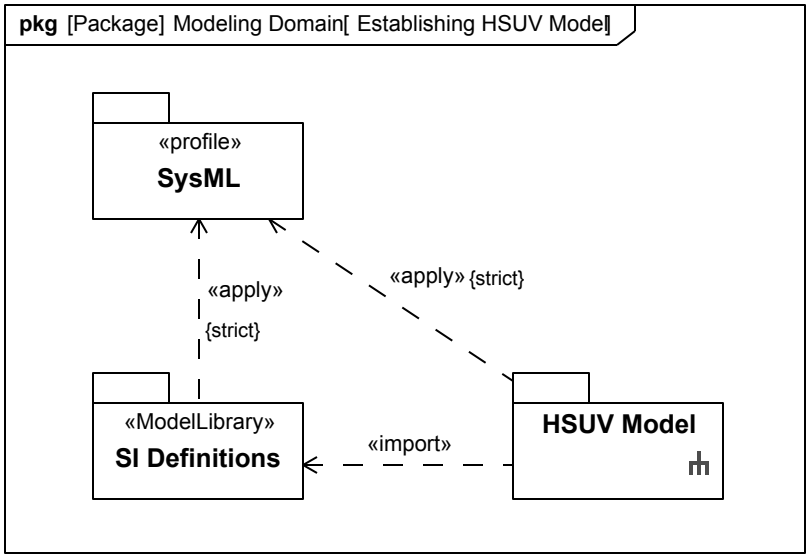


Figure 1. Establishing HSUV Model

5.1.4 Status

DONE

5.2 Figure 02

5.2.1 Figure Number

1.7-D.2

5.2.2 Figure Name

Defining value Types and units to be used in the Sample Problem

5.2.3 Figure Diagram

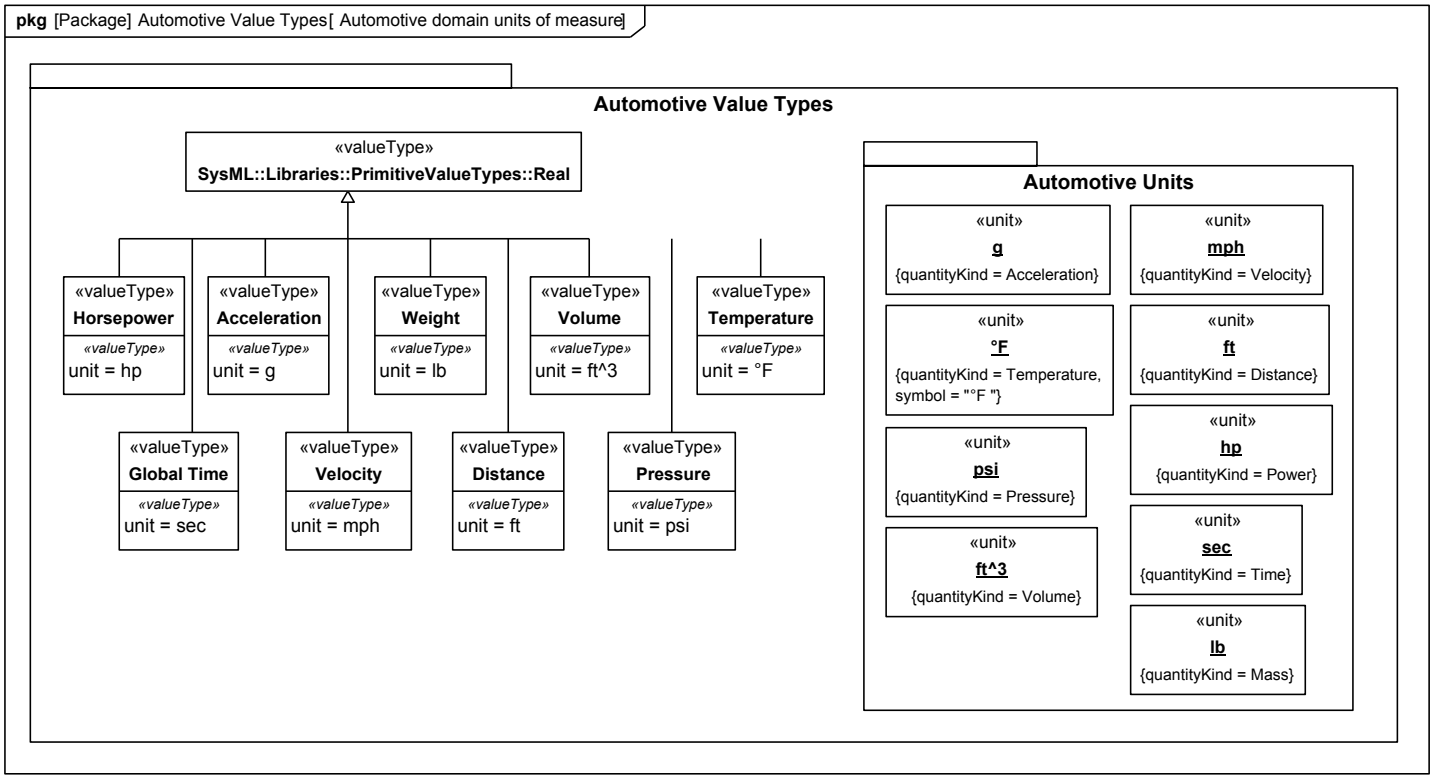


Figure 2. Automotive domain units of measure

5.2.4 Status

DONE.

5.3 Figure 03

5.3.1 Figure Number

1.7-D.3

5.3.2 Figure Name

Establishing Structure of the User Model using 916562e6-8766-439a-9911-22abb7bfed7c and Views (Package Diagram)

5.3.3 Figure Diagram

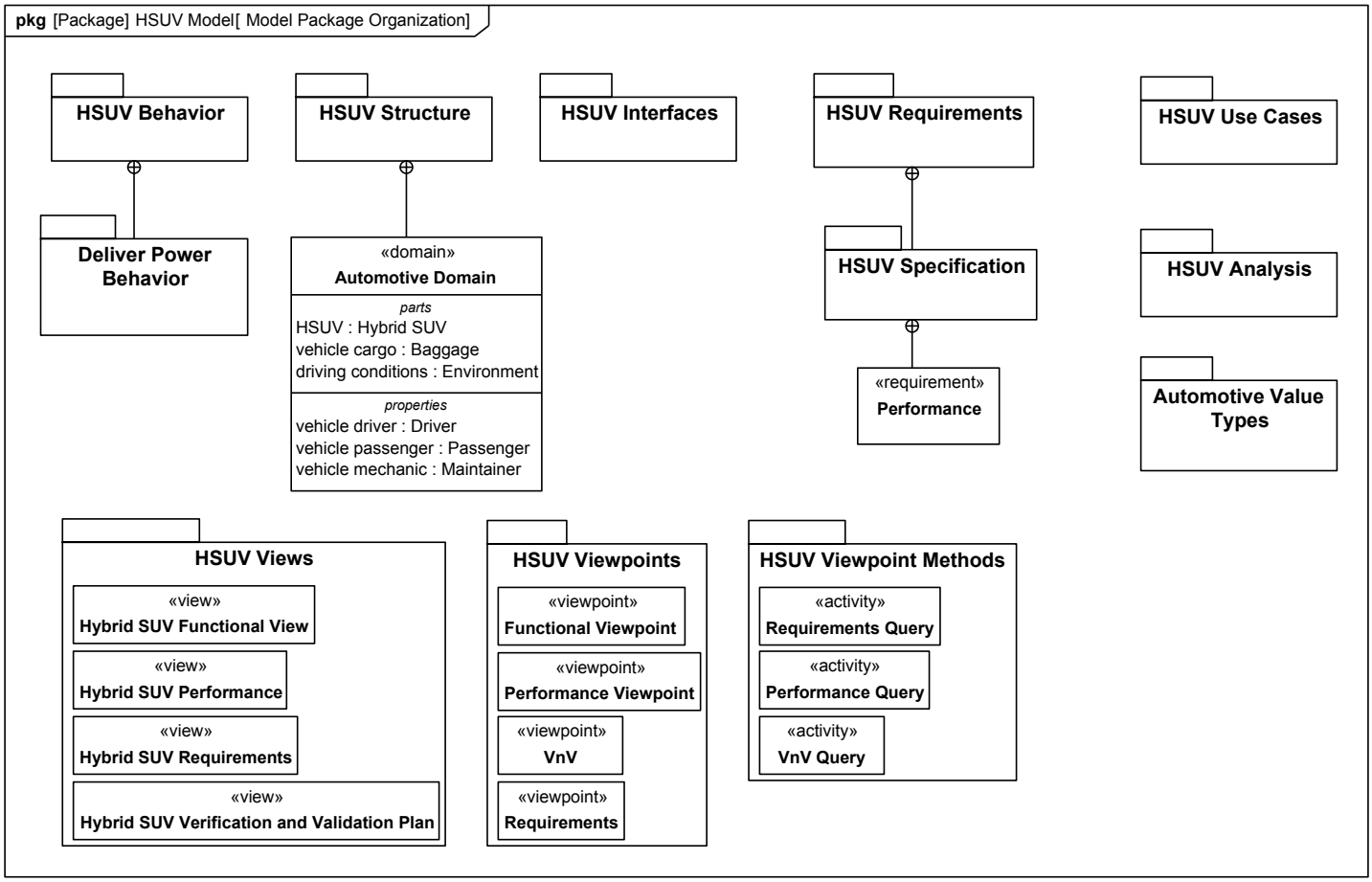


Figure 3. Model Package Organization

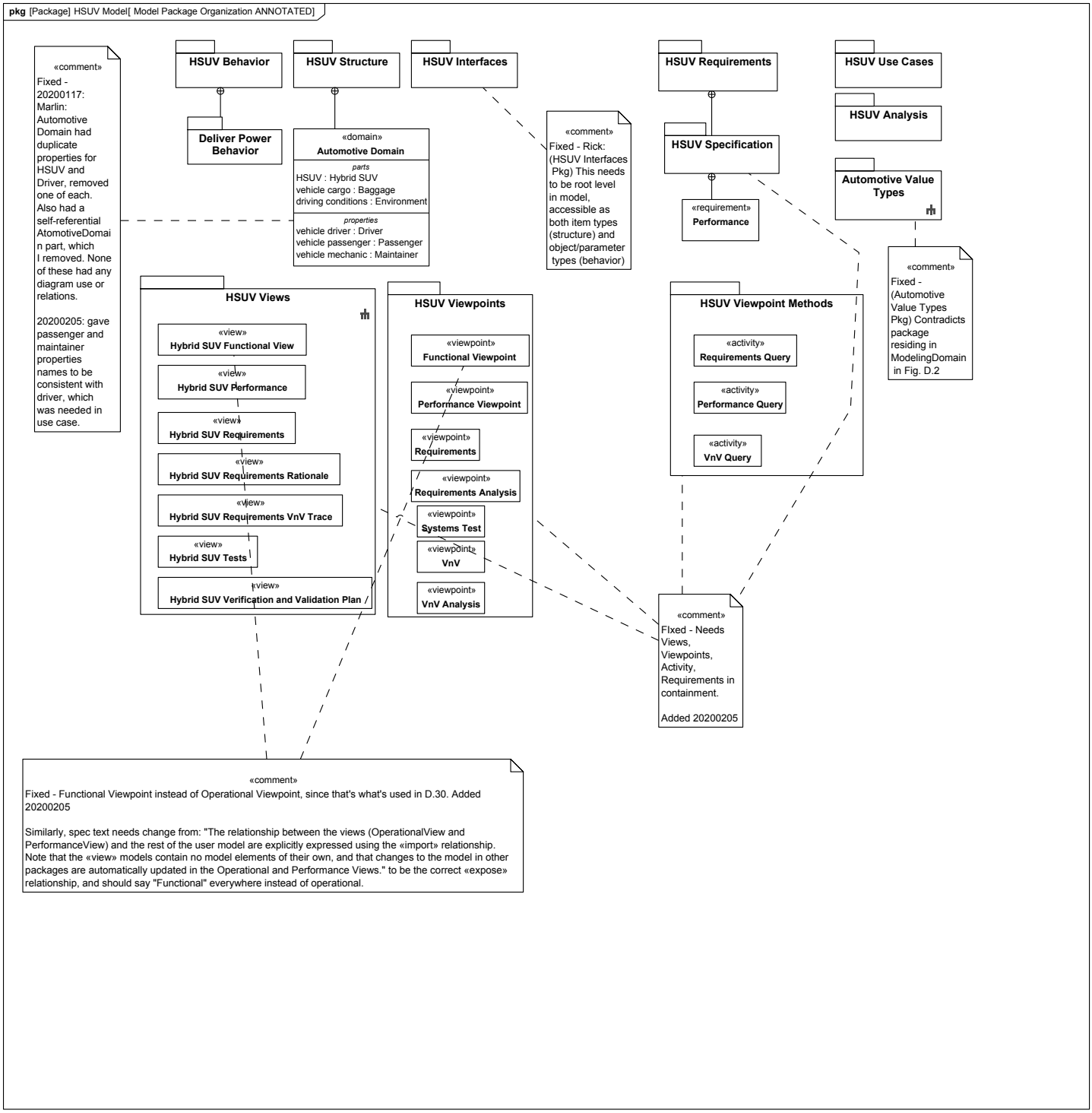


Figure 4. Model Package Organization ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.3, yet reflect the structure of the integrated model. Modeling Domain does not appear on this diagram (see Figure D.1)

5.3.4 Status

DONE. Updated for view/viewpoint modifications.

5.4 Figure 04

5.4.1 Figure Number

1.7-D.4

5.4.2 Figure Name

Establishing the Context of the Hybrid SUV System using a User-Defined Context Diagram. (Internal Block Diagram) Completeness of Diagram Noted in Diagram Description

5.4.3 Figure Diagram

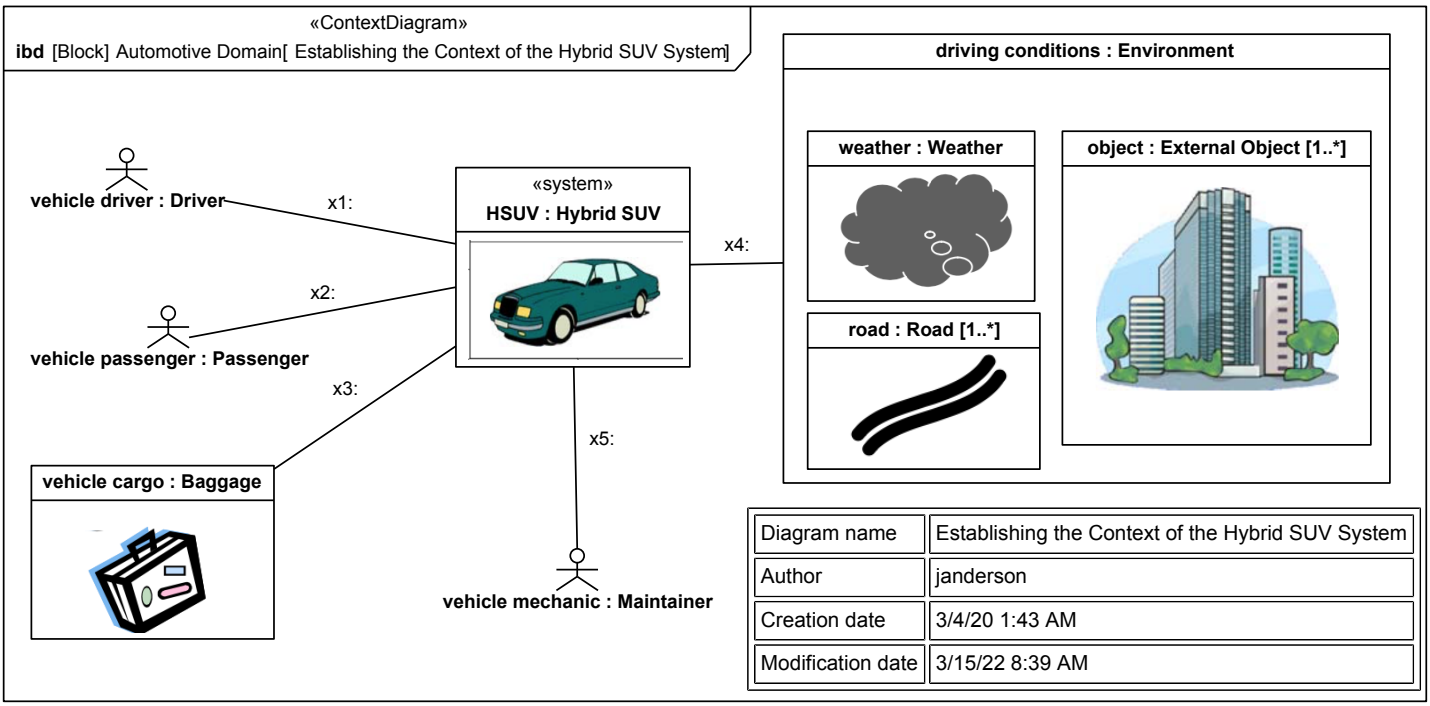


Figure 5. Establishing the Context of the Hybrid SUV System

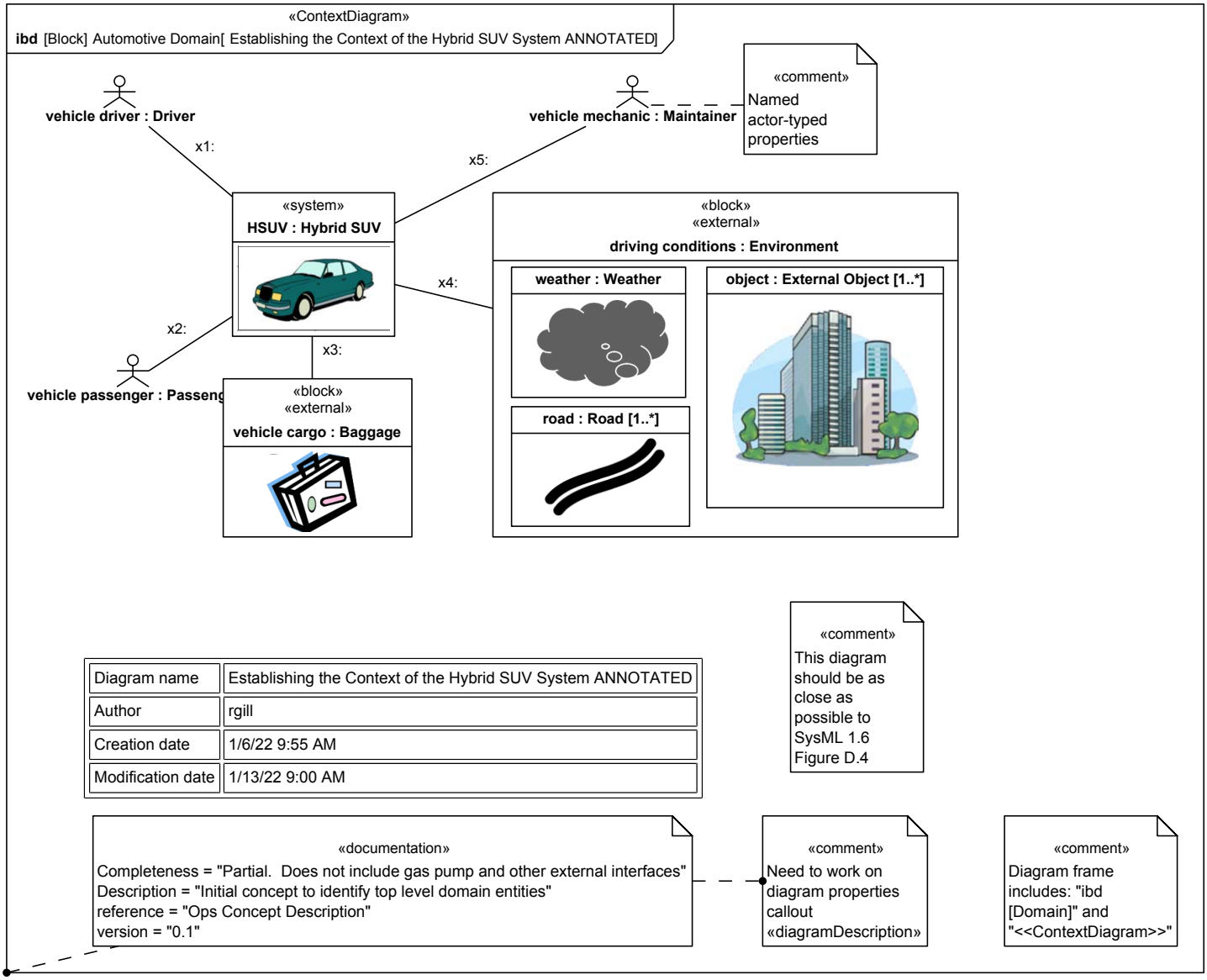


Figure 6. Establishing the Context of the Hybrid SUV System ANNOTATED

Completeness = "Partial. Does not include gas pump and other external interfaces"

Description = "Initial concept to identify top level domain entities"

reference = "Ops Concept Description"

version = "0.1"

5.4.4 Status

DONE.

5.5 Figure 05

5.5.1 Figure Number

1.7-D.5

5.5.2 Figure Name

Establishing Top Level Use Cases for the Hybrid SUV (Use Case Diagram)

5.5.3 Figure Diagram

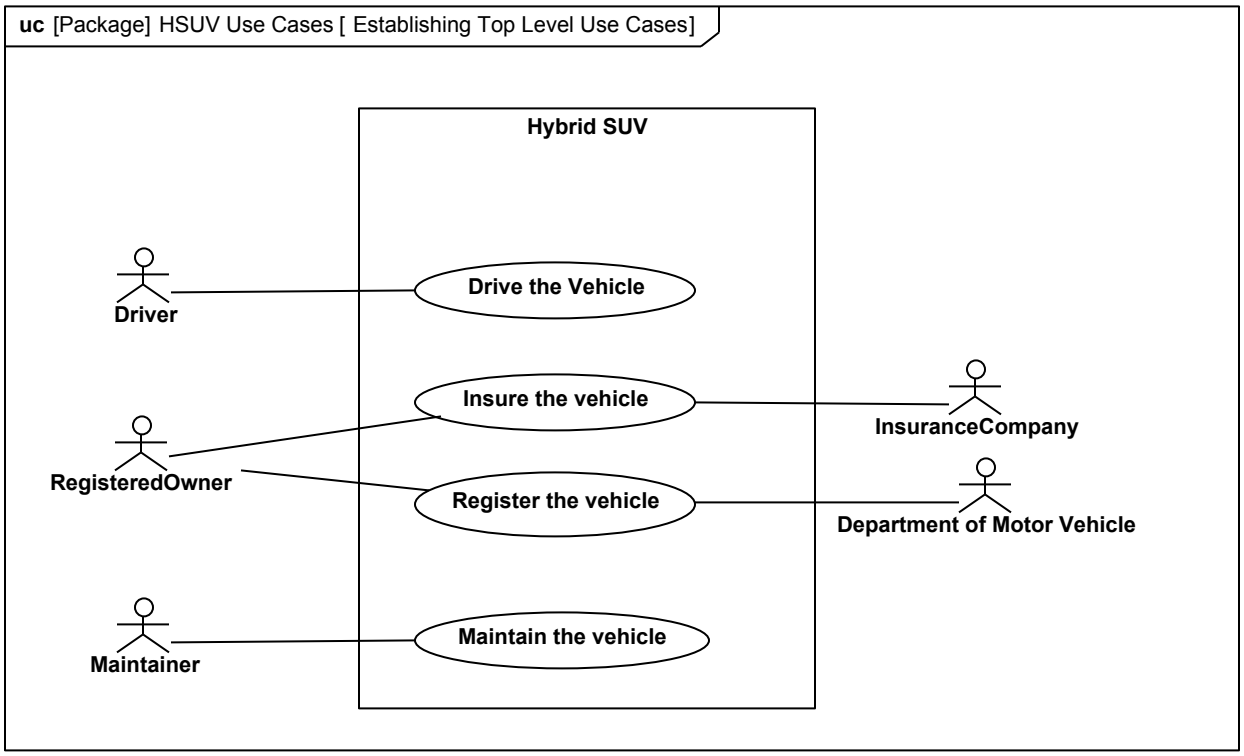


Figure 7. Establishing Top Level Use Cases

5.5.4 Status

DONE.

5.6 Figure 06

5.6.1 Figure Number

1.7-D.6

5.6.2 Figure Name

Establishing Operational Use Cases for “Drive the Vehicle” (Use Case Diagram)

5.6.3 Figure Diagram

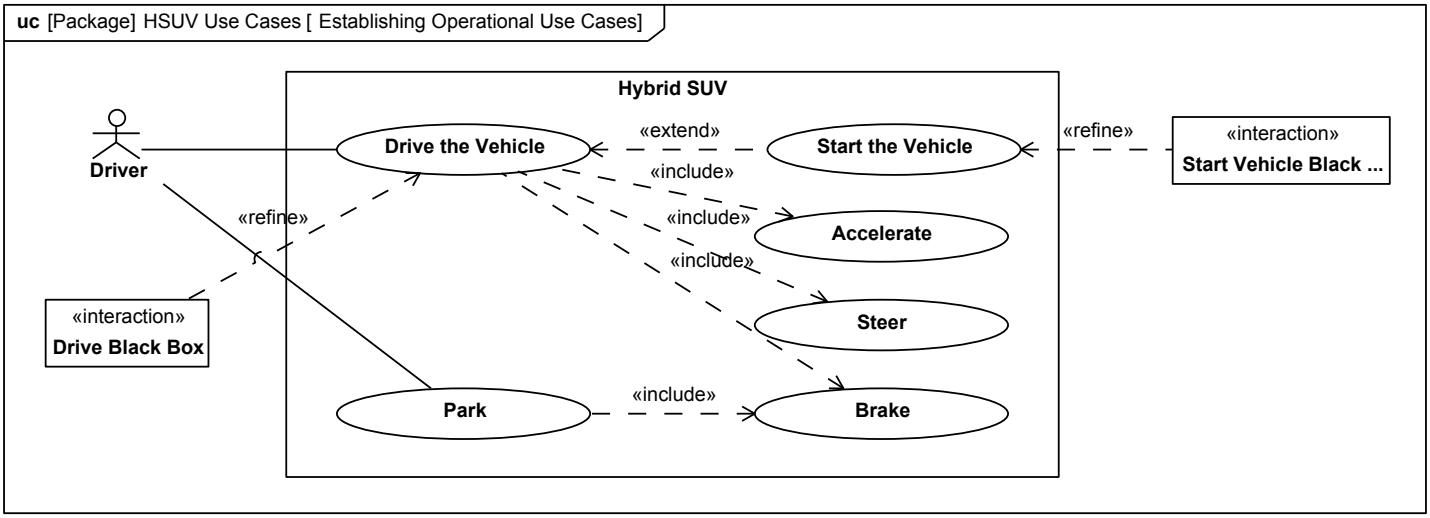


Figure 8. Establishing Operational Use Cases

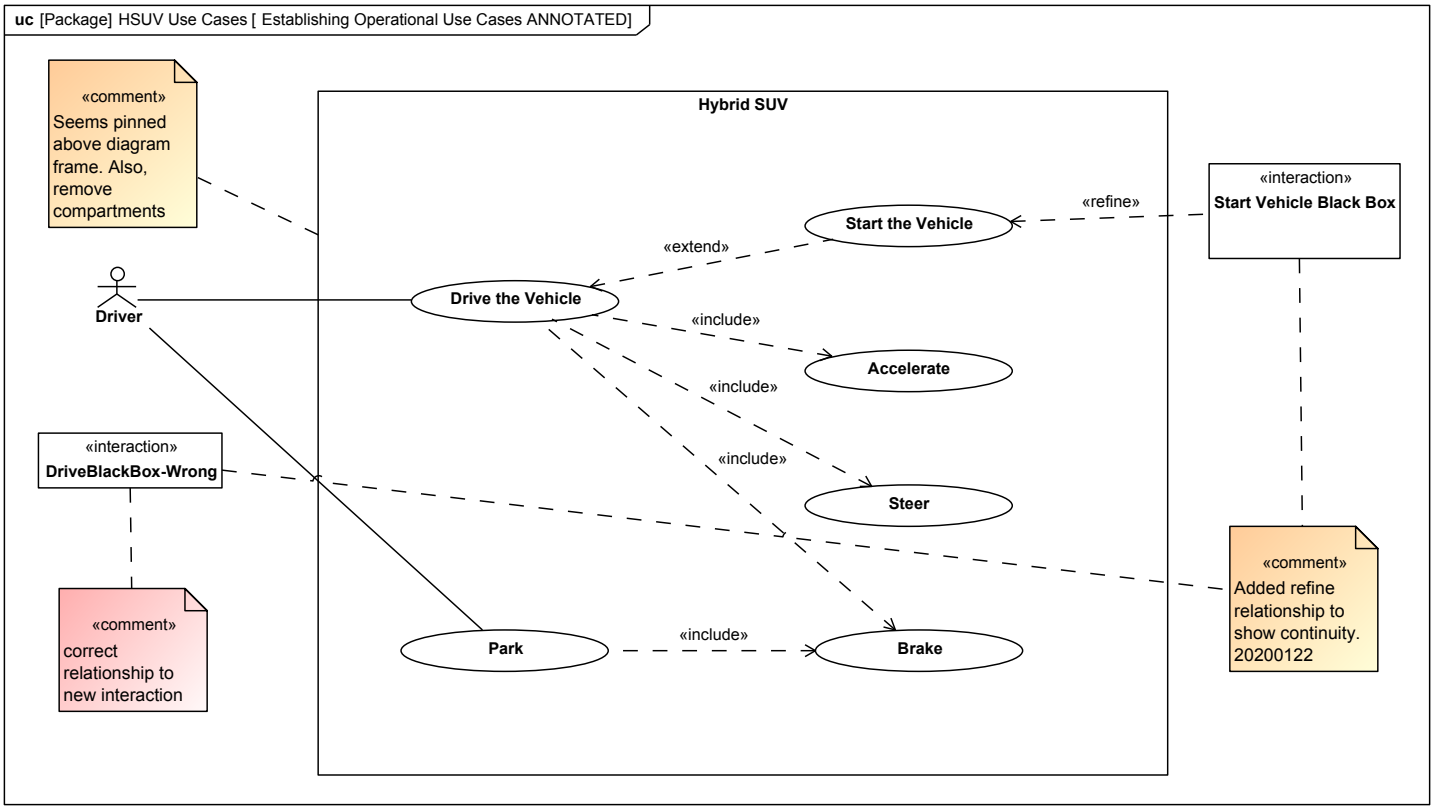


Figure 9. Establishing Operational Use Cases ANNOTATED

Notes: This diagram is based on SysML 1.6 Figure D.5. New «refine» relationships shown, but this is not in response to any SYSML17 issue.

5.6.4 Status

DONE.

5.7 Figure 07

5.7.1 Figure Number

1.7-D.7

5.7.2 Figure Name

Elaborating Black Box Behavior for the “Drive the Vehicle” Use Case (Sequence Diagram)

5.7.3 Figure Diagram

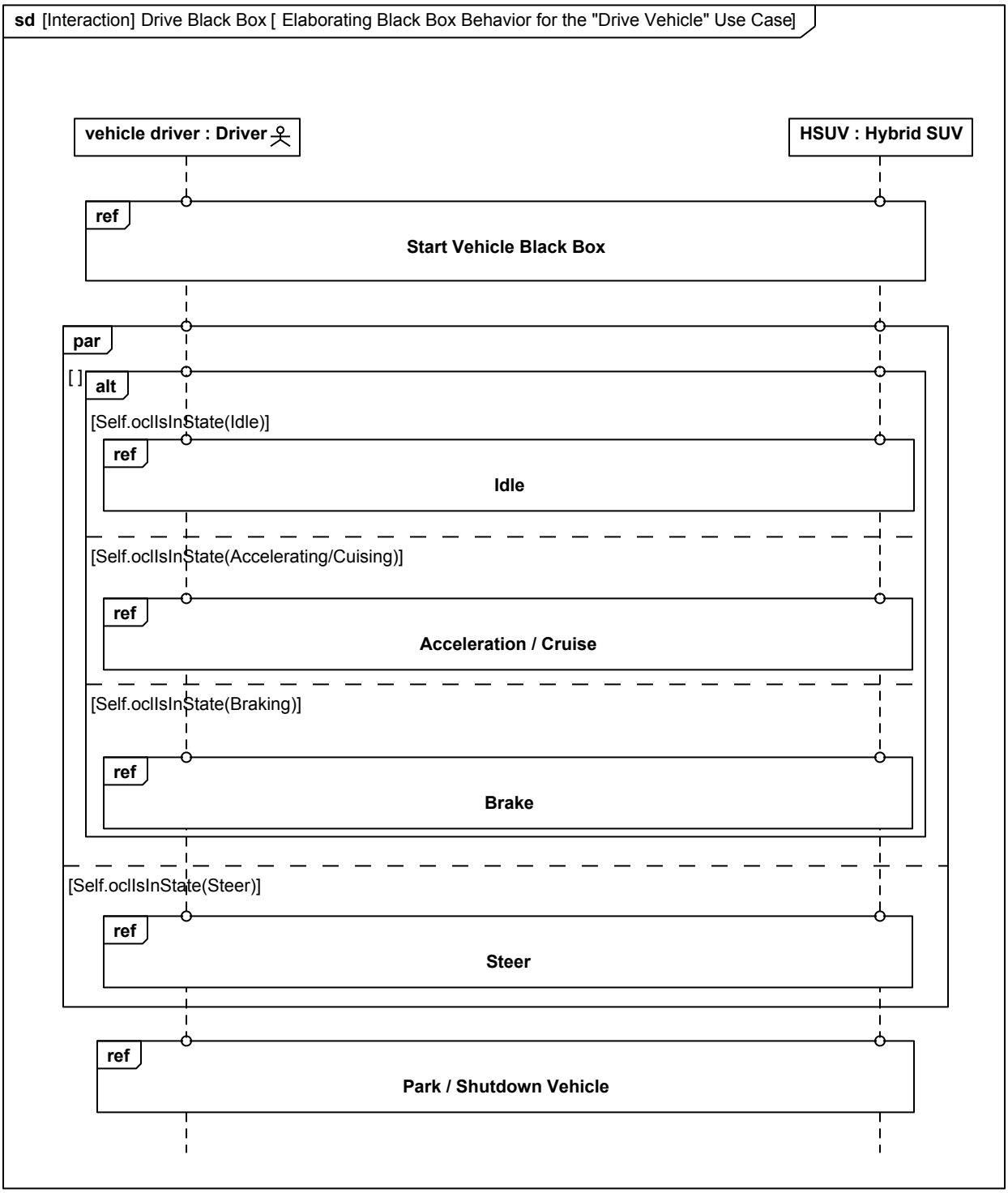


Figure 10. Elaborating Black Box Behavior for the "Drive Vehicle" Use Case

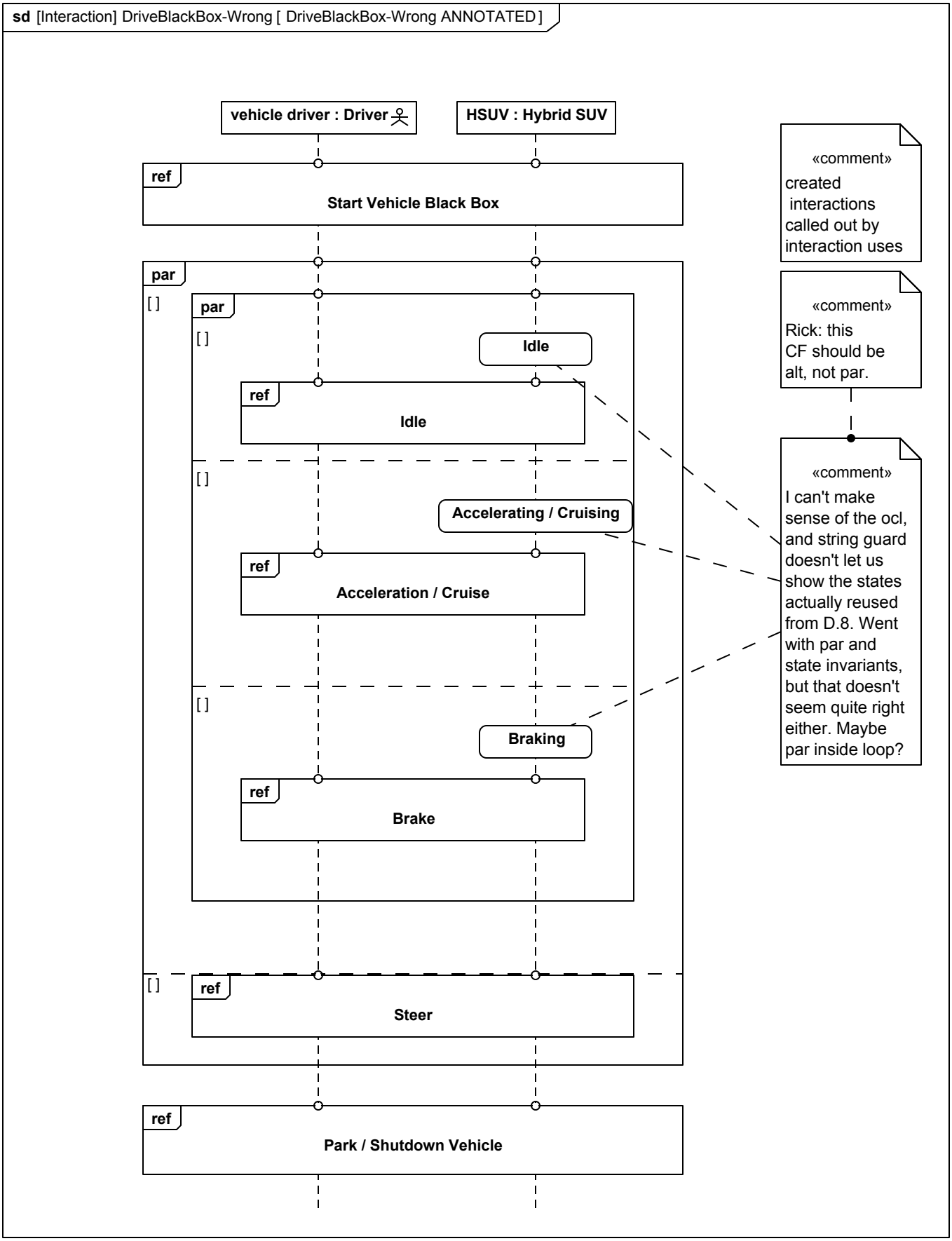


Figure 11. DriveBlackBox-Wrong ANNOTATED

Notes: This was the initial attempt at updating this diagram, and responding to the issue re. OCL being wrong (cannot query state of the object representing the lifeline). The use of state invariant in different sections of a [par], however, does not seem to express the original intent.

5.7.4 Status

DRAFT Could use OCL review.

5.8 Figure 08

5.8.1 Figure Number

1.7-D.8

5.8.2 Figure Name

HSUVOperationalStates

5.8.3 Figure Diagram

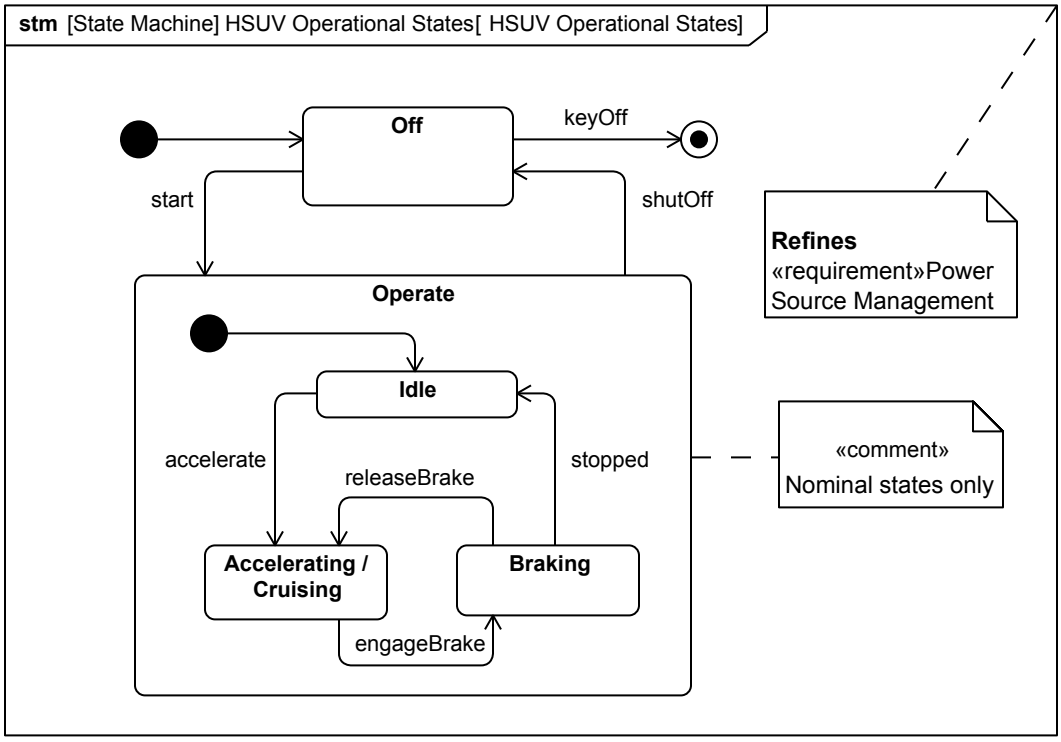


Figure 12. HSUV Operational States

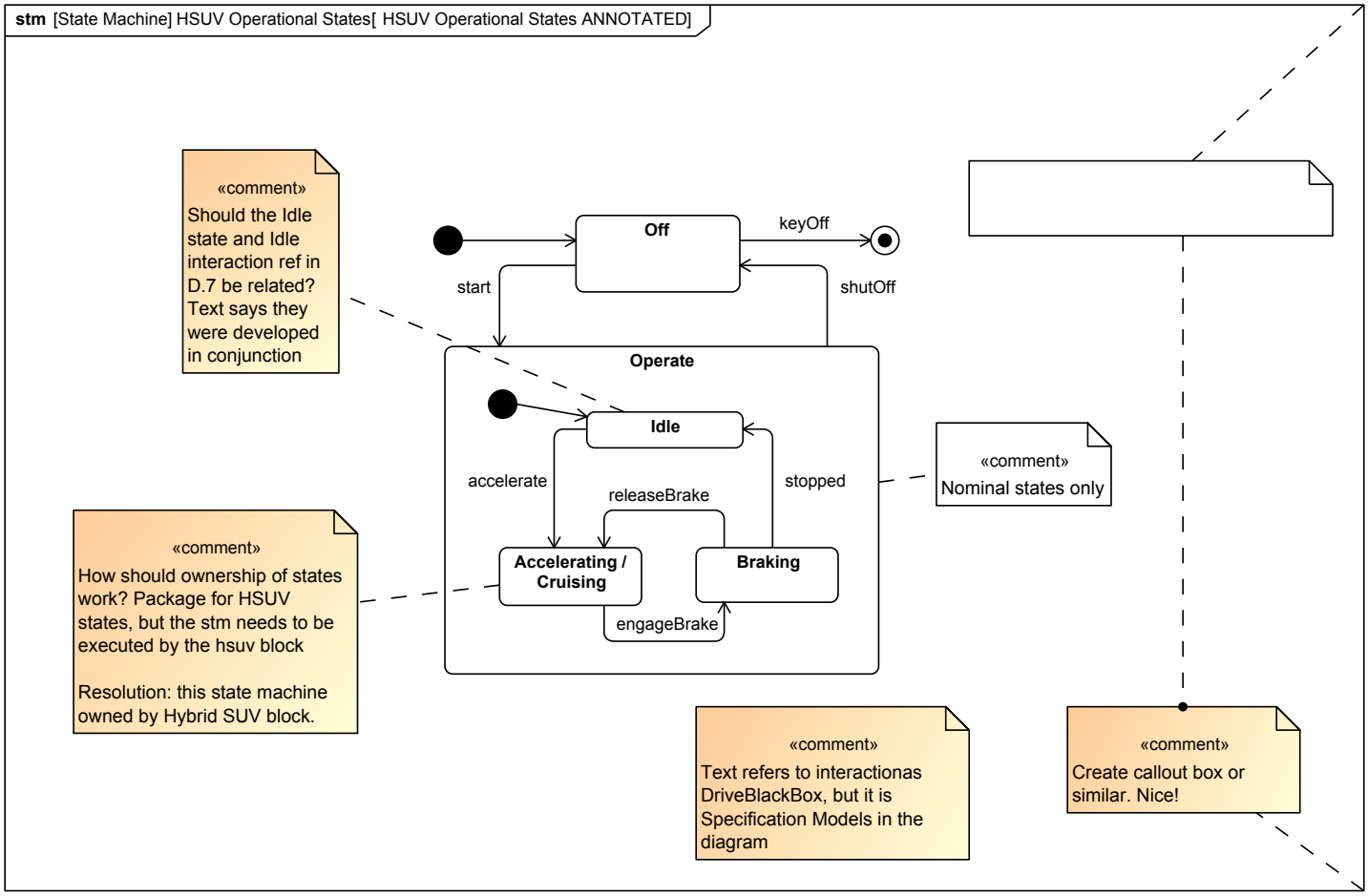


Figure 13. HSUV Operational States ANNOTATED

Notes: Notes: This diagram should be as close as possible to SysML 1.6 Figure D.8, displaying real integrated model relationships.

5.8.4 Status

DONE.

5.9 Figure 09

5.9.1 Figure Number

1.7-D.9

5.9.2 Figure Name

Black Box Interaction for “StartVehicle,” referencing White Box Interaction (Sequence Diagram)

5.9.3 Figure Diagram

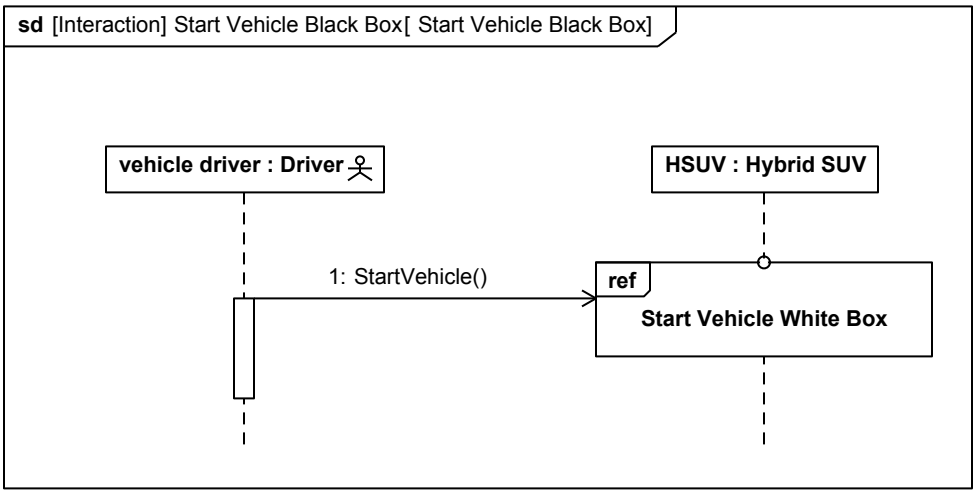


Figure 14. Start Vehicle Black Box

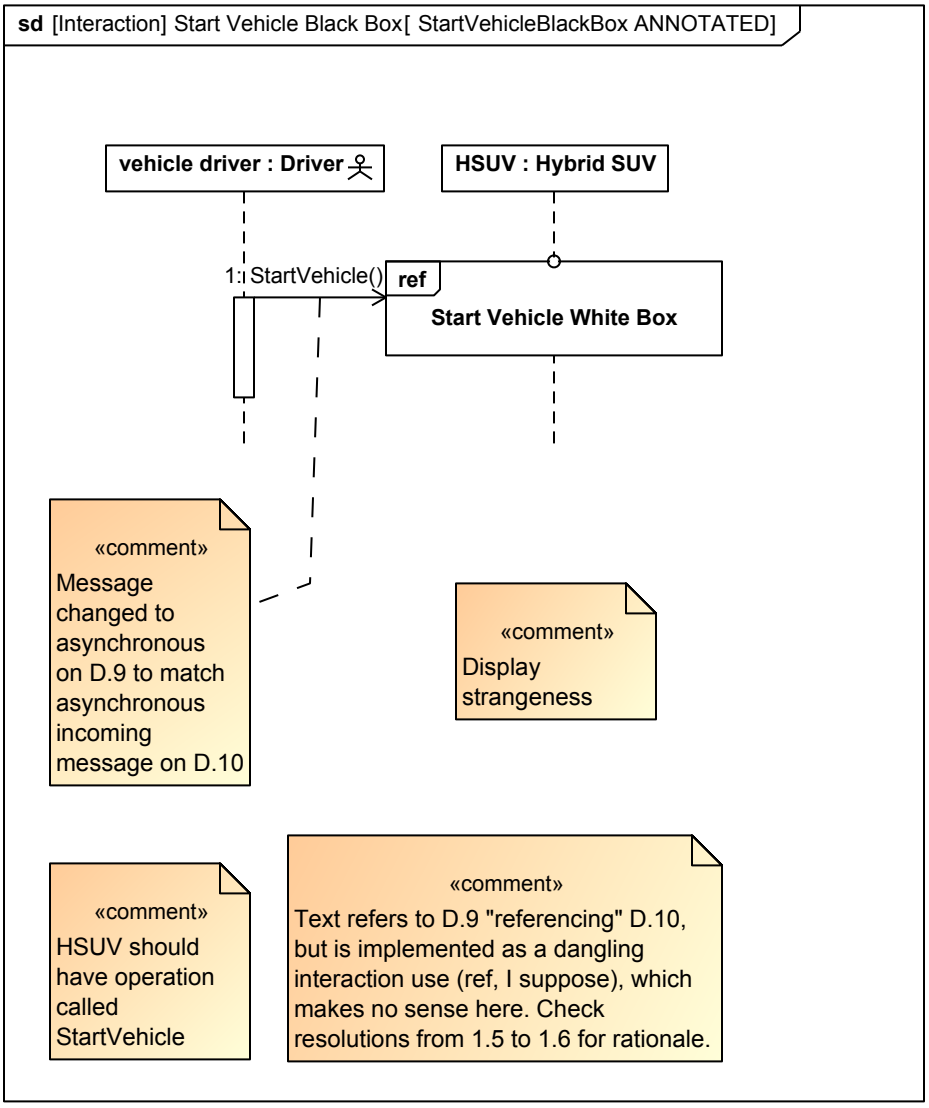


Figure 15. StartVehicleBlackBox ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.9.

5.9.4 Status

DONE

5.10 Figure 10

5.10.1 Figure Number

1.7-D.10

5.10.2 Figure Name

White Box Interaction for “StartVehicle” (Sequence Diagram)

5.10.3 Figure Diagram

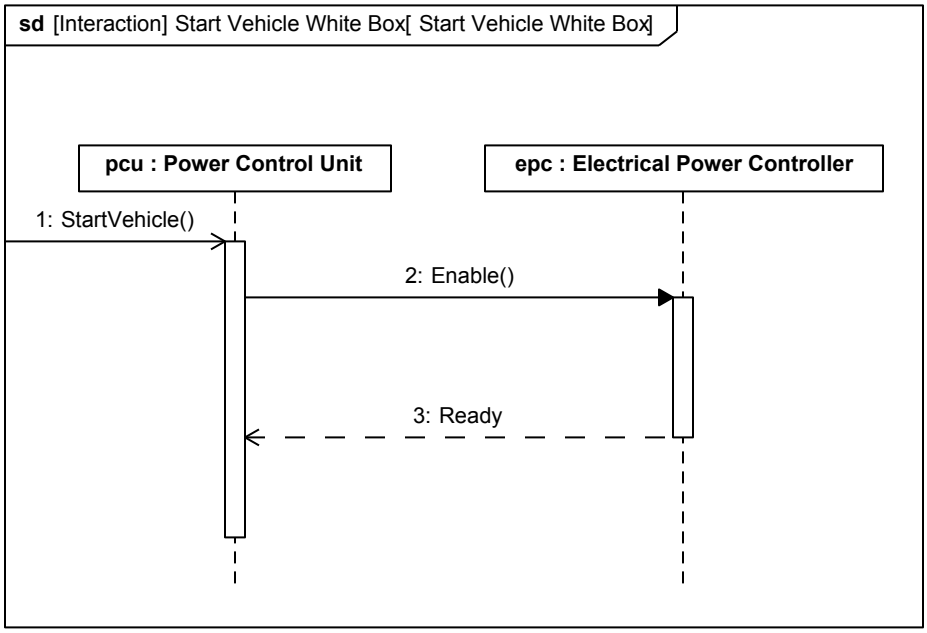


Figure 16. Start Vehicle White Box

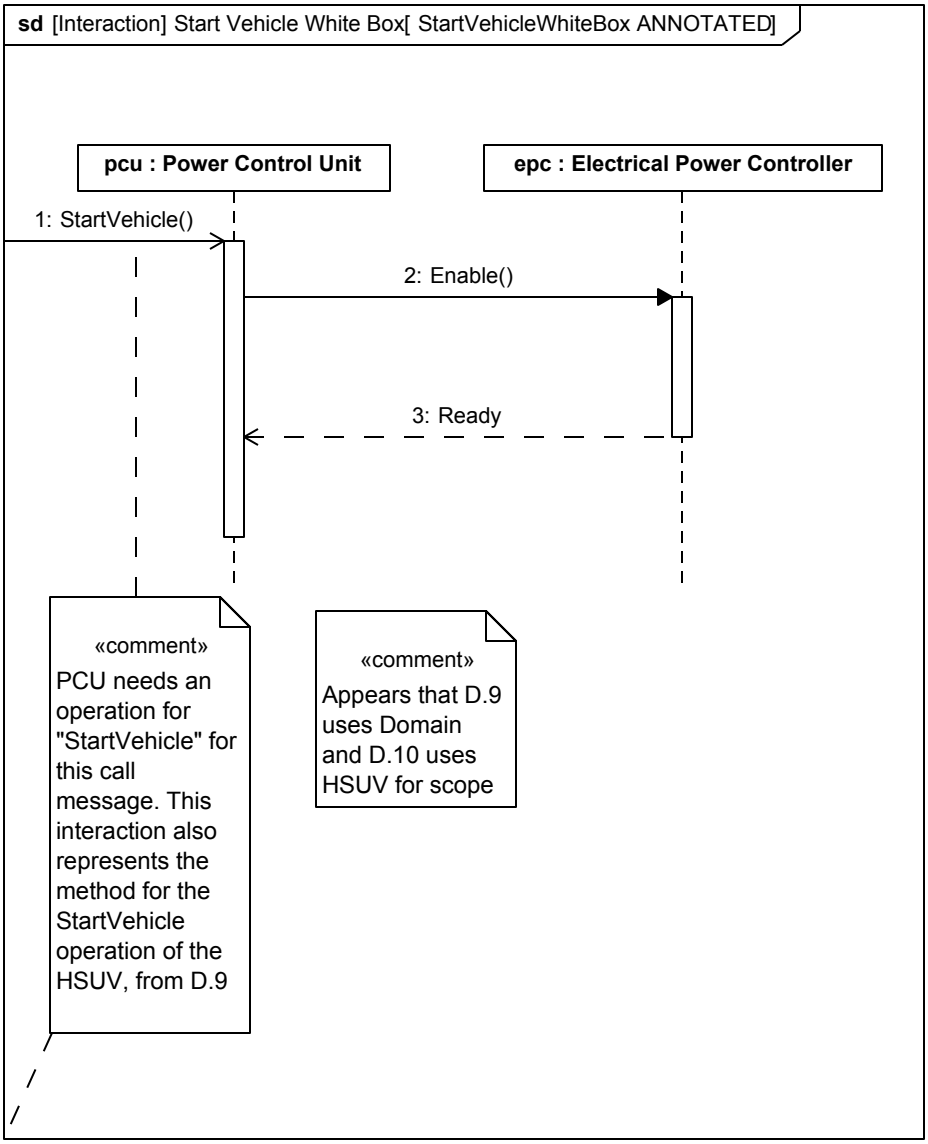


Figure 17. StartVehicleWhiteBox ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.10.

5.10.4 Status

DONE.

5.11 Figure 11

5.11.1 Figure Number

1.7-D.11

5.11.2 Figure Name

Establishing HSUV Requirements Hierarchy (containment) - (Requirements Diagram)

5.11.3 Figure Diagram

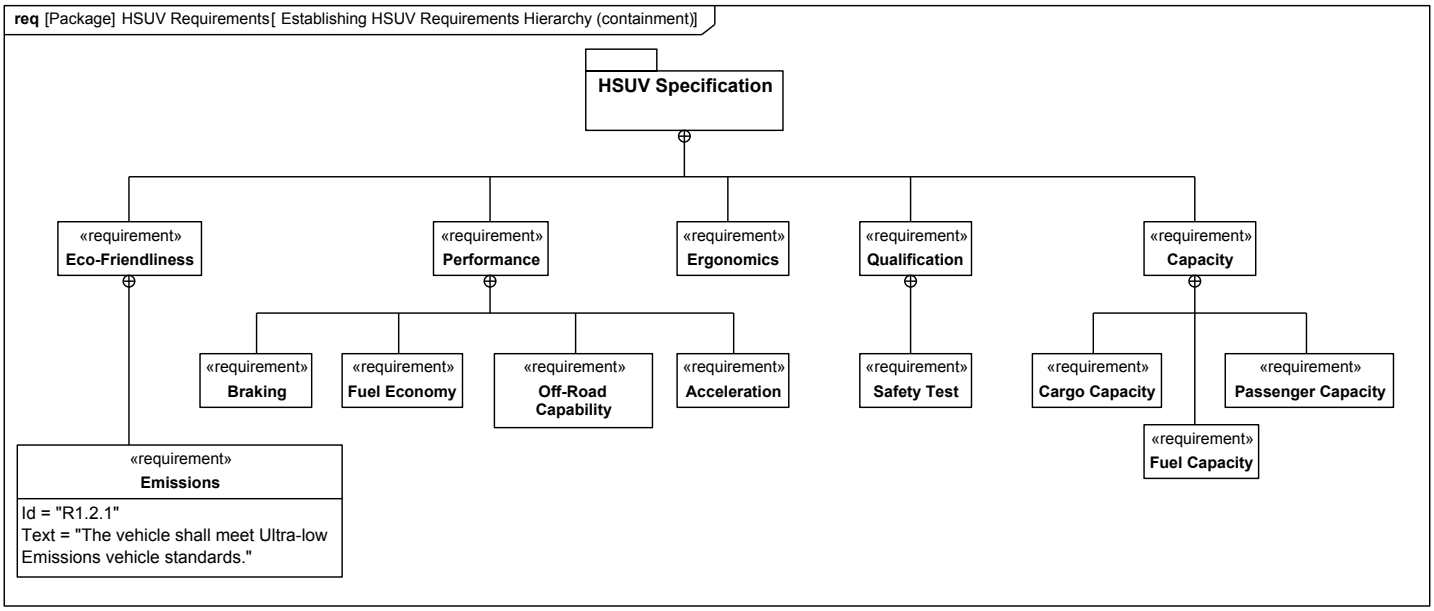


Figure 18. Establishing HSUV Requirements Hierarchy (containment)

5.11.4 Status

DONE.

5.12 Figure 12

5.12.1 Figure Number

1.7-D.12

5.12.2 Figure Name

Establishing Derived Requirements and Rationale from Lowest Tier of Requirements Hierarchy (Requirements Diagram)

5.12.3 Figure Diagram

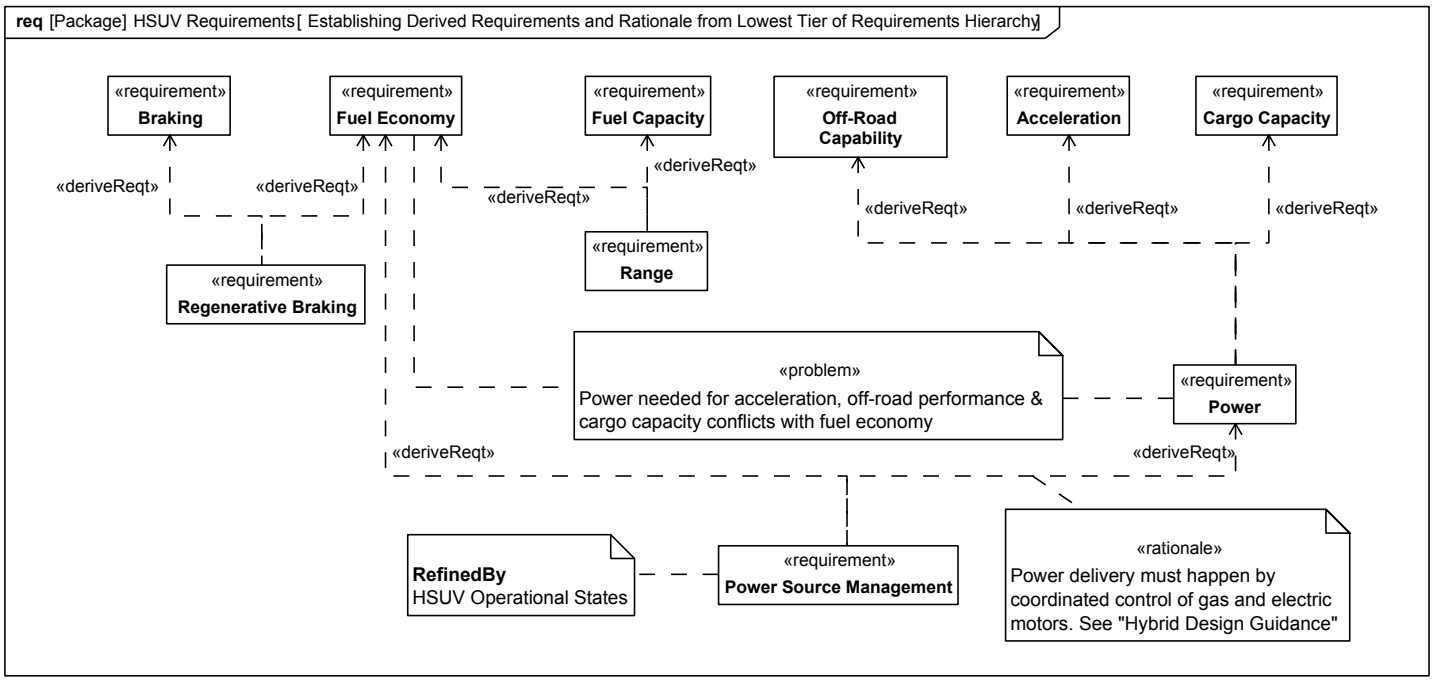


Figure 19. Establishing Derived Requirements and Rationale from Lowest Tier of Requirements Hierarchy

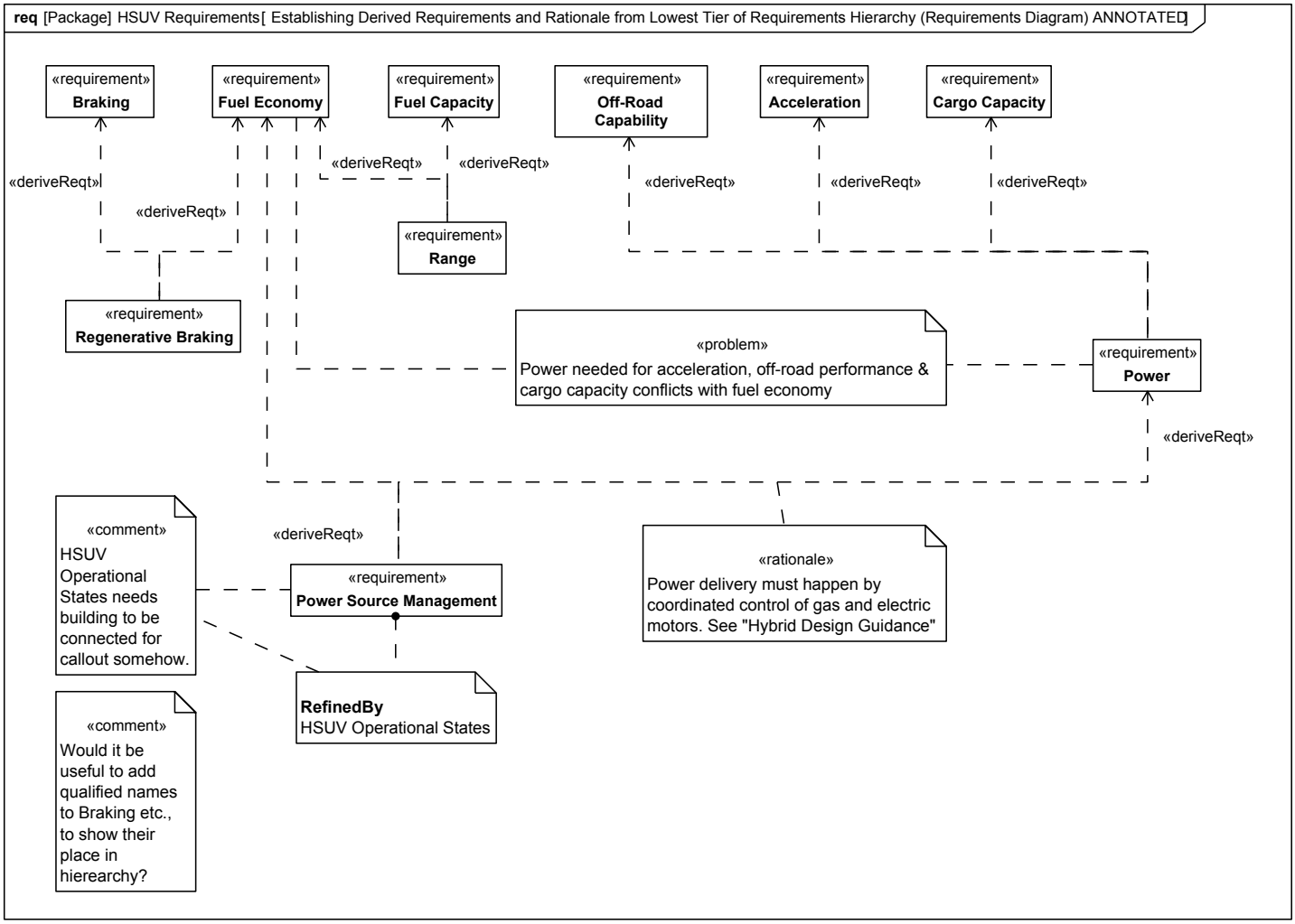


Figure 20. Establishing Derived Requirements and Rationale from Lowest Tier of Requirements Hierarchy (Requirements Diagram) ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.12.

5.12.4 Status

DONE.

5.13 Figure 13

5.13.1 Figure Number

1.7-D.13

5.13.2 Figure Name

Acceleration Requirement Relationships (Requirements Diagram)

5.13.3 Figure Diagram

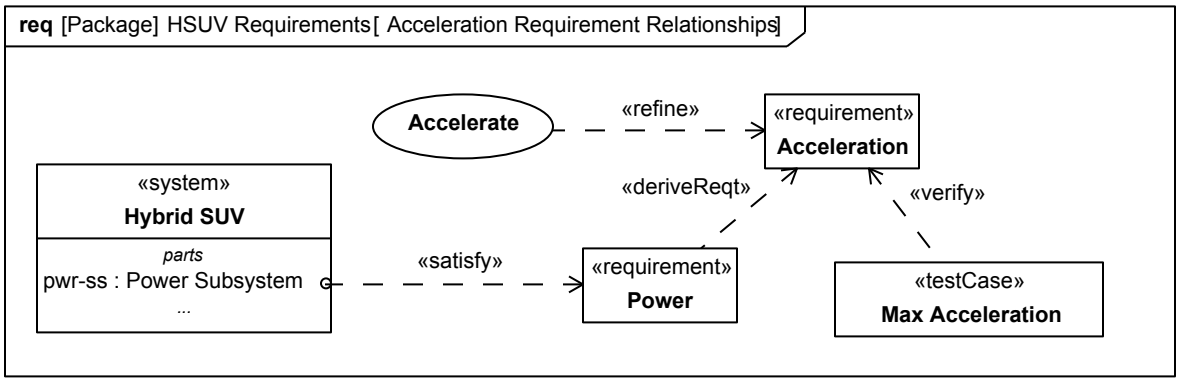


Figure 21. Acceleration Requirement Relationships

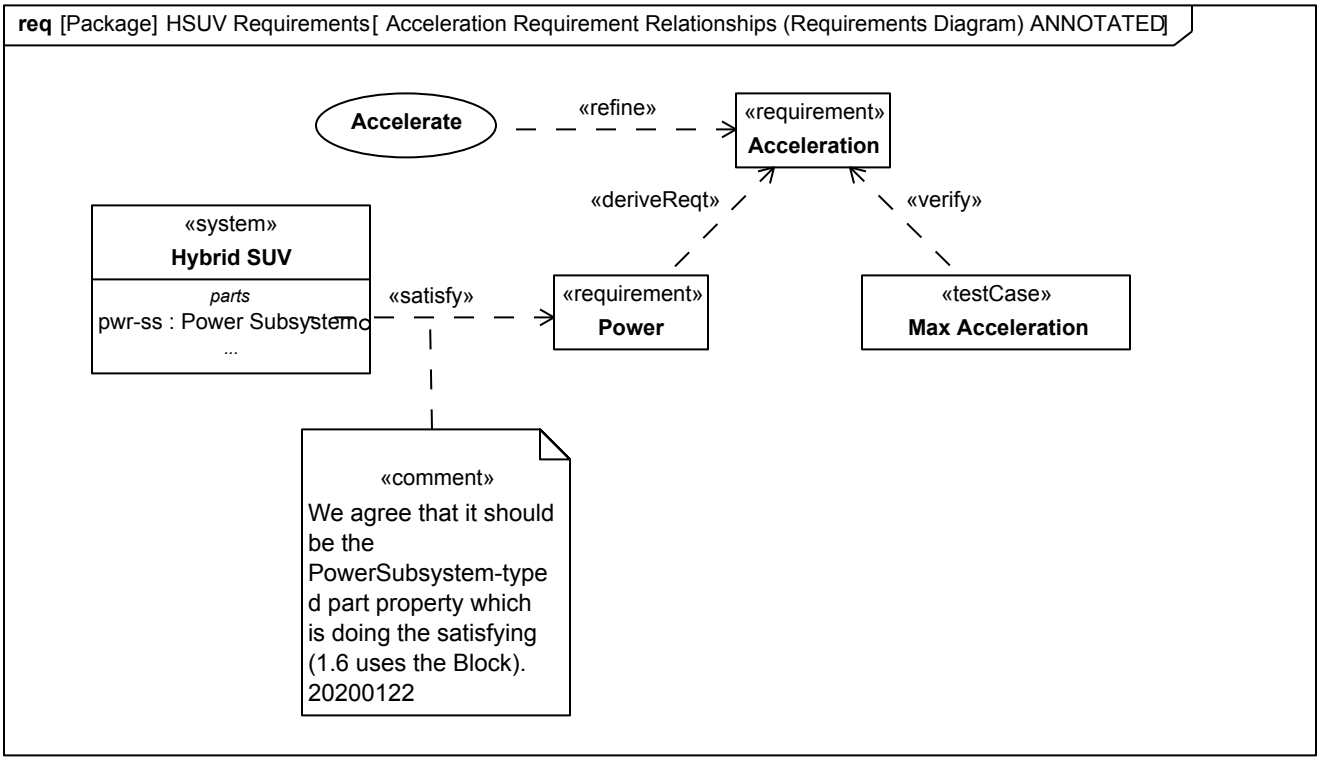


Figure 22. Acceleration Requirement Relationships (Requirements Diagram) ANNOTATED

Notes: This diagram clarified SysML 1.6 Figure D.13 by showing the «satisfy» relationship to the part p:Power Subsystem, instead of the block. SYSML17-63 (Test Case) will not be directly addressed here.

5.13.4 Status

DONE.

5.14 Figure 14

5.14.1 Figure Number

1.7-D.14

5.14.2 Figure Name

Requirements Relationships Expressed in Tabular Format (Table)

5.14.3 Figure Diagram

#	Id	△ Name	Text
1	2	⊟ R 2 Performance	The Hybrid SUV shall have the braking, acceleration, and off-road capability of a typical SUV, but have dramatically better fuel economy.
2	2.1	R 2.1 Acceleration	The Hybrid SUV shall have the braking capability of a typical SUV.
3	2.2	R 2.2 Braking	The Hybrid SUV shall have dramatically better fuel economy than a typical SUV.
4	2.3	R 2.3 Fuel Economy	The Hybrid SUV shall have dramatically better fuel economy than a typical SUV.
5	2.4	R 2.4 Off-Road Capability	The Hybrid SUV shall have the off-road capability of a typical SUV.

Figure 23. Decomposition of Performance Requirements

Notes: This diagram should be as close as possible to the upper portion of SysML 1.6 Figure D.14.

#	△ Id	Name	Relation 1	R1 Id	Derived	Relation 2	R2 Id	Derived 2
1	2.1	R Acceleration		d.4	R Power		d.2	R Power Source Management
2	2.2	R Braking		d.1	R Regenerative Braking			
3	2.3	R Fuel Economy		d.2 d.1 d.3	R Power Source Management R Regenerative Braking R Range			
4	2.4	R Off-Road Capability		d.4	R Power		d.2	R Power Source Management
5	4.1	R Cargo Capacity		d.4	R Power		d.2	R Power Source Management

Figure 24. Tree of Performance Requirements

Notes: This diagram should be as close as possible to the lower portion of SysML 1.6 Figure D.14. This needs to be expressed as a derivation table, following «deriveReqt» relationships. Some column names are editable, some are not.

#	Id	△ Name	Text
1	2	⊟ R 2 Performance	The Hybrid SUV shall have the braking, acceleration, and off-road capability of a typical SUV, but have dramatically better fuel economy.
2	2.1	R 2.1 Acceleration	The Hybrid SUV shall have the braking capability of a typical SUV.
3	2.2	R 2.2 Braking	The Hybrid SUV shall have dramatically better fuel economy than a typical SUV.
4	2.3	R 2.3 Fuel Economy	The Hybrid SUV shall have dramatically better fuel economy than a typical SUV.
5	2.4	R 2.4 Off-Road Capability	The Hybrid SUV shall have the off-road capability of a typical SUV.

#	△ Id	Name	Relation 1	R1 Id	Derived	Relation 2	R2 Id	Derived 2
1	2.1	R Acceleration		d.4	R Power		d.2	R Power Source Management
2	2.2	R Braking		d.1	R Regenerative Braking			
3	2.3	R Fuel Economy		d.2 d.1 d.3	R Power Source Management R Regenerative Braking R Range			
4	2.4	R Off-Road Capability		d.4	R Power		d.2	R Power Source Management
5	4.1	R Cargo Capacity		d.4	R Power		d.2	R Power Source Management

Figure 25. Requirements Relationships Expressed in Tabular Format

Please Note: Tables are not a normative part of the SysML specification. So all tables are for illustration and reference only.

5.14.4 Status

DONE.

5.15 Figure 15

5.15.1 Figure Number

1.7-D.15

5.15.2 Figure Name

Defining the Automotive Domain - (Block Definition Diagram)

5.15.3 Figure Diagram

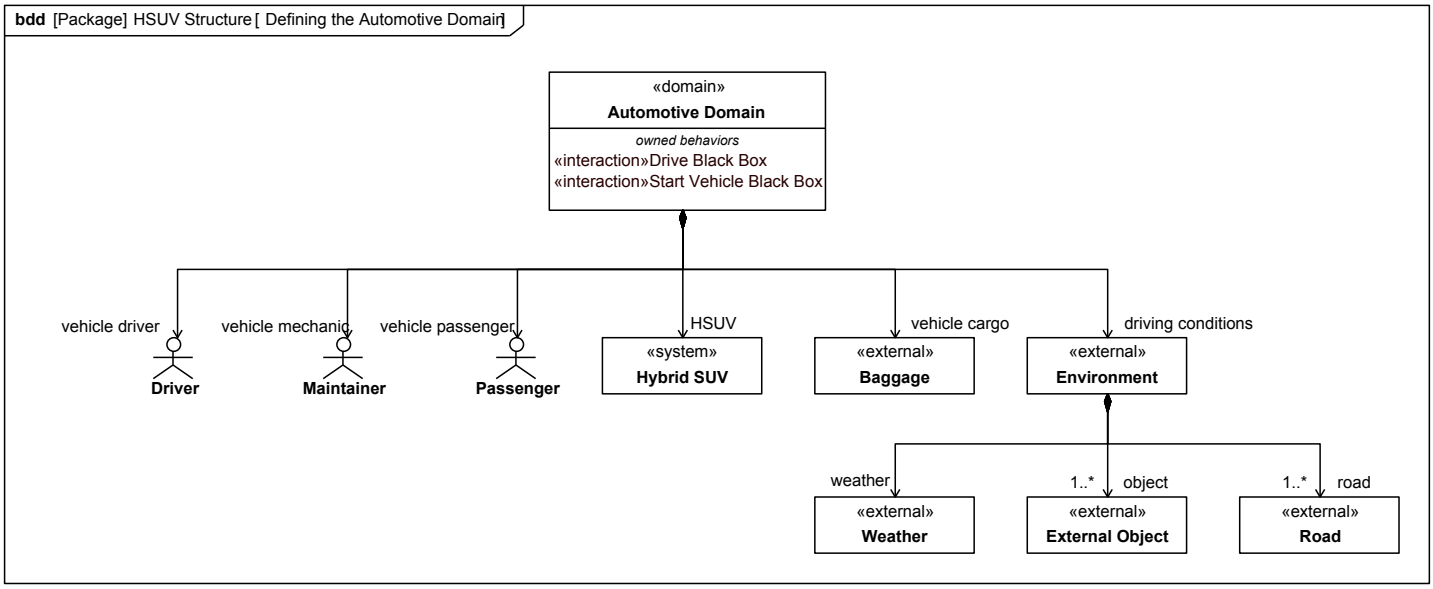


Figure 26. Defining the Automotive Domain

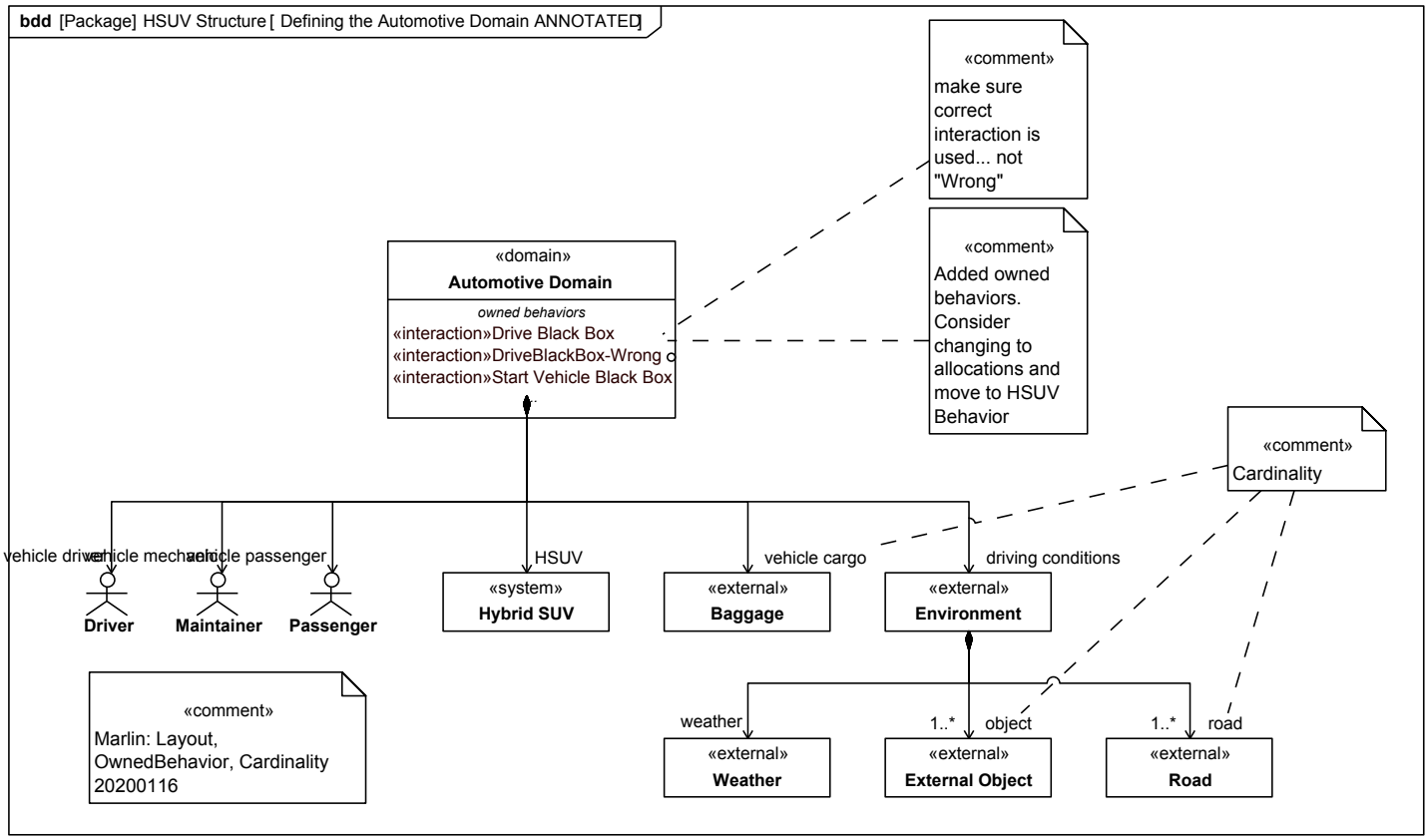


Figure 27. Defining the Automotive Domain ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.15.

5.15.4 Status

DONE.

5.16 Figure 16

5.16.1 Figure Number

1.7-D.16

5.16.2 Figure Name

Defining Structure of the Hybrid SUV System (Block Definition Diagram)

5.16.3 Figure Diagram

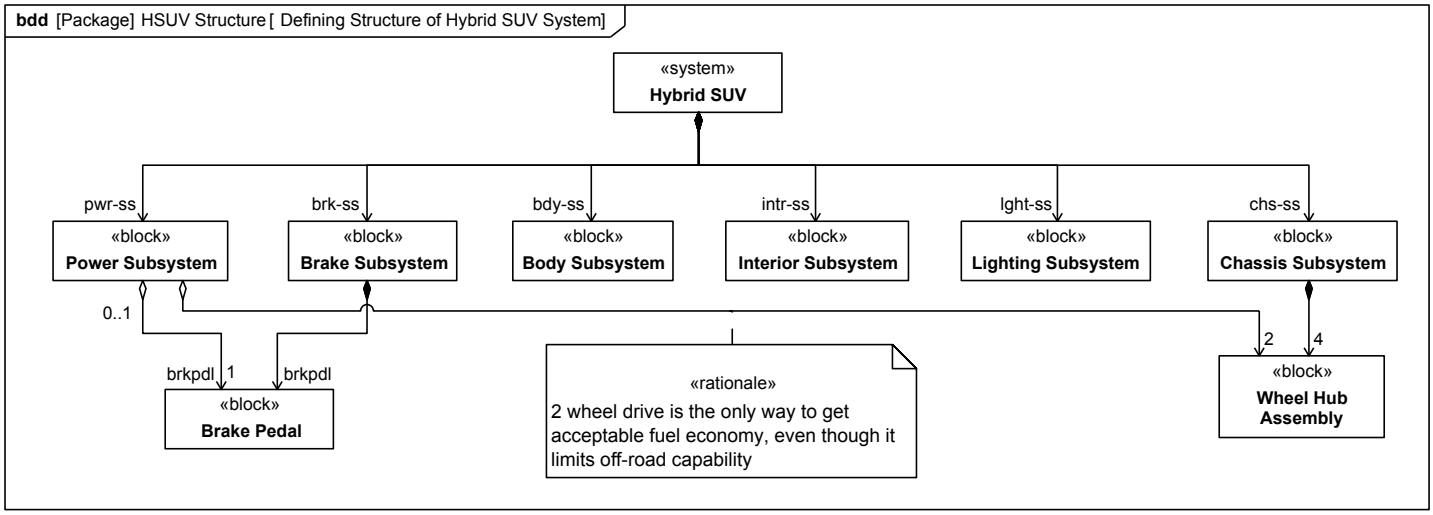


Figure 28. Defining Structure of Hybrid SUV System

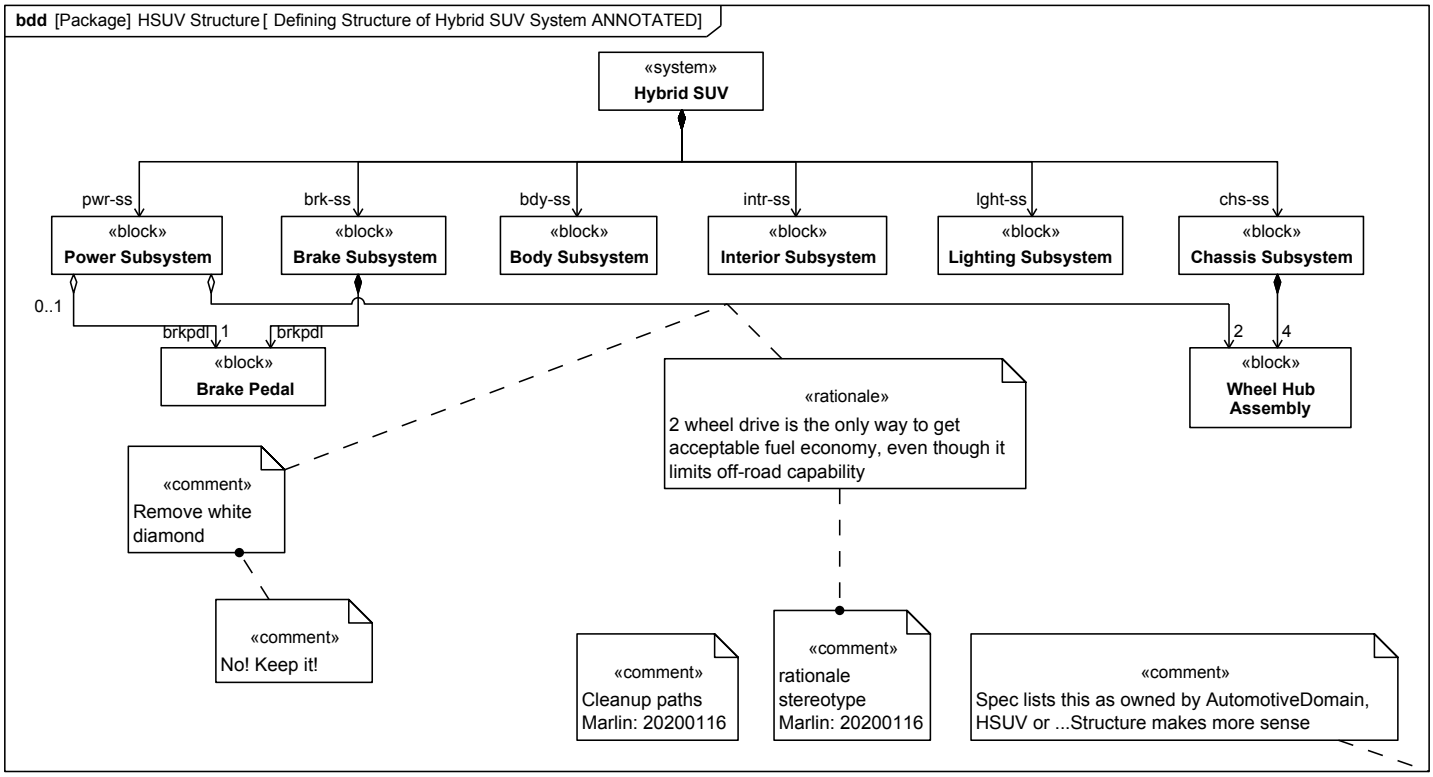


Figure 29. Defining Structure of Hybrid SUV System ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.16.

5.16.4 Status

DONE.

5.17 Figure 17

5.17.1 Figure Number

1.7-D.17

5.17.2 Figure Name

Internal Structure of Hybrid SUV (Internal Block Diagram)

5.17.3 Figure Diagram

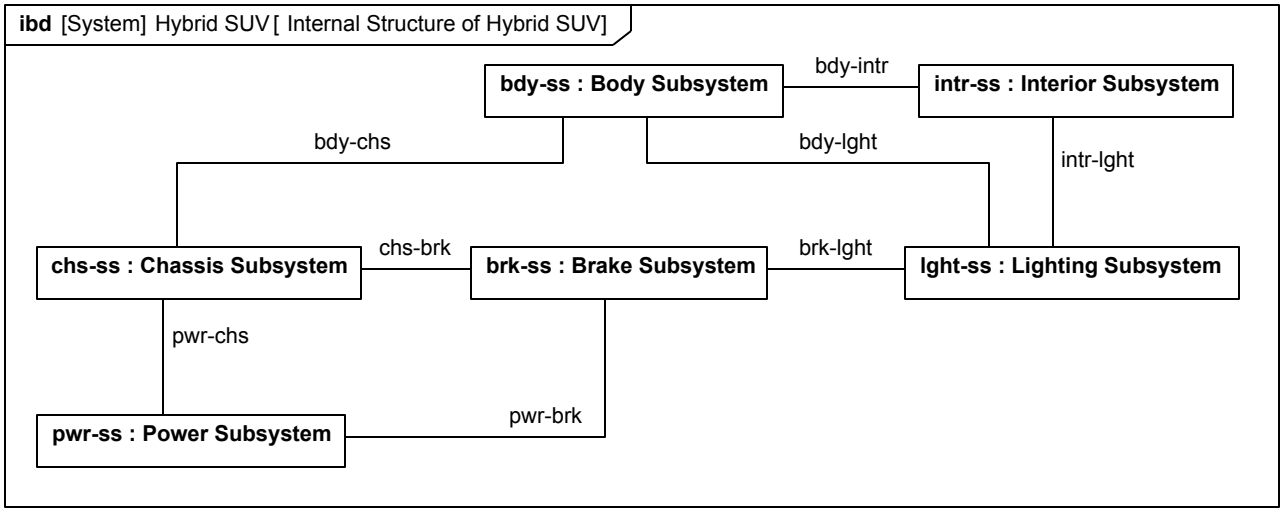


Figure 30. Internal Structure of Hybrid SUV

5.17.4 Status

DONE.

5.18 Figure 18

5.18.1 Figure Number

1.7-D.18

5.18.2 Figure Name

Defining Structure of Power Subsystem (Block Definition Diagram)

5.18.3 Figure Diagram

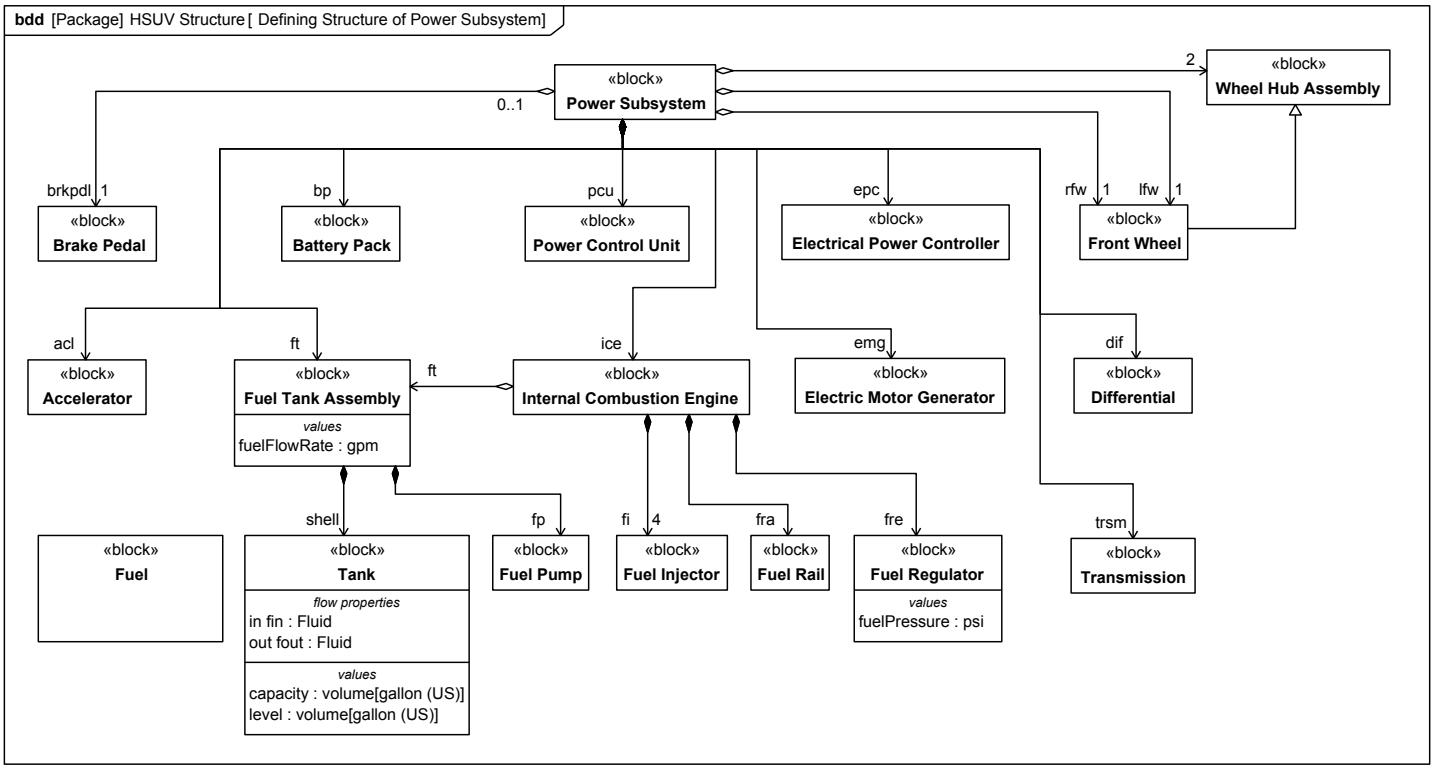


Figure 31. Defining Structure of Power Subsystem

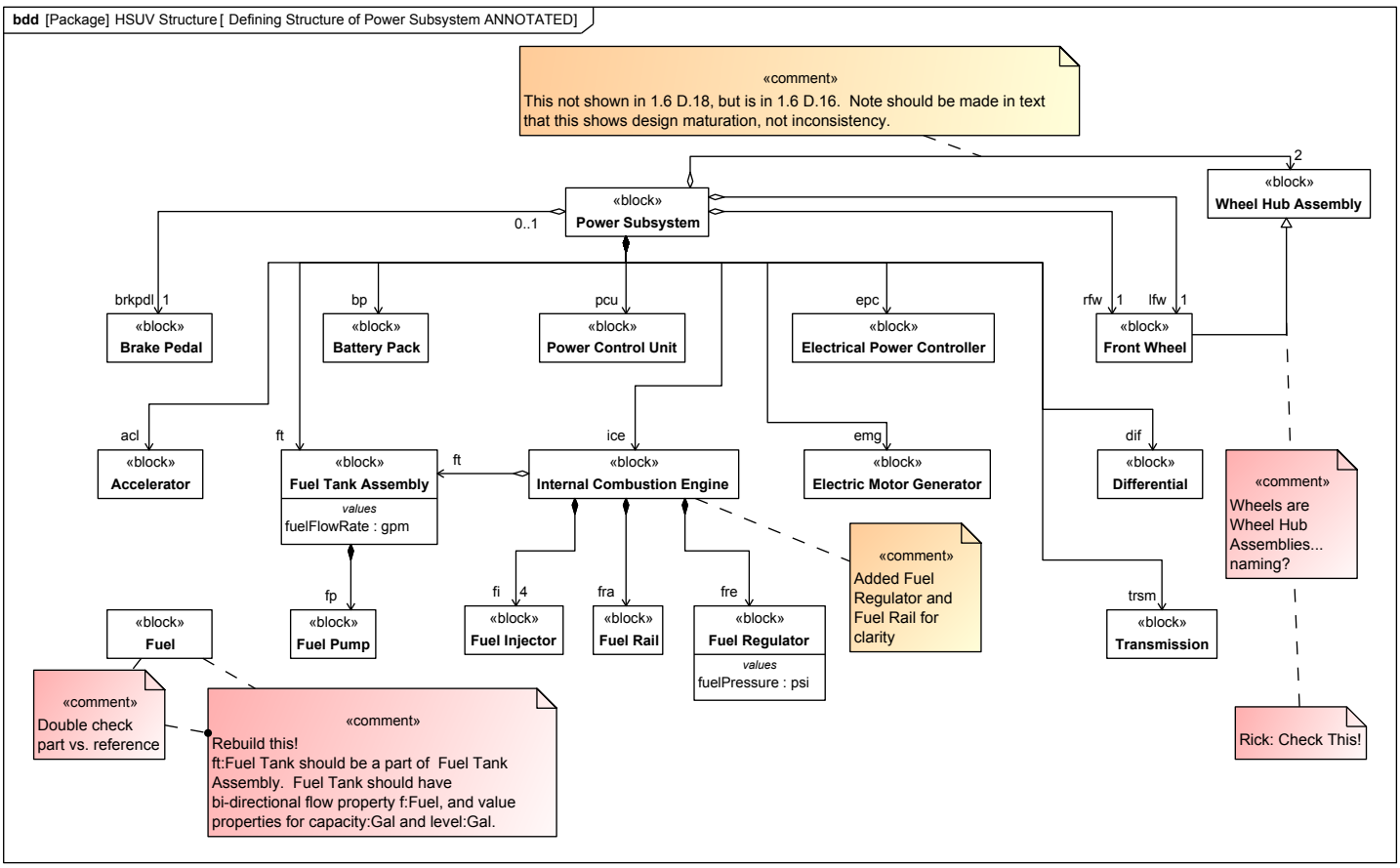


Figure 32. Defining Structure of Power Subsystem ANNOTATED

Notes: This diagram should be an improvement to SysML 1.6 Figure D.18. The modeling of Fuel, Fuel Tank, and Fuel Tank Assembly needs to be improved.

5.18.4 Status

DONE.

5.19 Figure 19

5.19.1 Figure Number

1.7-D.19

5.19.2 Figure Name

Internal Structure of the Power Subsystem (Internal Block Diagram)

5.19.3 Figure Diagram

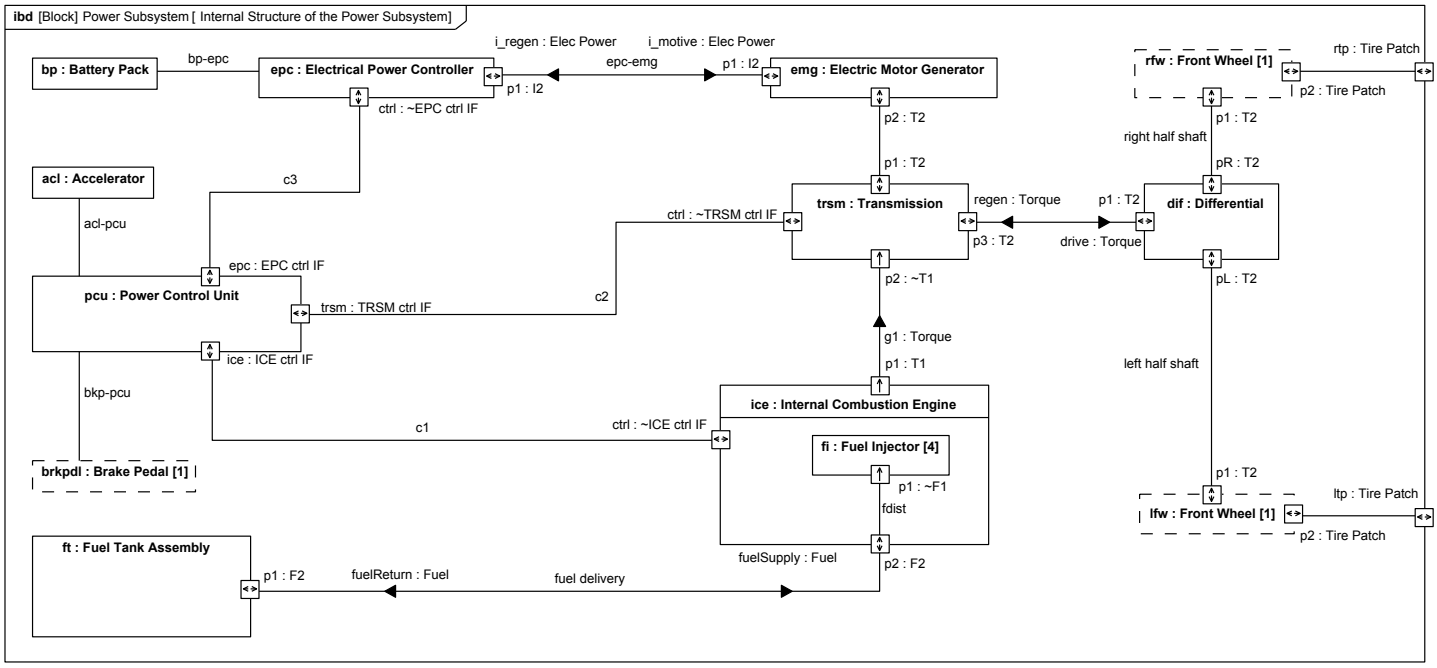


Figure 33. Internal Structure of the Power Subsystem

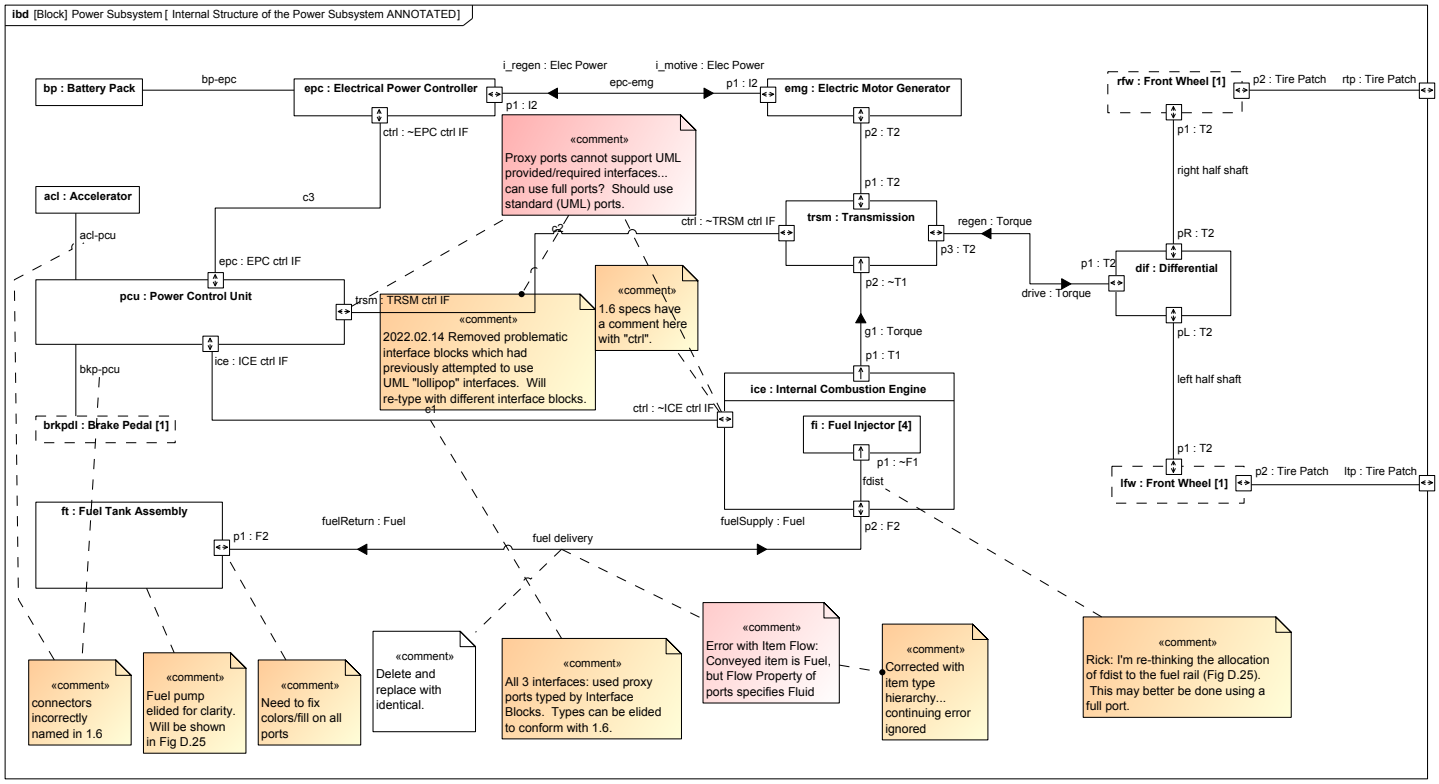


Figure 34. Internal Structure of the Power Subsystem ANNOTATED

Notes: This diagram should be based on the concepts expressed SysML 1.6 Figure D.19. This includes the concept of using UML «interface» ball-and-socket notation, but this has proven problematic. Also note that the SysML 1.6 text references a Fuel store (dashed borders) which will need to be edited.

5.19.4 Status

DRAFT: Removed UML «interface» from interface blocks typing PCU ports... see D.20 for details.

5.20 Figure 20

5.20.1 Figure Number

1.7-D.20

5.20.2 Figure Name

Blocks Typing Ports in the Power Subsystem (Block Definition Diagram)

5.20.3 Figure Diagram

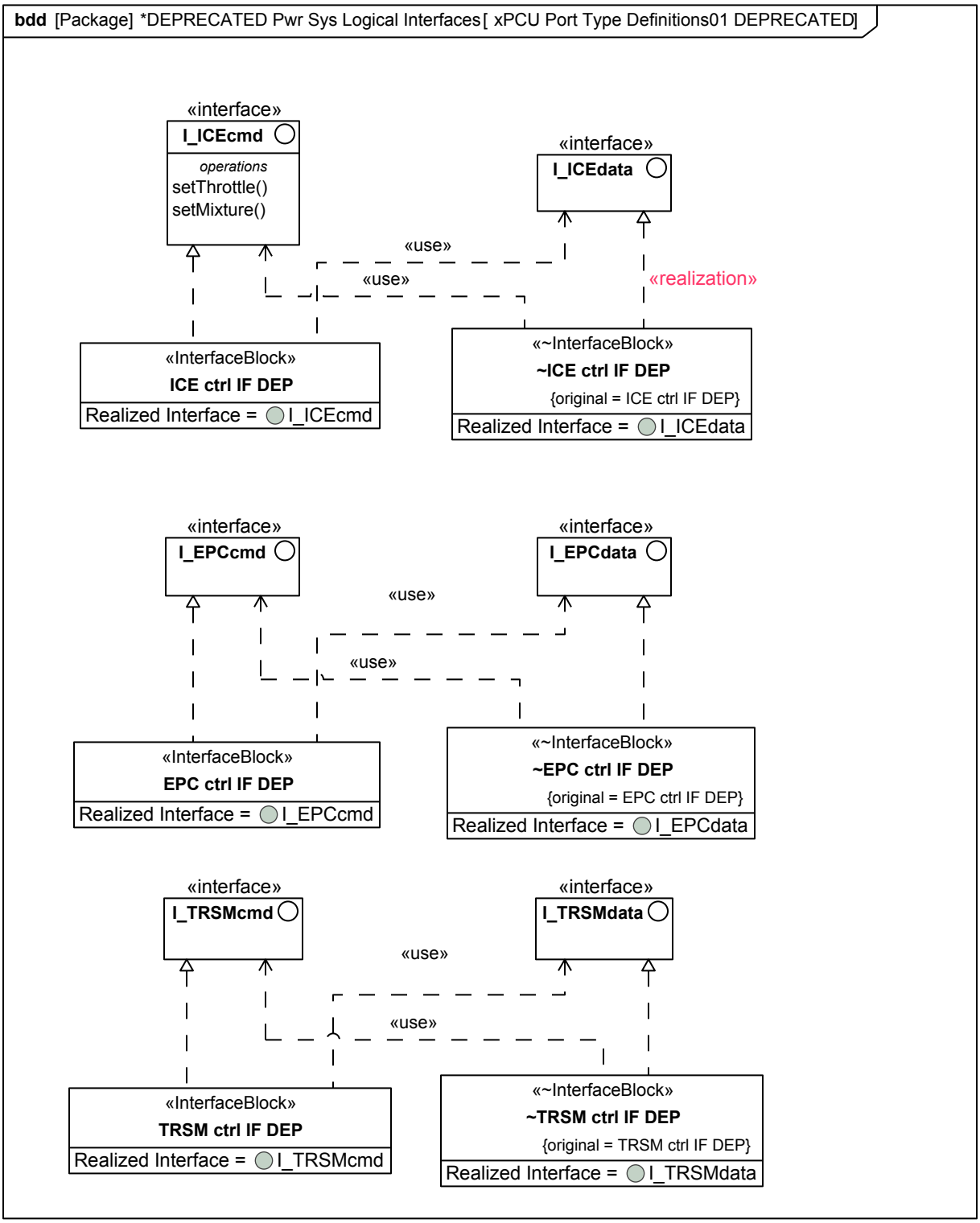


Figure 35. xPCU Port Type Definitions01 DEPRECATED

Notes: This diagram was intended to replace SysML 1.6 Figure D.20, but tool implementation constraints limit the representation of required & provided «interface» on «InterfaceBlocks». This diagram is included here to show the mess to represent this concept within the existing concrete syntax, and is NOT recommended for inclusion in the SysML 1.7 Annex D!

Note that the SysML 1.6 concept of the ICE «interfaceBlock» has been refined into the concept of the CAN IF «interfaceBlock» on Figure D.21, to more accurately and compellingly represent the behavior of the CAN bus. This decision has a ripple effect back into this figure, since the ICE/EPC/TRSM ctrl IF «interfaceBlocks» form a logical interface which is then allocated to a physical CAN interface on Figure D.24, and the connectors allocated to the CAN Bus on Figure D.45.

NOT USED in SysML 1.7

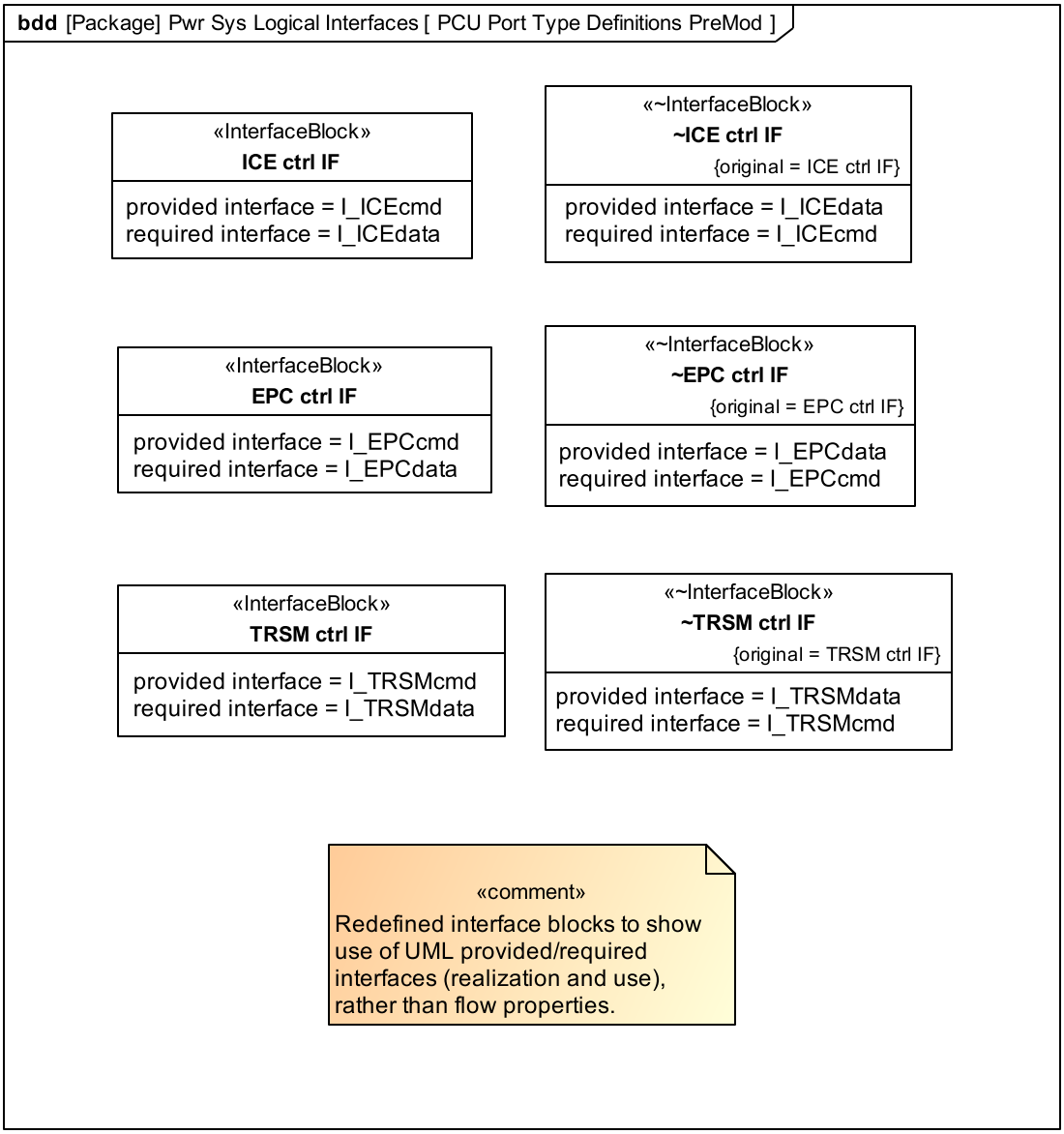


Figure 36. xPCU Port Type Definitions

Notes: This diagram was synthesized outside the model to be as close as possible to SysML 1.6 Figure D.20. **NOT USED in SysML 1.7**

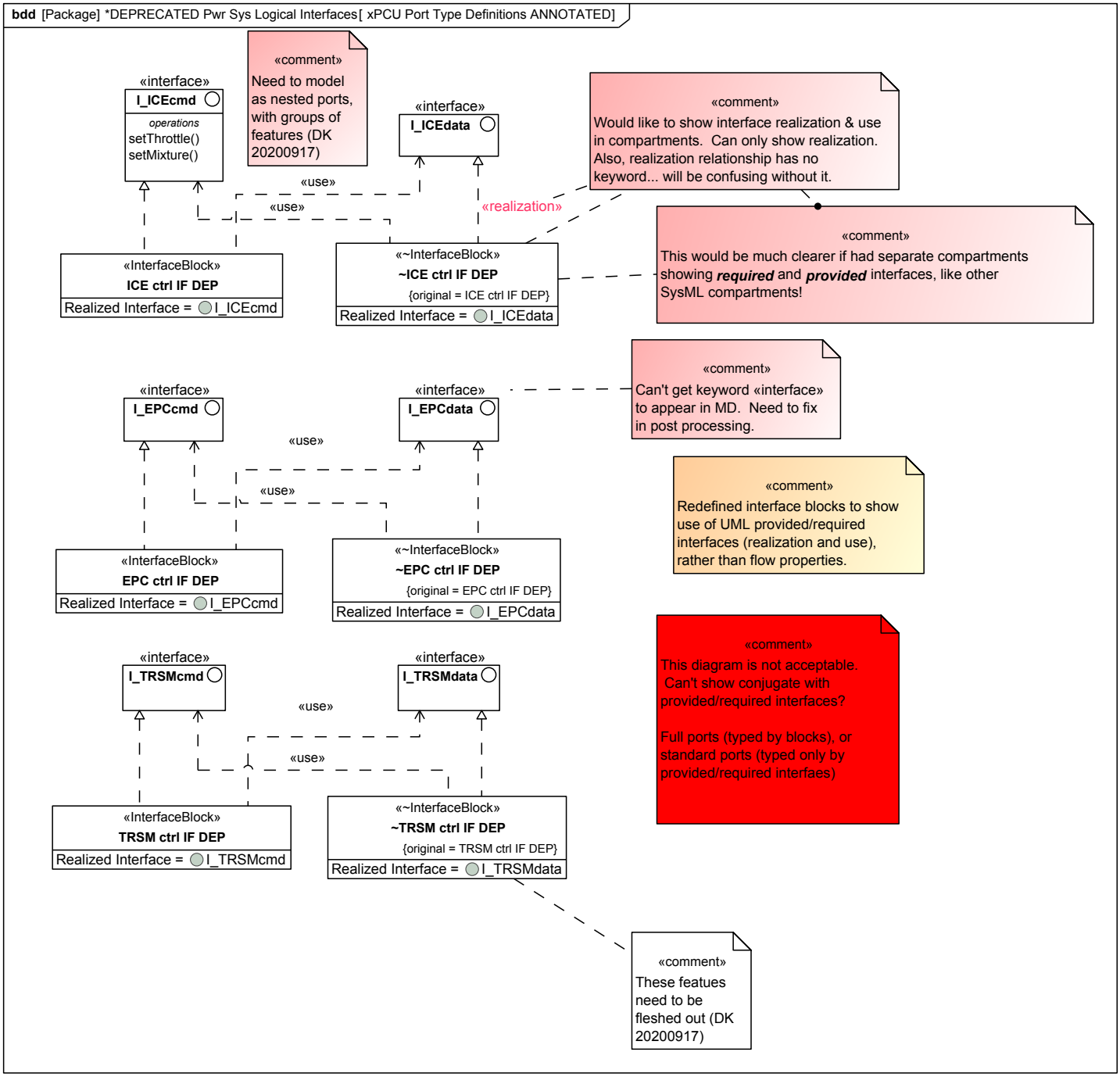


Figure 37. xPCU Port Type Definitions ANNOTATED

Notes: This diagram was intended to replace SysML 1.6 Figure D.20, but tool implementation constraints limit the representation of required & provided «interface» on «InterfaceBlocks». This diagram is included here to show the mess to represent this concept within the existing concrete syntax, and is NOT recommended for inclusion in the SysML 1.7 Annex D!

Note that the SysML 1.6 concept of the ICE «interfaceBlock» has been refined into the concept of the CAN IF «interfaceBlock» on Figure D.21, to more accurately and compellingly represent the behavior of the CAN bus. This decision has a ripple effect back into this figure, since the ICE/EPC/TRSM ctrl IF «interfaceBlocks» form a logical interface which is then allocated to a physical CAN interface on Figure D.24, and the connectors allocated to the CAN Bus on Figure D.45. **Annotated with comments, THIS DIAGRAM NOT USED in SysML 1.7**

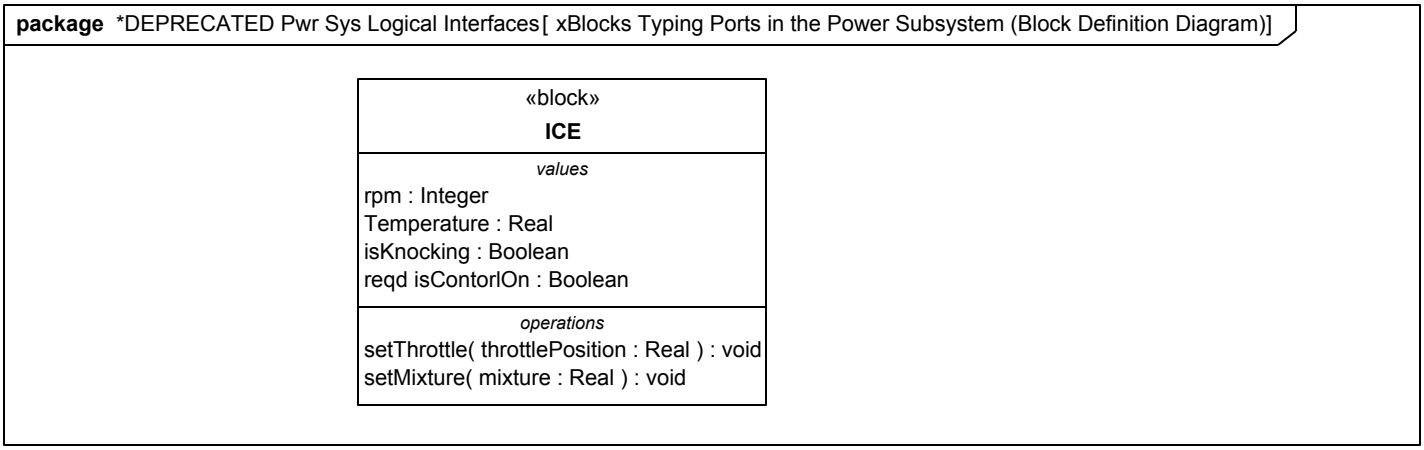


Figure 38. xBlocks Typing Ports in the Power Subsystem (Block Definition Diagram)

Interim diagram, **NOT USED in SysML 1.7**

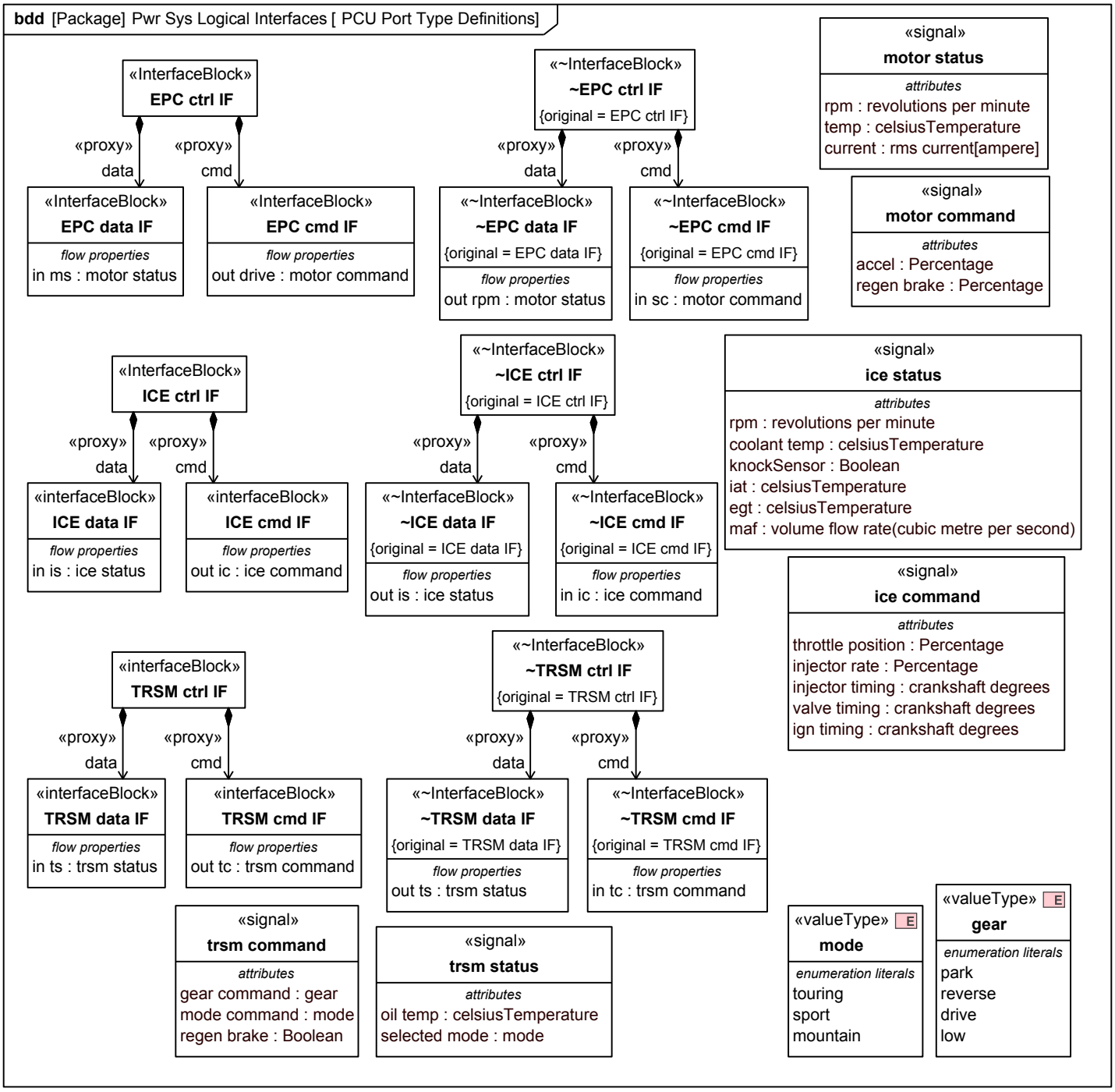


Figure 39. PCU Port Type Definitions

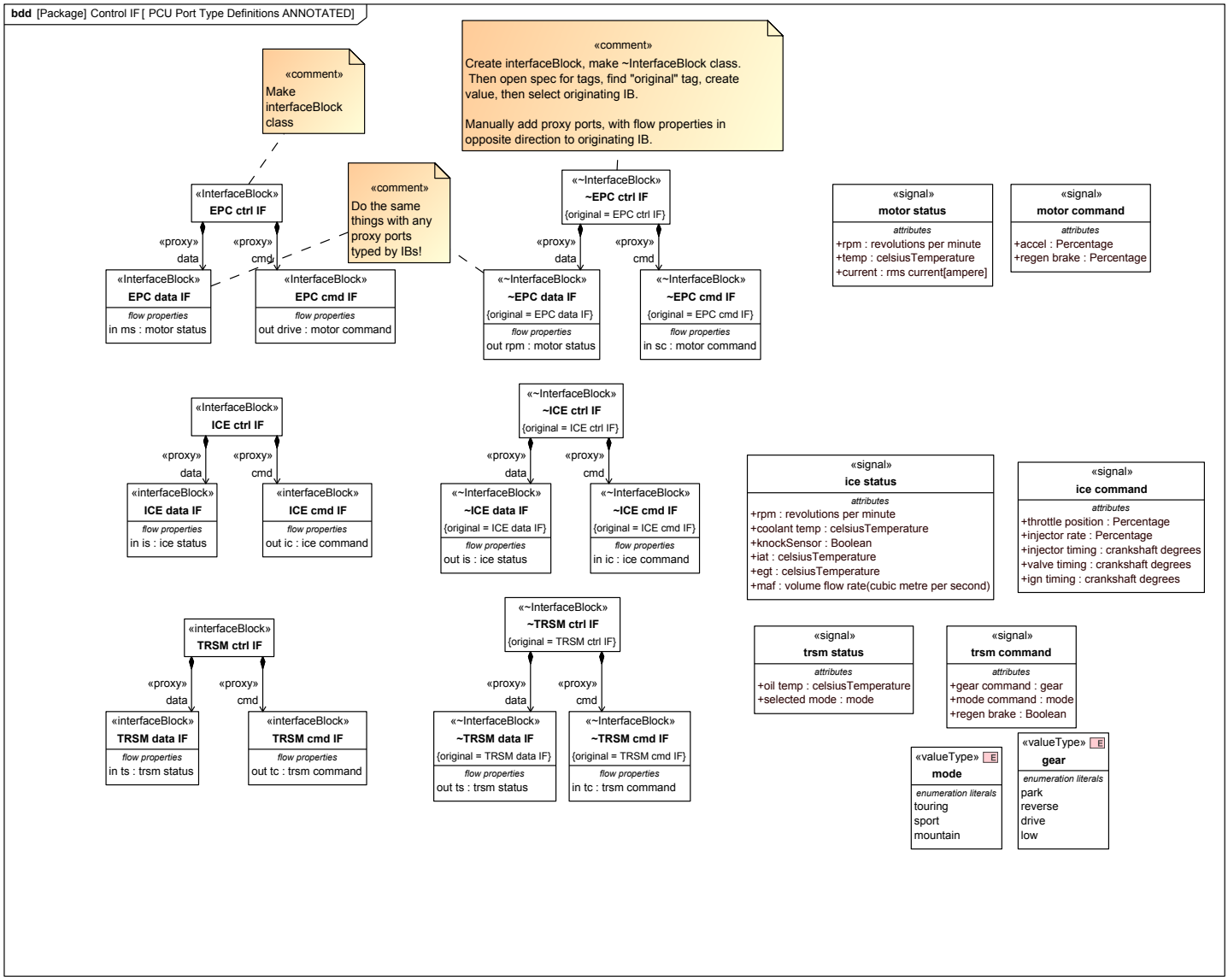


Figure 40. PCU Port Type Definitions ANNOTATED

5.20.4 Status

DRAFT. Deleted "lollipop" UML «interface» use, refocused on nested proxy ports (and conjugate proxy ports) with signals as flow properties.

All related diagrams with "x" in name should be deleted, provided here only for continuity.

5.21 Figure 21

5.21.1 Figure Number

1.7-D.21

5.21.2 Figure Name

Initially Defining Port Types with Flow Properties for the CAN Bus (Block Definition Diagram)

5.21.3 Figure Diagram

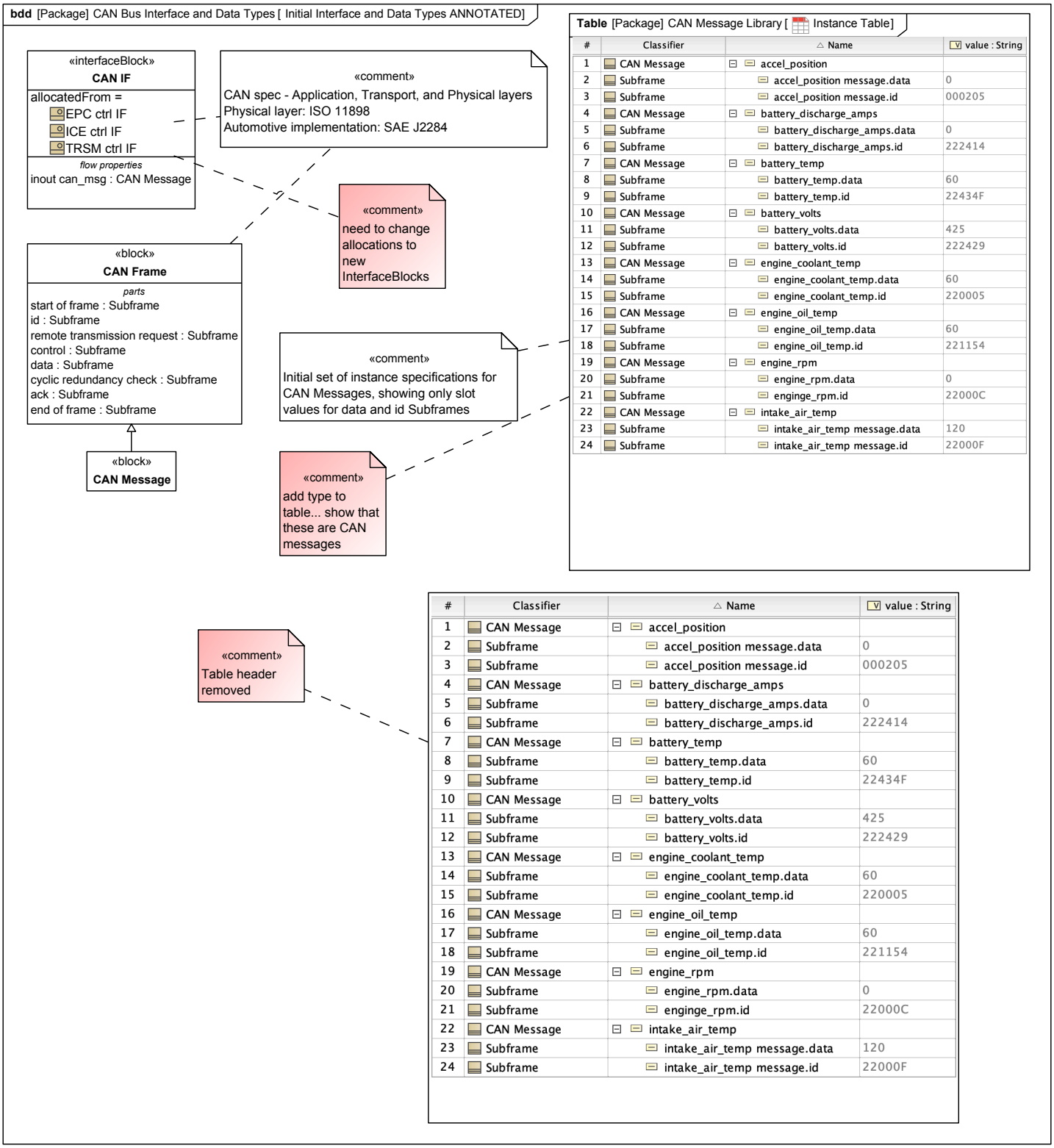
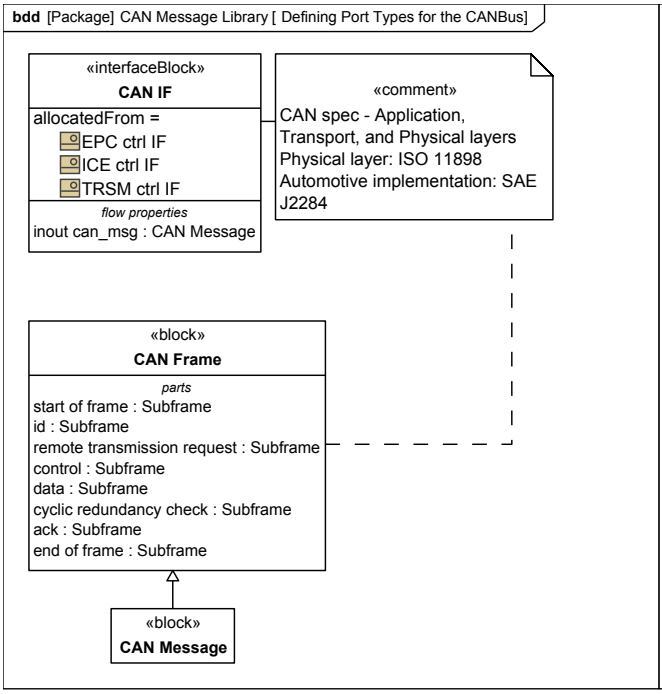


Figure 41. Initial Interface and Data Types ANNOTATED

Notes: This diagram has been completely reworked to more accurately and compellingly represent the behavior of the CAN bus, replacing Figure D.21 in SysML 1.6. Reference to CAN standards and structure is provided. Note that the CAN Message Library has been adapted from the Chevrolet Volt CAN message specification.



#	Classifier	Name	value : String
1	CAN Message	accel_position	
2	Subframe	accel_position message.data	0
3	Subframe	accel_position message.id	000205
4	CAN Message	battery_discharge_amps	
5	Subframe	battery_discharge_amps.data	0
6	Subframe	battery_discharge_amps.id	222414
7	CAN Message	battery_temp	
8	Subframe	battery_temp.data	60
9	Subframe	battery_temp.id	22434F
10	CAN Message	battery_volts	
11	Subframe	battery_volts.data	425
12	Subframe	battery_volts.id	222429
13	CAN Message	engine_coolant_temp	
14	Subframe	engine_coolant_temp.data	60
15	Subframe	engine_coolant_temp.id	220005
16	CAN Message	engine_oil_temp	
17	Subframe	engine_oil_temp.data	60
18	Subframe	engine_oil_temp.id	221154
19	CAN Message	engine_rpm	
20	Subframe	engine_rpm.data	0
21	Subframe	enginge_rpm.id	22000C
22	CAN Message	intake_air_temp	
23	Subframe	intake_air_temp message.data	120
24	Subframe	intake_air_temp message.id	22000F

Figure 42. Initially Port Types with Flow Properties for the CANBus

Please Note: Tables are not a normative part of the SysML specification. So all tables are for illustration and reference only.

5.21.4 Status

DRAFT. MAJOR CHANGE/update focused on CAN interface spec, based on SAE & ISO references.

5.22 Figure 22

5.22.1 Figure Number

1.7-D.22

5.22.2 Figure Name

Consolidating Connectors into the CAN Bus. (Internal Block Diagram)

5.22.3 Figure Diagram

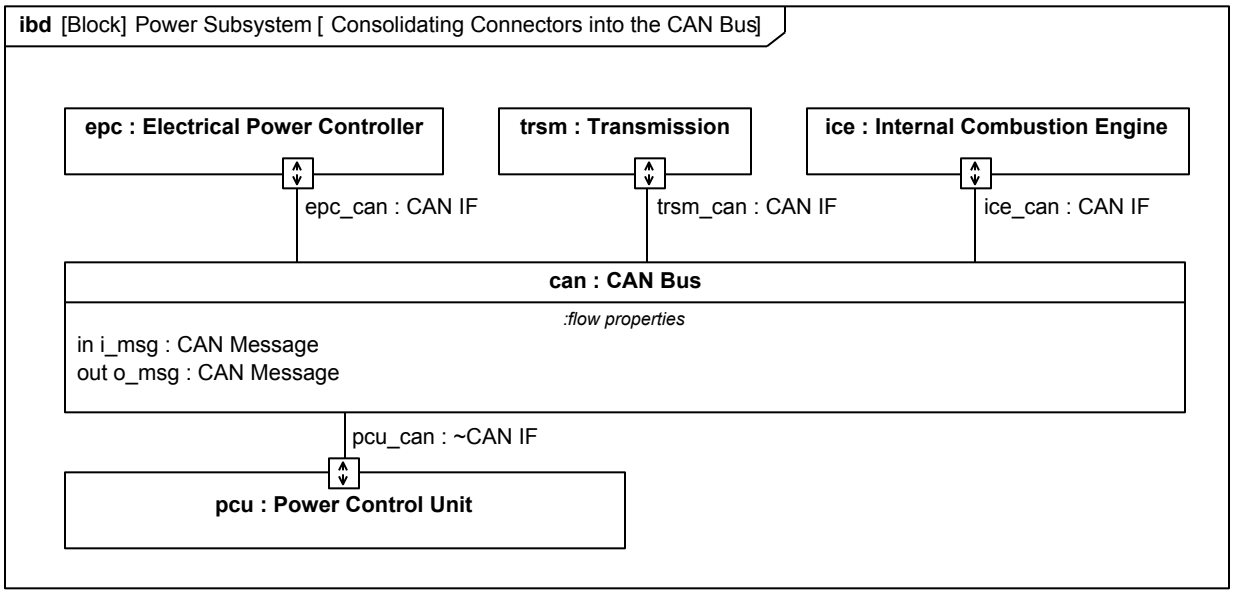


Figure 43. Consolidating Connectors into the CAN Bus

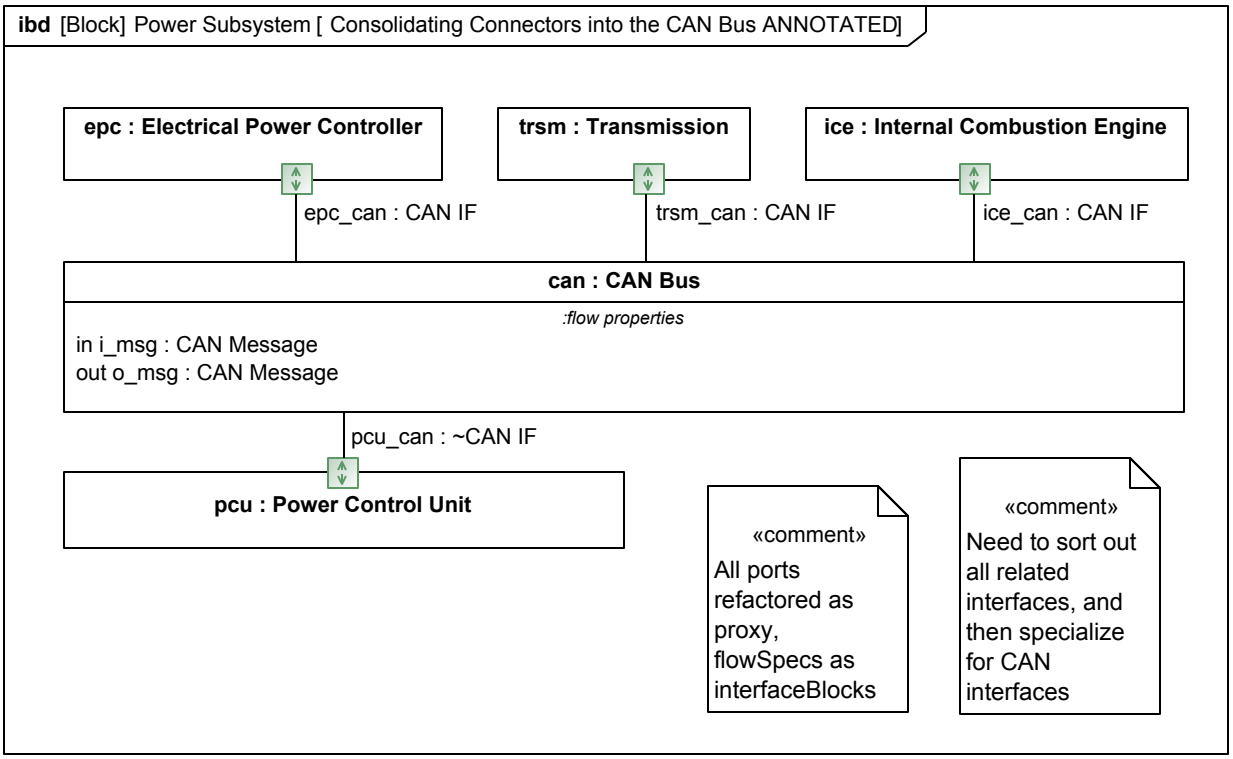


Figure 44. Consolidating Connectors into the CAN Bus ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.22. Flow properties added to the CAN Bus for clarity and continuity.

5.22.4 Status

DONE. Changed to incorporate updated CAN bus interface definition.

5.23 Figure 23

5.23.1 Figure Number

1.7-D.23

5.23.2 Figure Name

Elaborating Definition of Fuel Flow. (Block Definition Diagram)

5.23.3 Figure Diagram

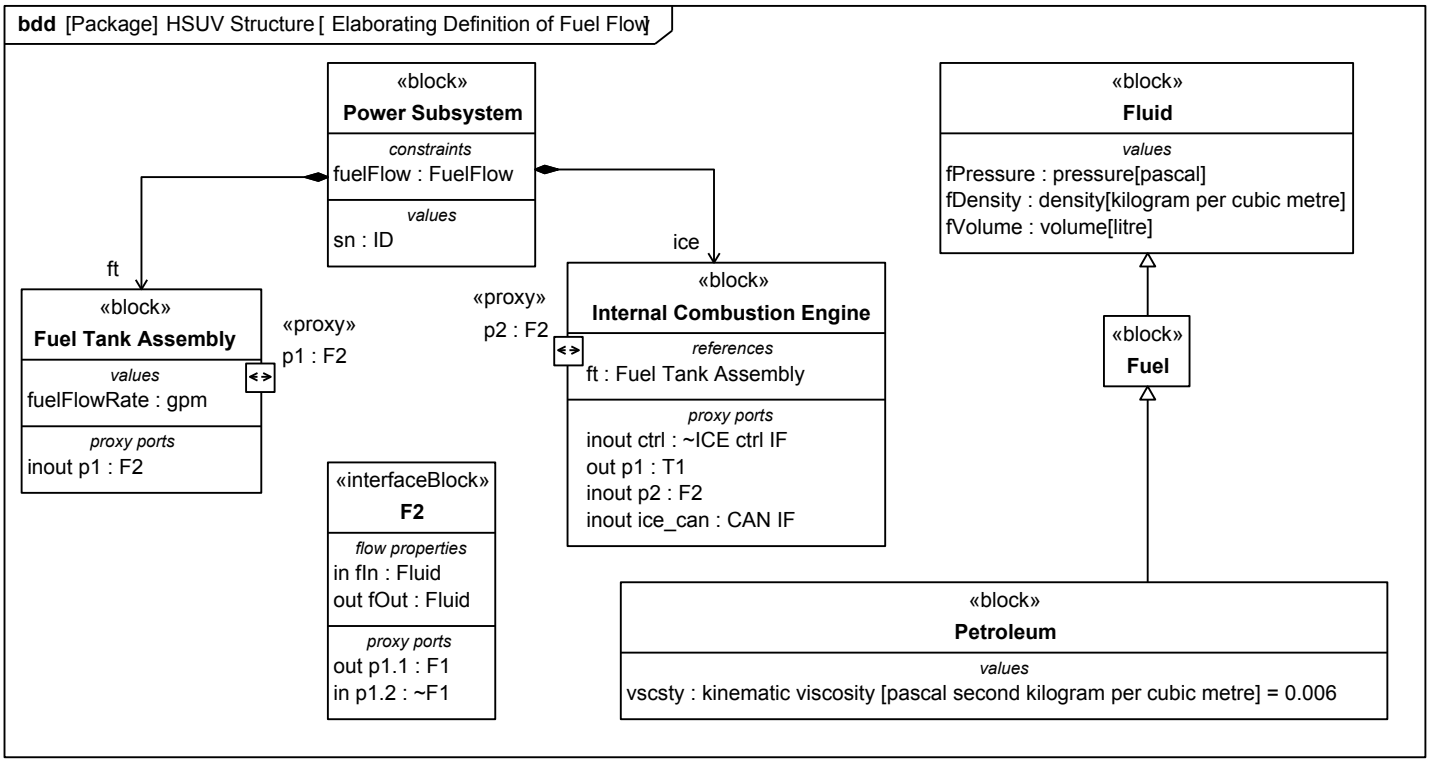


Figure 45. Elaborating Definition of Fuel Flow

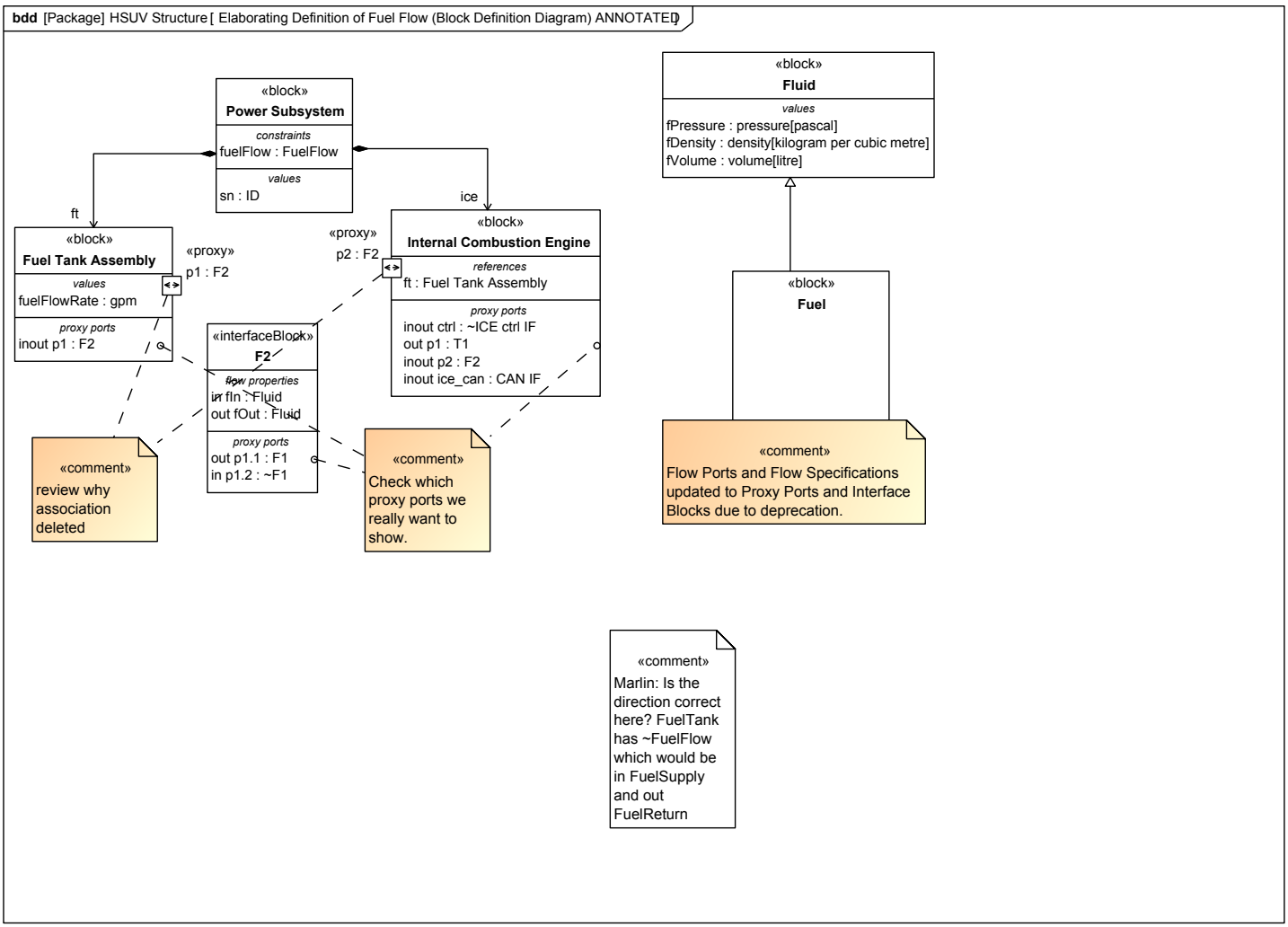


Figure 46. Elaborating Definition of Fuel Flow (Block Definition Diagram) ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.23.

5.23.4 Status

Done. Added new Petroleum which inherits from the fuel block. Question on Fuel Flow Direction & Proxy Port P1. Turn off redundant symbology, refine layout.

5.24 Figure 24

5.24.1 Figure Number

1.7-D.24

5.24.2 Figure Name

Defining Fuel Flow Constraints (Parametric Diagram)

5.24.3 Figure Diagram

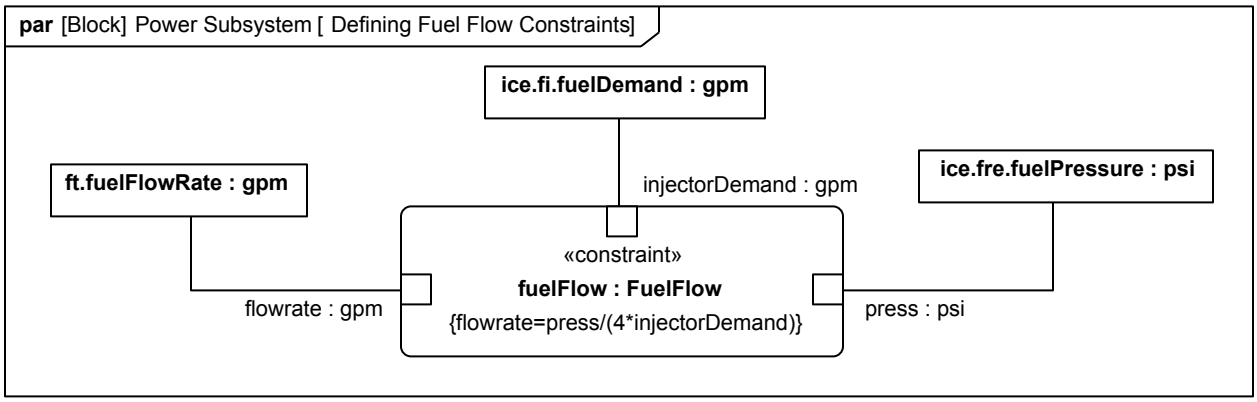


Figure 47. Defining Fuel Flow Constraints

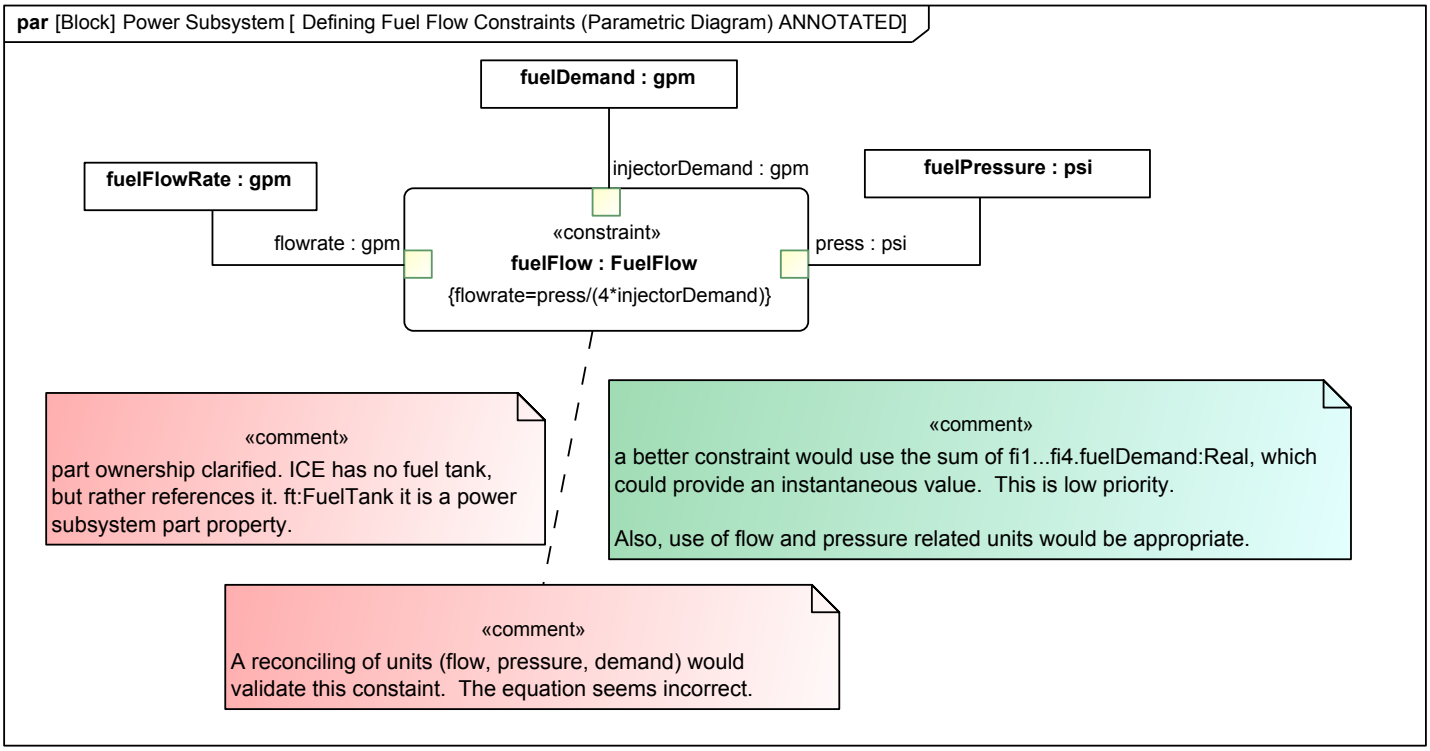


Figure 48. Defining Fuel Flow Constraints (Parametric Diagram) ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.24.

5.24.4 Status

DRAFT. Changed fuel tank flow rate value property to better context.

5.25 Figure 25

5.25.1 Figure Number

1.7-D.25

5.25.2 Figure Name

Detailed Internal Structure of Fuel Delivery Subsystem (Internal Block Diagram)

5.25.3 Figure Diagram

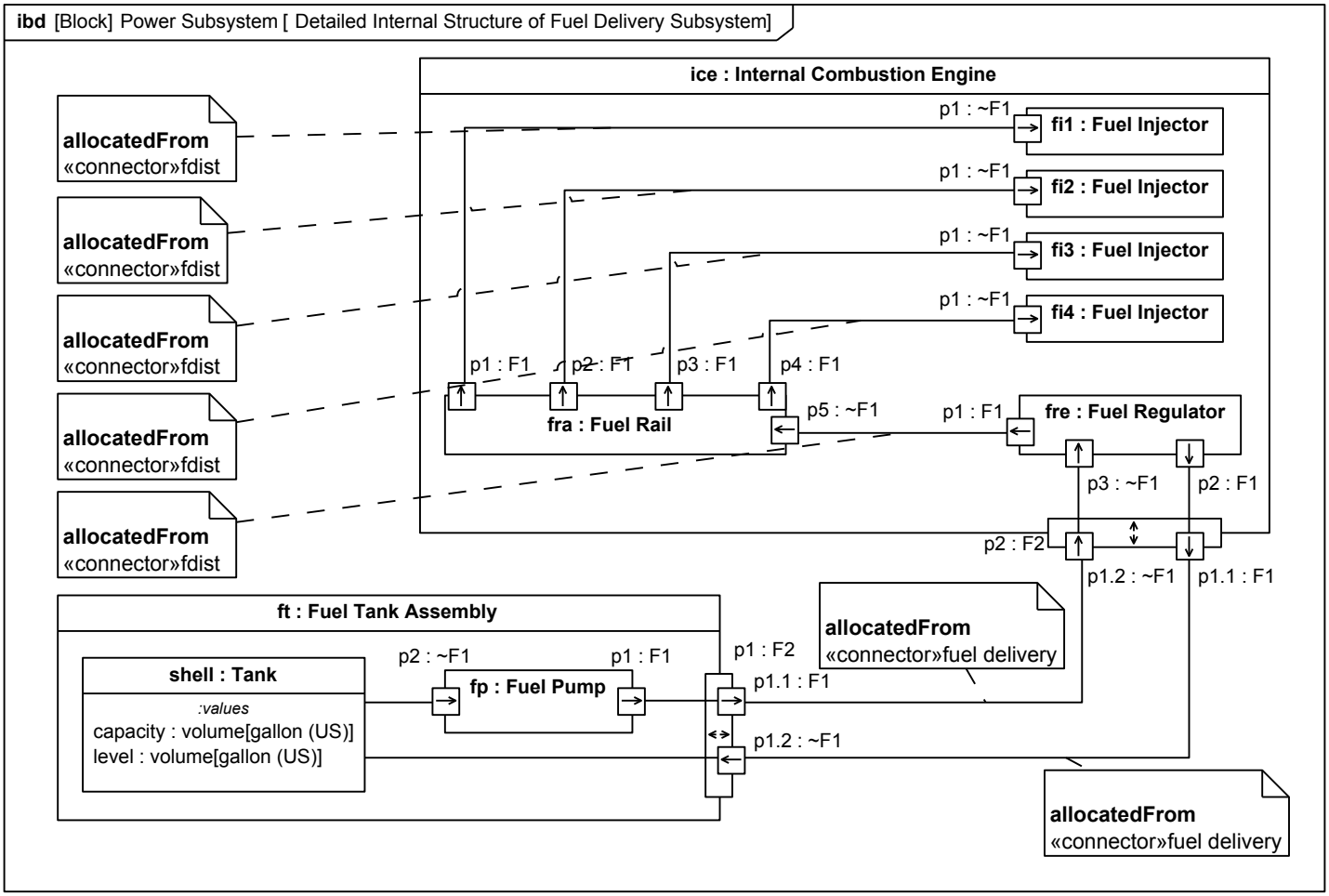


Figure 49. Detailed Internal Structure of Fuel Delivery Subsystem

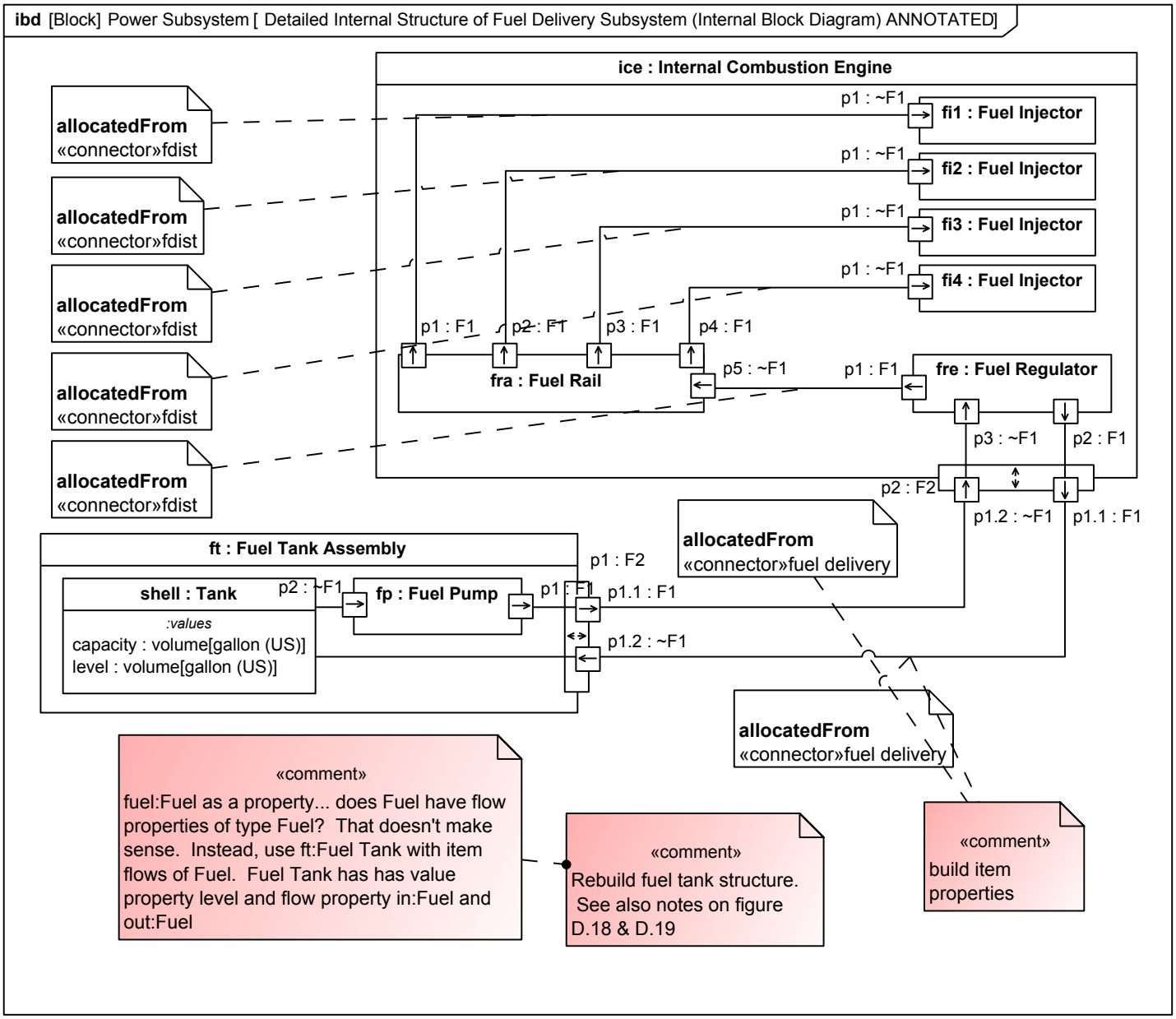


Figure 50. Detailed Internal Structure of Fuel Delivery Subsystem (Internal Block Diagram) ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.25, while still addressing noted issues.

5.25.4 Status

DRAFT

5.26 Figure 26

5.26.1 Figure Number

1.7-D.26

5.26.2 Figure Name

Defining Analyses for Hybrid SUV Engineering Development (Block Definition Diagram)

5.26.3 Figure Diagram

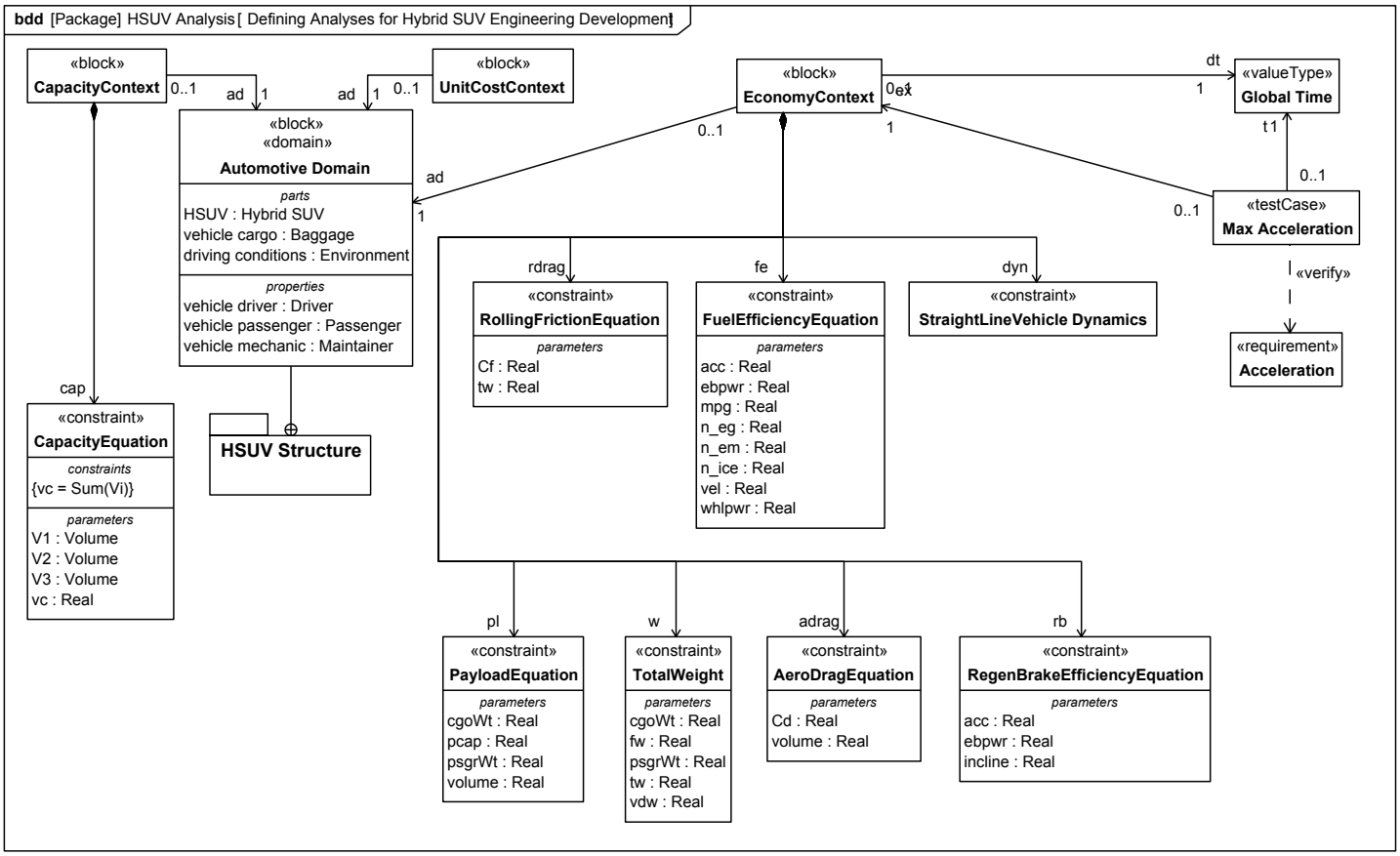


Figure 51. Defining Analyses for Hybrid SUV Engineering Development

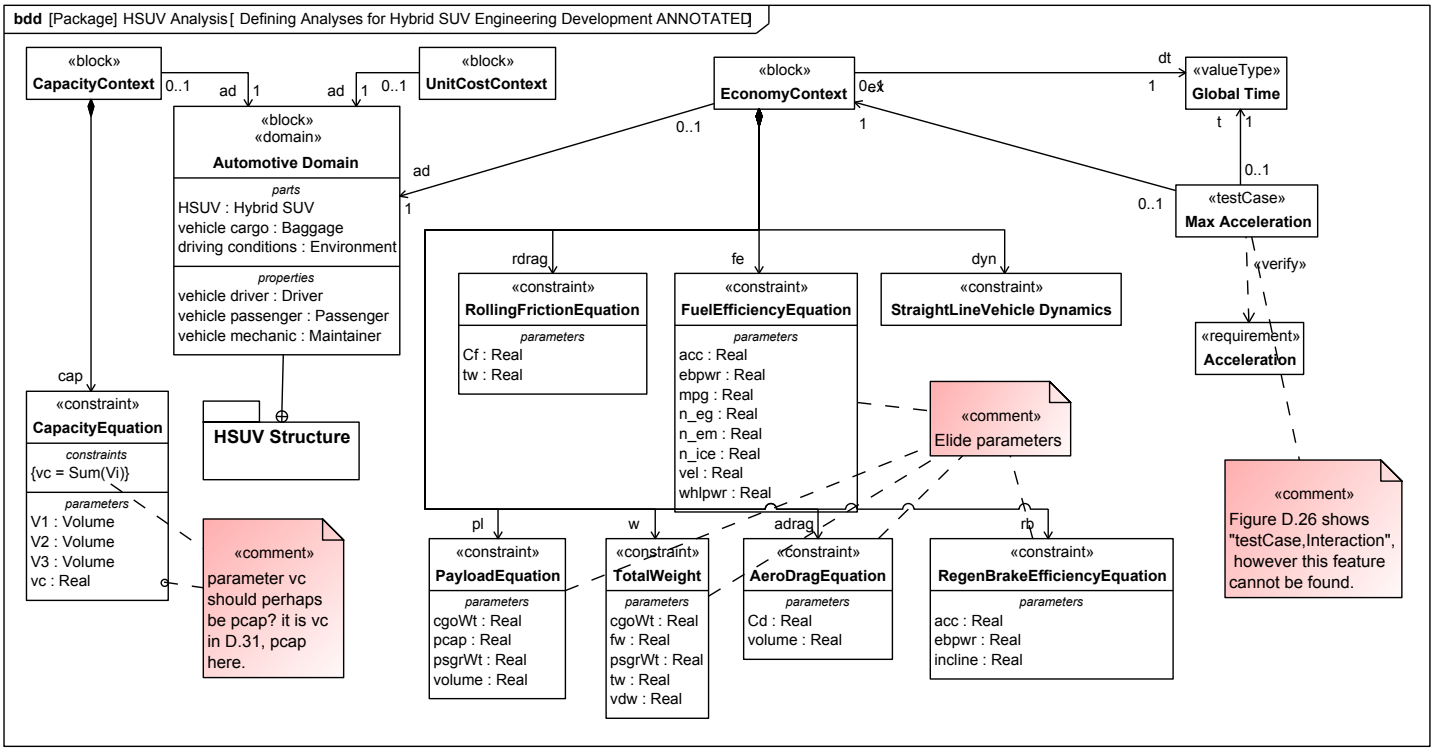


Figure 52. Defining Analyses for Hybrid SUV Engineering Development ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.26.

5.26.4 Status

DONE. minor issues, see comments.

5.27 Figure 27

5.27.1 Figure Number

1.7-D.27

5.27.2 Figure Name

Performance View

5.27.3 Figure Diagram

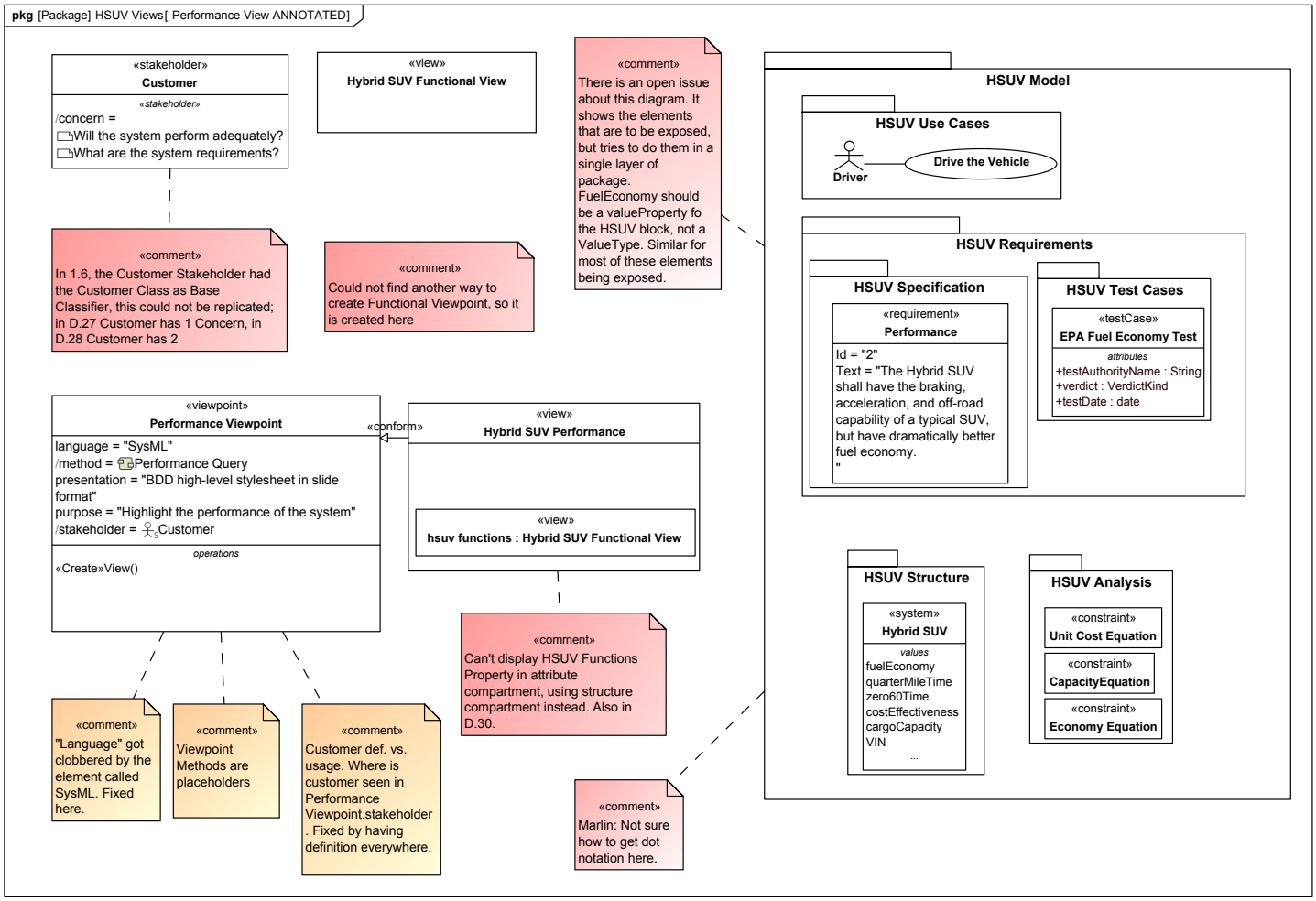


Figure 53. Performance View ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.27.

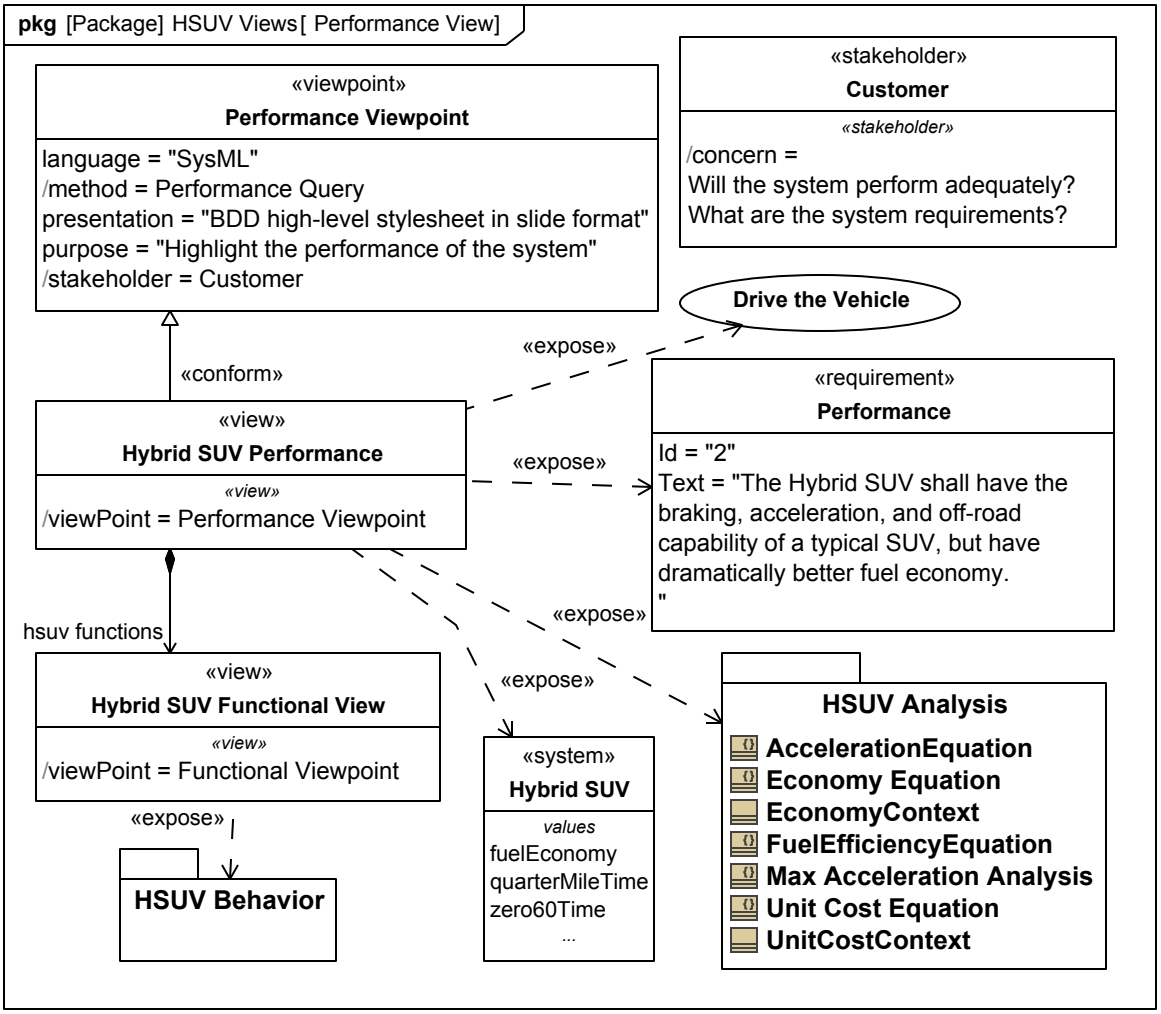


Figure 54. Performance View

5.27.4 Status

DRAFT. New layout.

5.28 Figure 28

5.28.1 Figure Number

1.7-D.28

5.28.2 Figure Name

Defining Requirements and VnV viewpoints (Package Diagram)

5.28.3 Figure Diagram

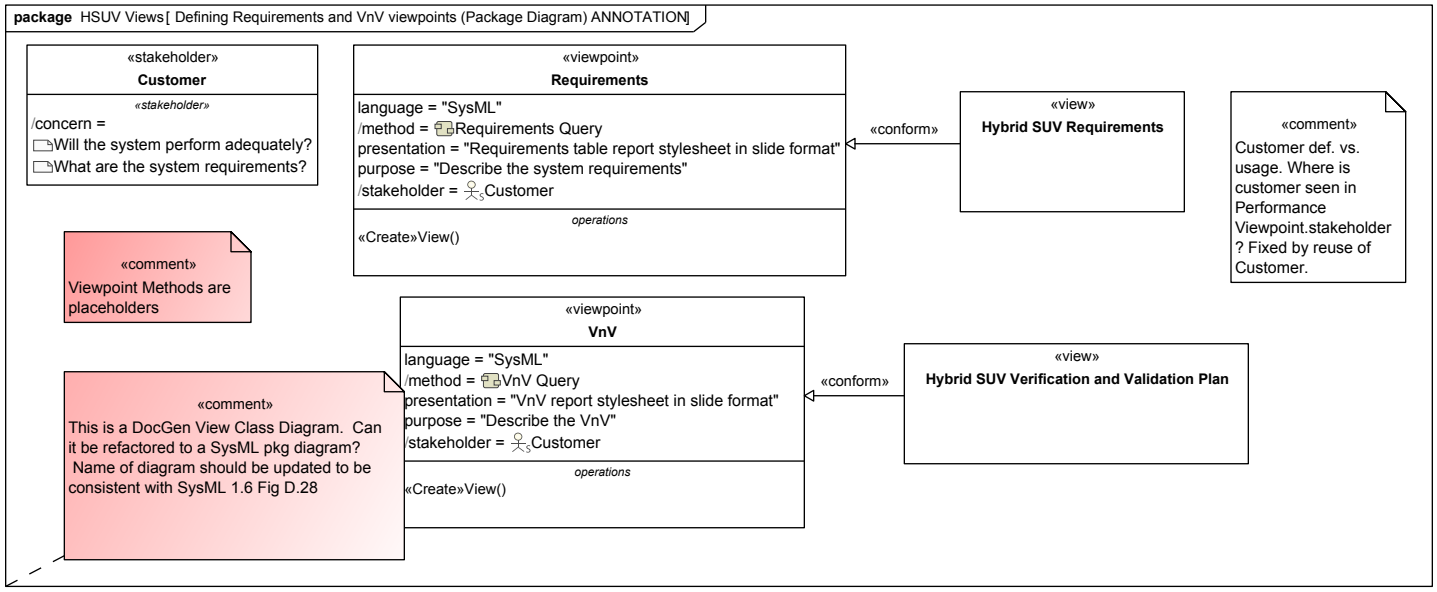


Figure 55. Defining Requirements and VnV viewpoints (Package Diagram) ANNOTATION

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.28.

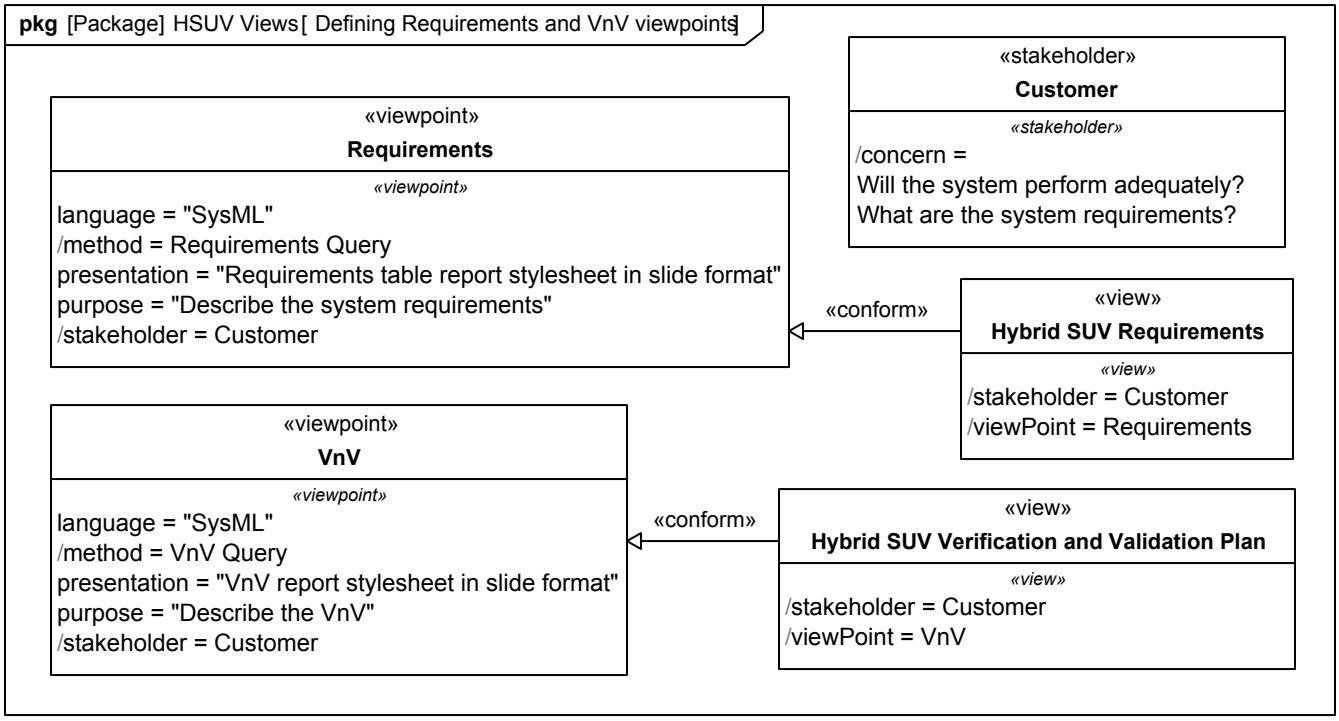


Figure 56. Defining Requirements and VnV viewpoints

5.28.4 Status

DRAFT. Minor update to be consistent with model.

5.29 Figure 29

5.29.1 Figure Number

1.7-D.29

5.29.2 Figure Name

Requirements and VnV views exposing elements from the model (Package Diagram)

5.29.3 Figure Diagram

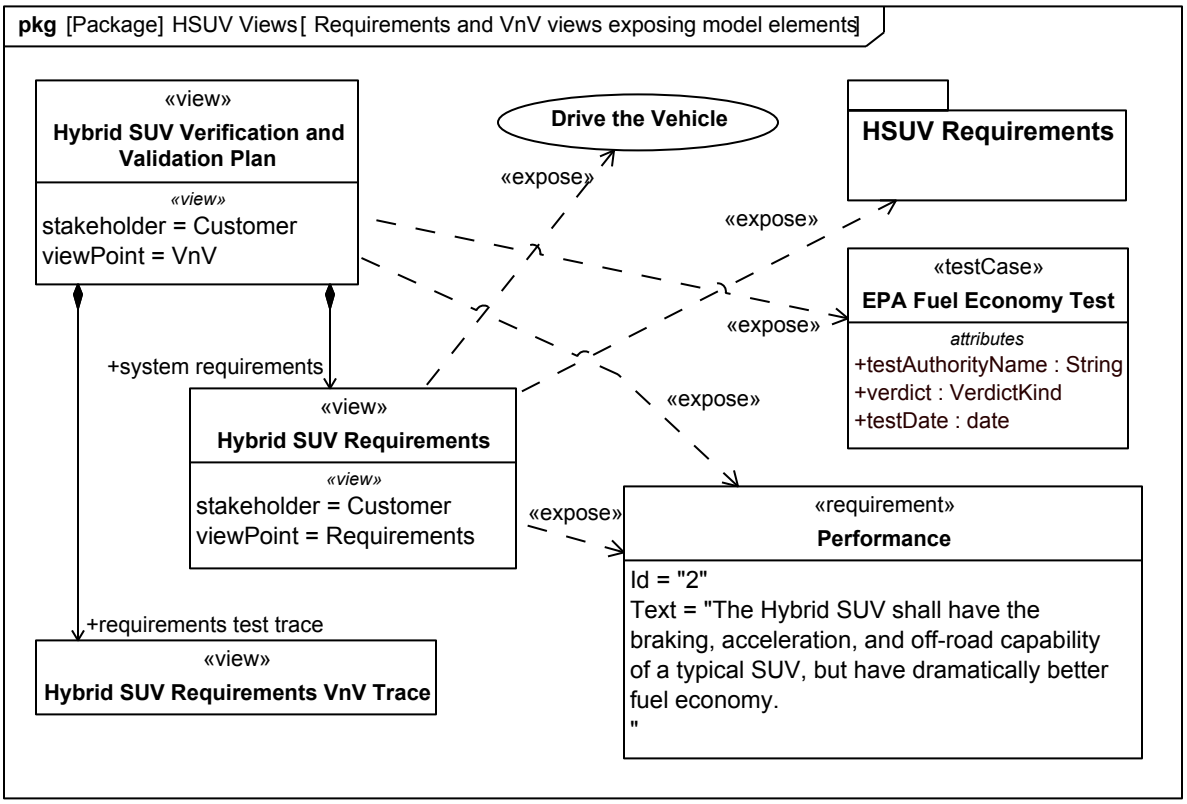


Figure 57. Requirements and VnV views exposing model elements

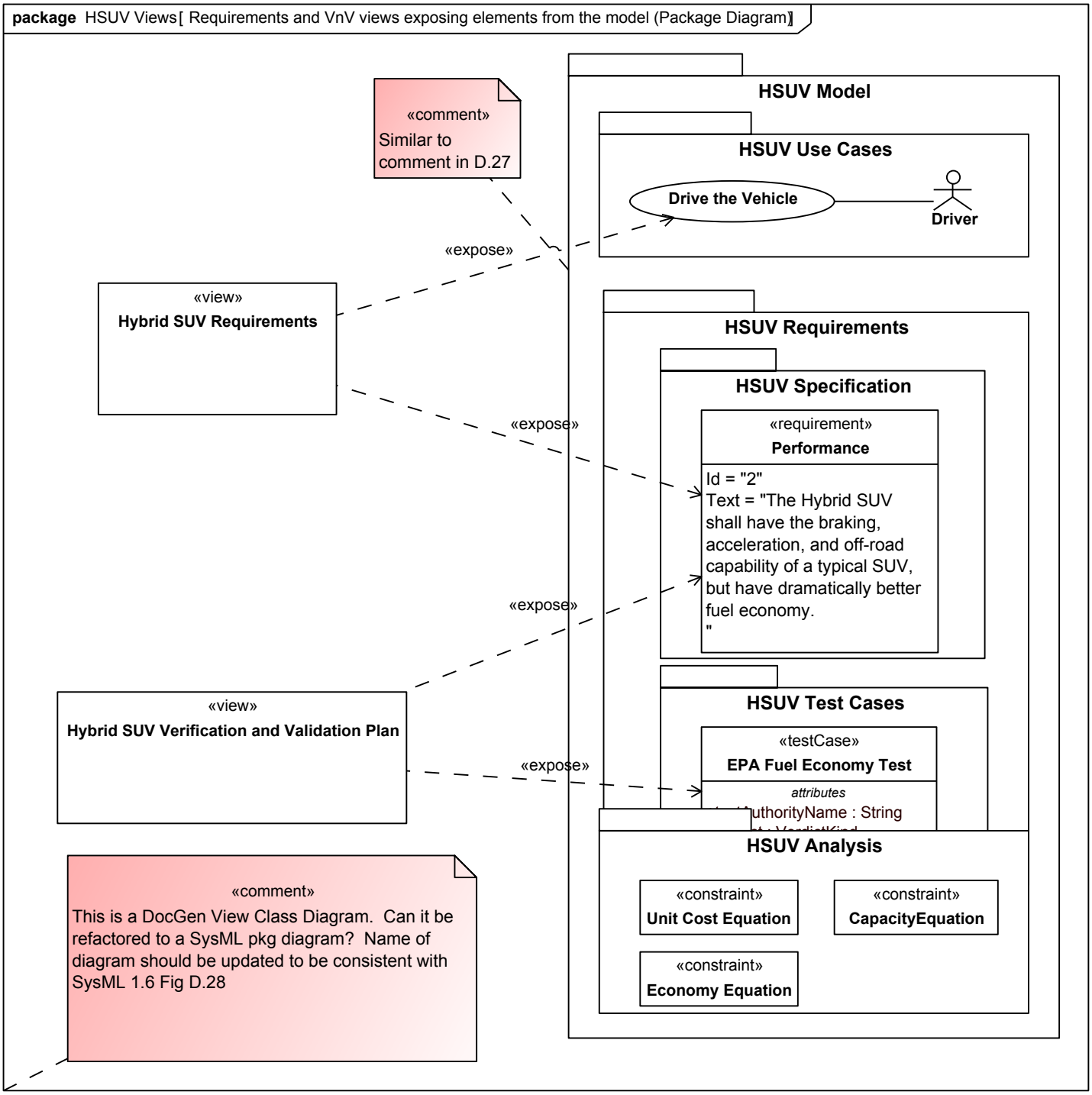


Figure 58. Requirements and VnV views exposing elements from the model (Package Diagram)

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.29.

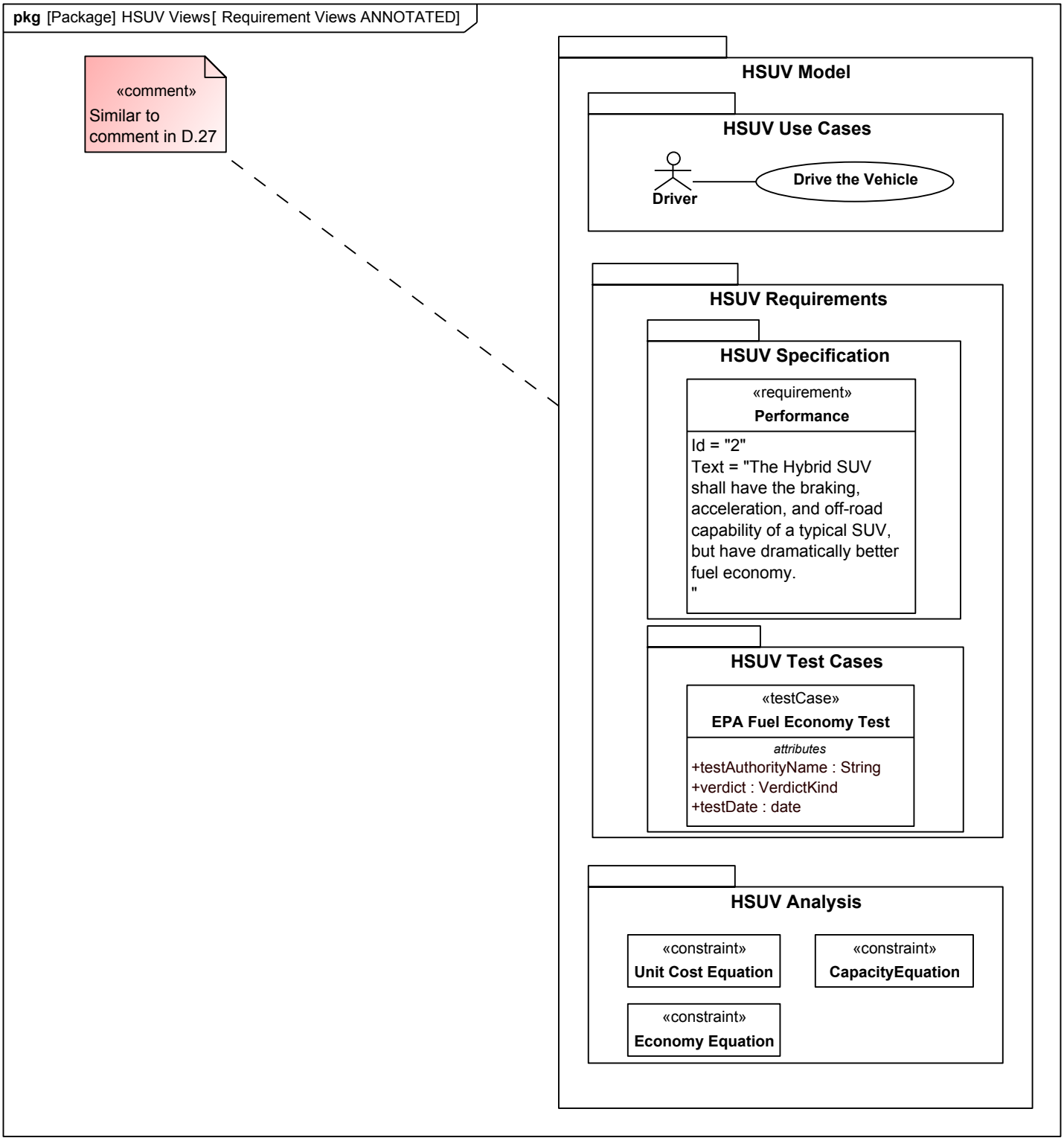


Figure 59. Requirement Views ANNOTATED

This was a starting point for creating a viewpoints diagram, similar to SysML 1.6 figure D.28. It has been superceded.

5.29.4 Status

DRAFT. Updated to be consistent with model.

5.30 Figure 30

5.30.1 Figure Number

1.7-D.30

5.30.2 Figure Name

The Requirements and VnV views with supporting views (Package Diagram)

5.30.3 Figure Diagram

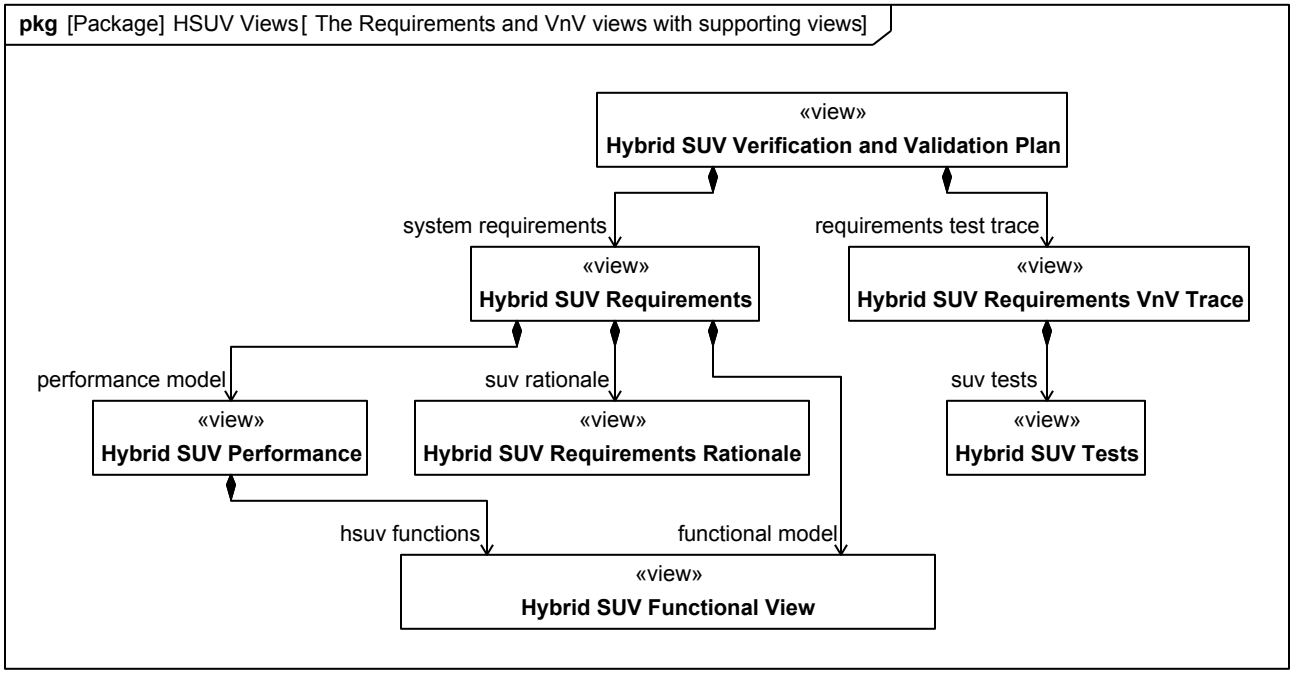


Figure 60. The Requirements and VnV views with supporting views

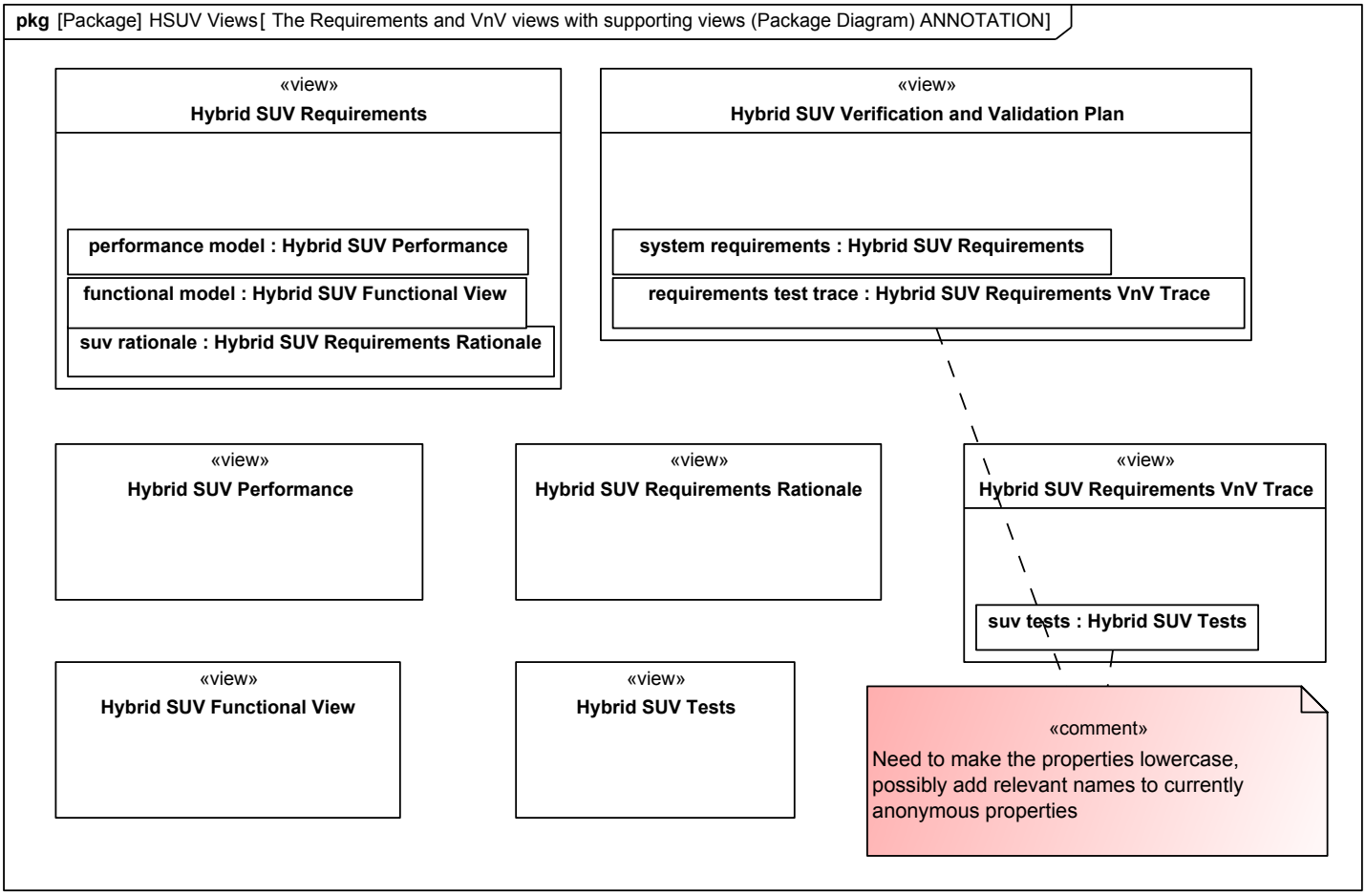


Figure 61. The Requirements and VnV views with supporting views (Package Diagram) ANNOTATION

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.30.

5.30.4 Status

DONE. Changed to hierarchical layout (bdd style)

5.31 Figure 31

5.31.1 Figure Number

1.7-D.31

5.31.2 Figure Name

Defining Measures of Effectiveness and Key Relationships (Parametric Diagram)

5.31.3 Figure Diagram

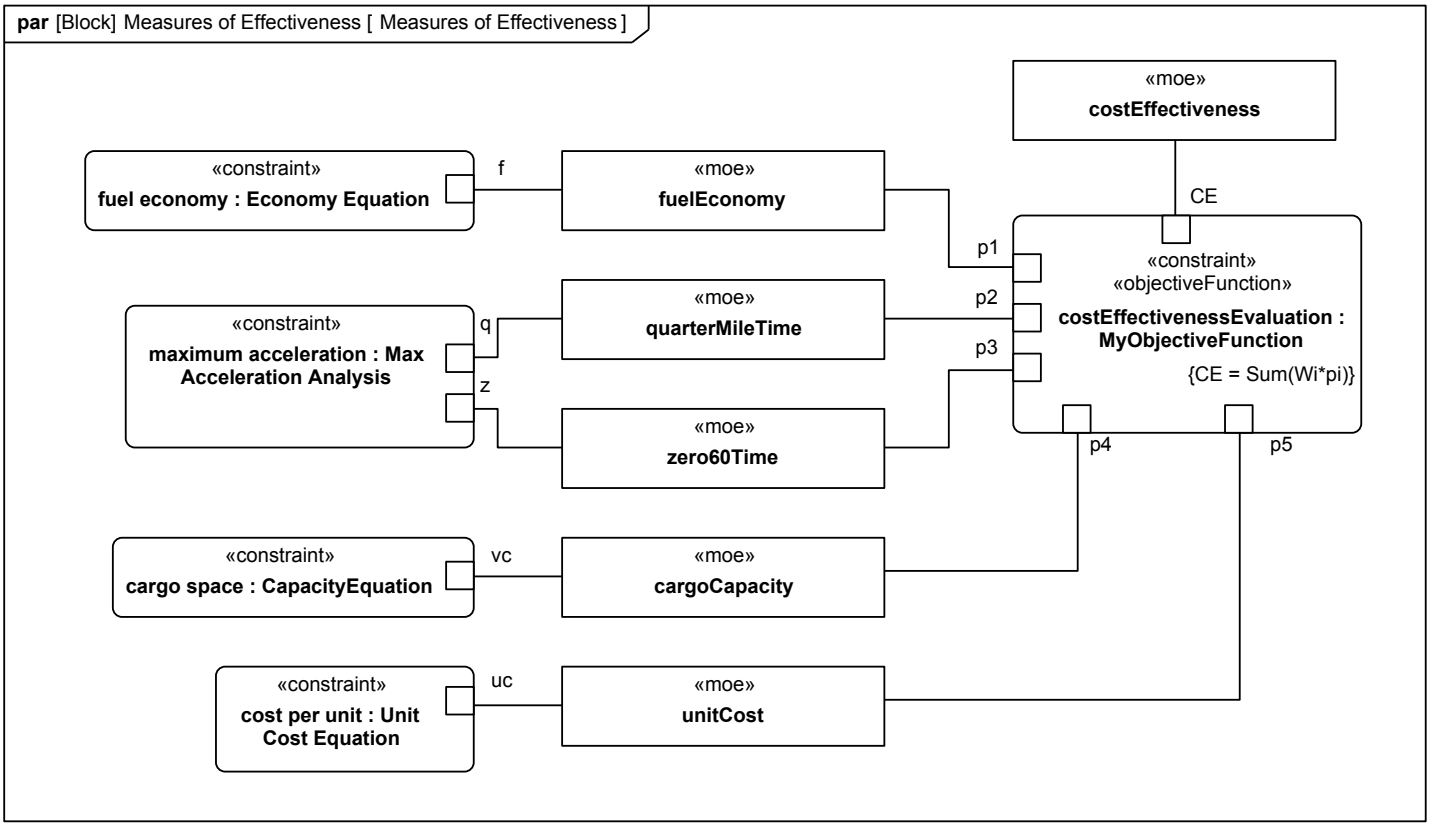


Figure 62. Measures of Effectiveness

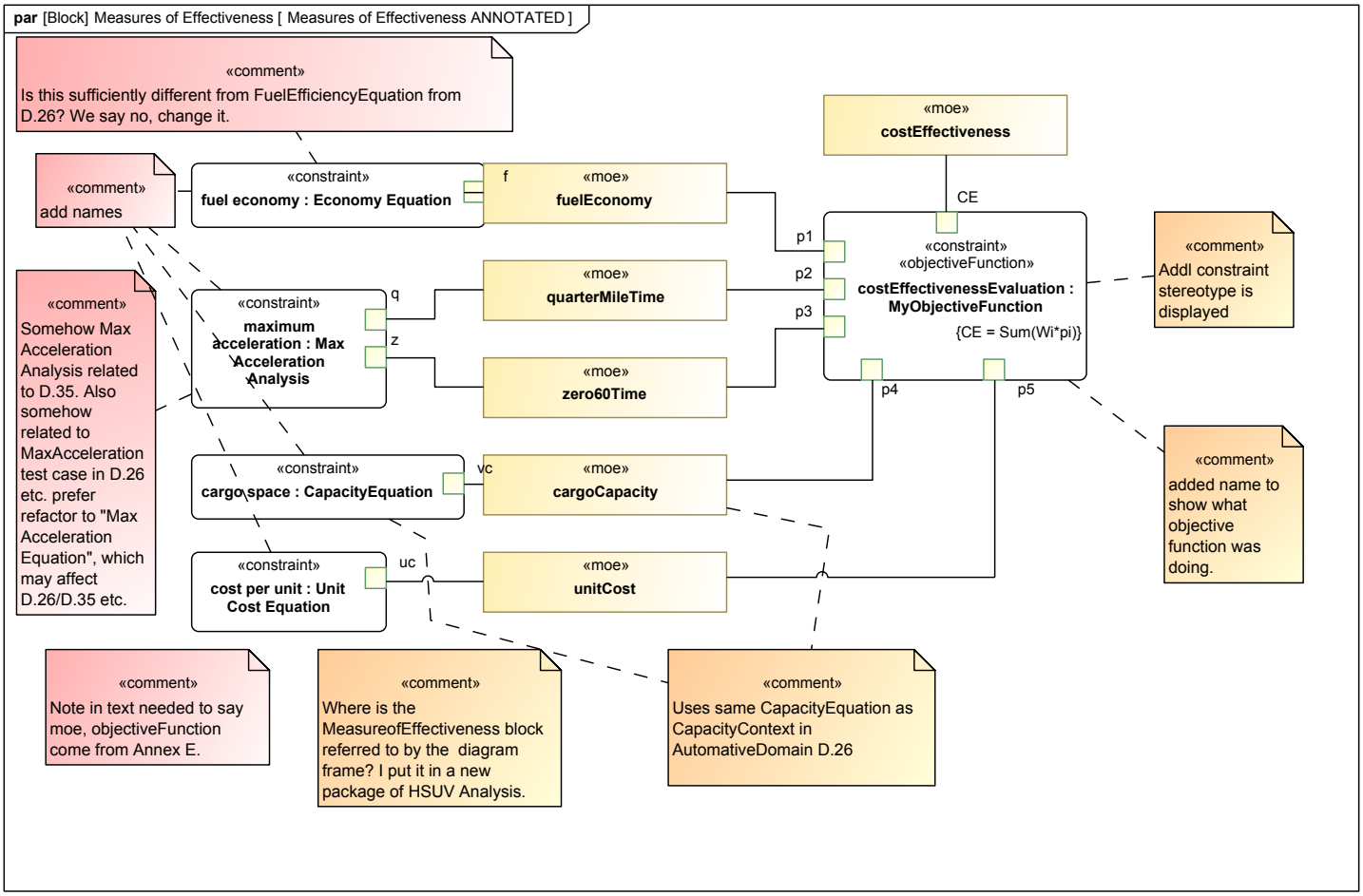


Figure 63. Measures of Effectiveness ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.31.

5.31.4 Status

DONE. review & hide comments.

5.32 Figure 32

5.32.1 Figure Number

1.7-D.32

5.32.2 Figure Name

Establishing Mathematical Relationships for Fuel Economy Calculations (Parametric Diagram)

5.32.3 Figure Diagram

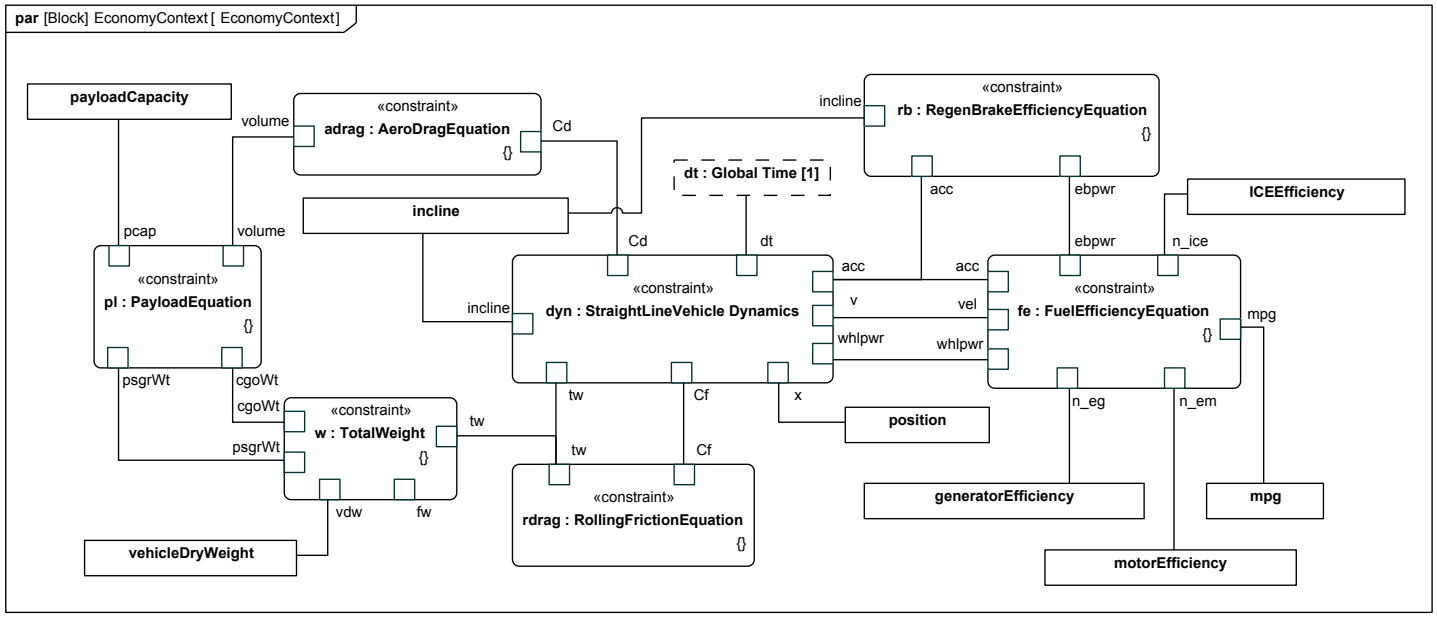


Figure 64. EconomyContext

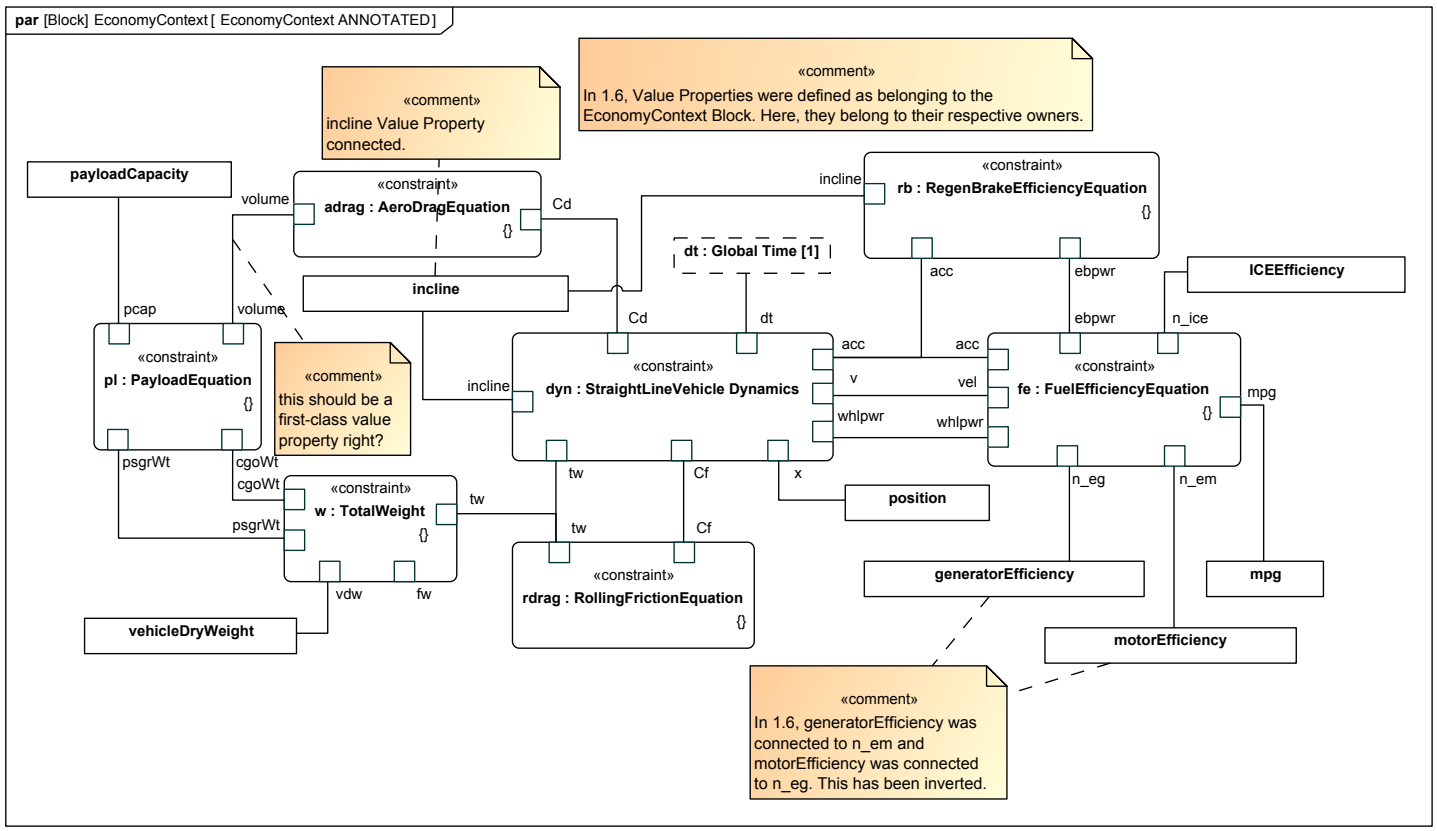


Figure 65. EconomyContext ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.32.

5.32.4 Status

DONE. review & hide comments.

5.33 Figure 33

5.33.1 Figure Number

1.7-D.33

5.33.2 Figure Name

Straight Line Vehicle Dynamics Mathematical Model (Parametric Diagram)

5.33.3 Figure Diagram

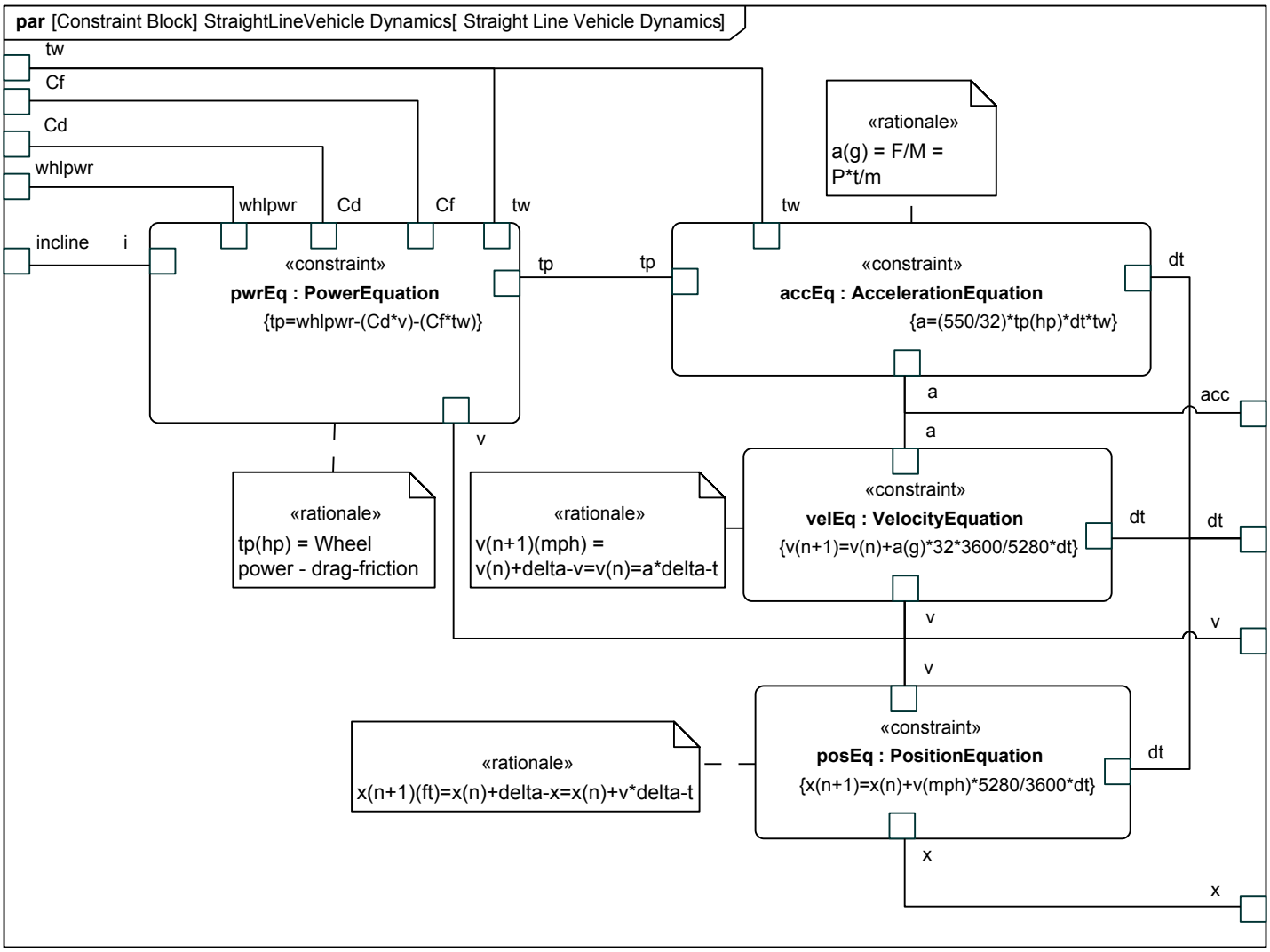


Figure 66. Straight Line Vehicle Dynamics

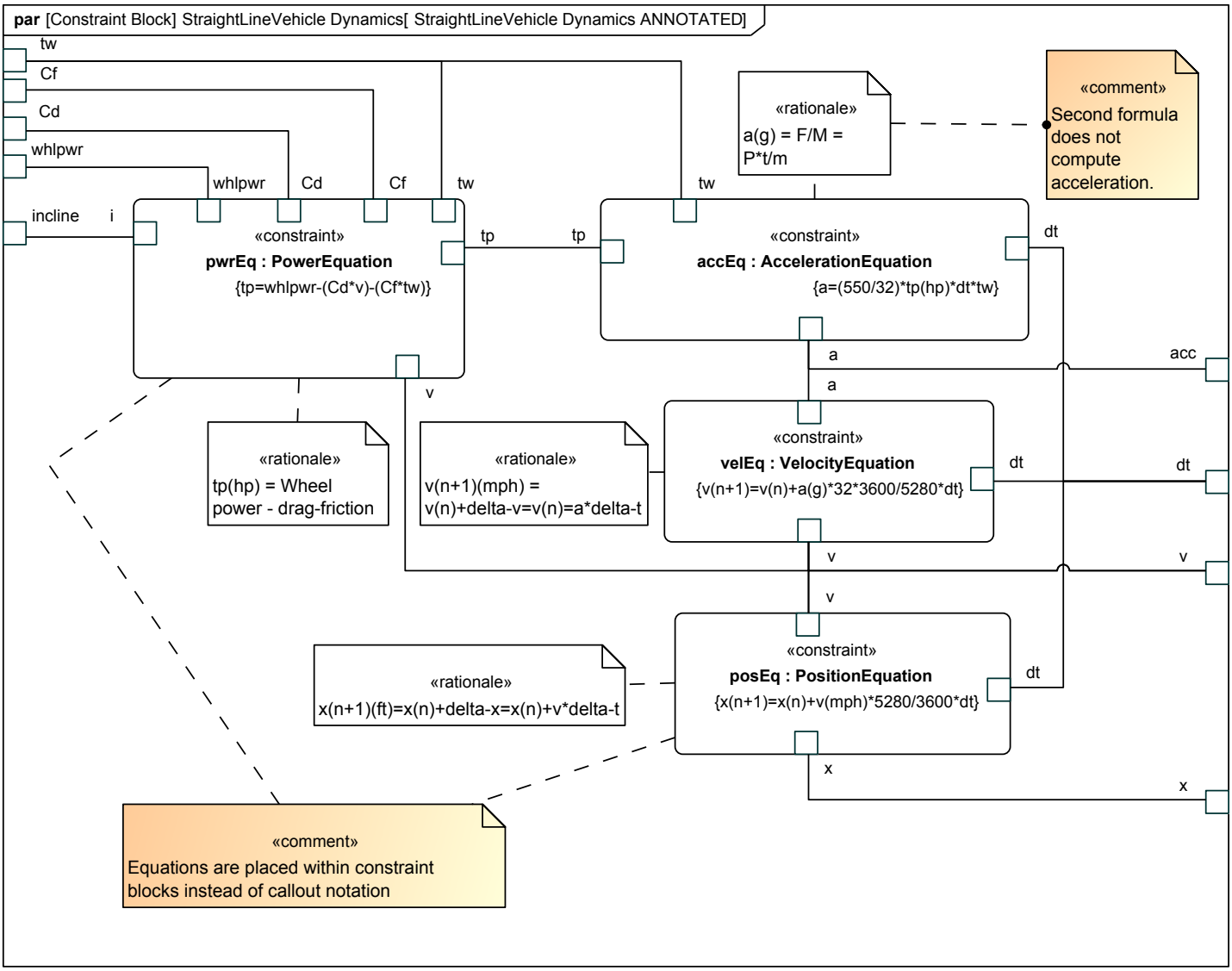


Figure 67. StraightLineVehicle Dynamics ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.33.

5.33.4 Status

DONE. review & hide comments.

5.34 Figure 34

5.34.1 Figure Number

1.7-D.34

5.34.2 Figure Name

Defining Straight-Line Vehicle Dynamics Mathematical Constraints (Block Definition Diagram)

5.34.3 Figure Diagram

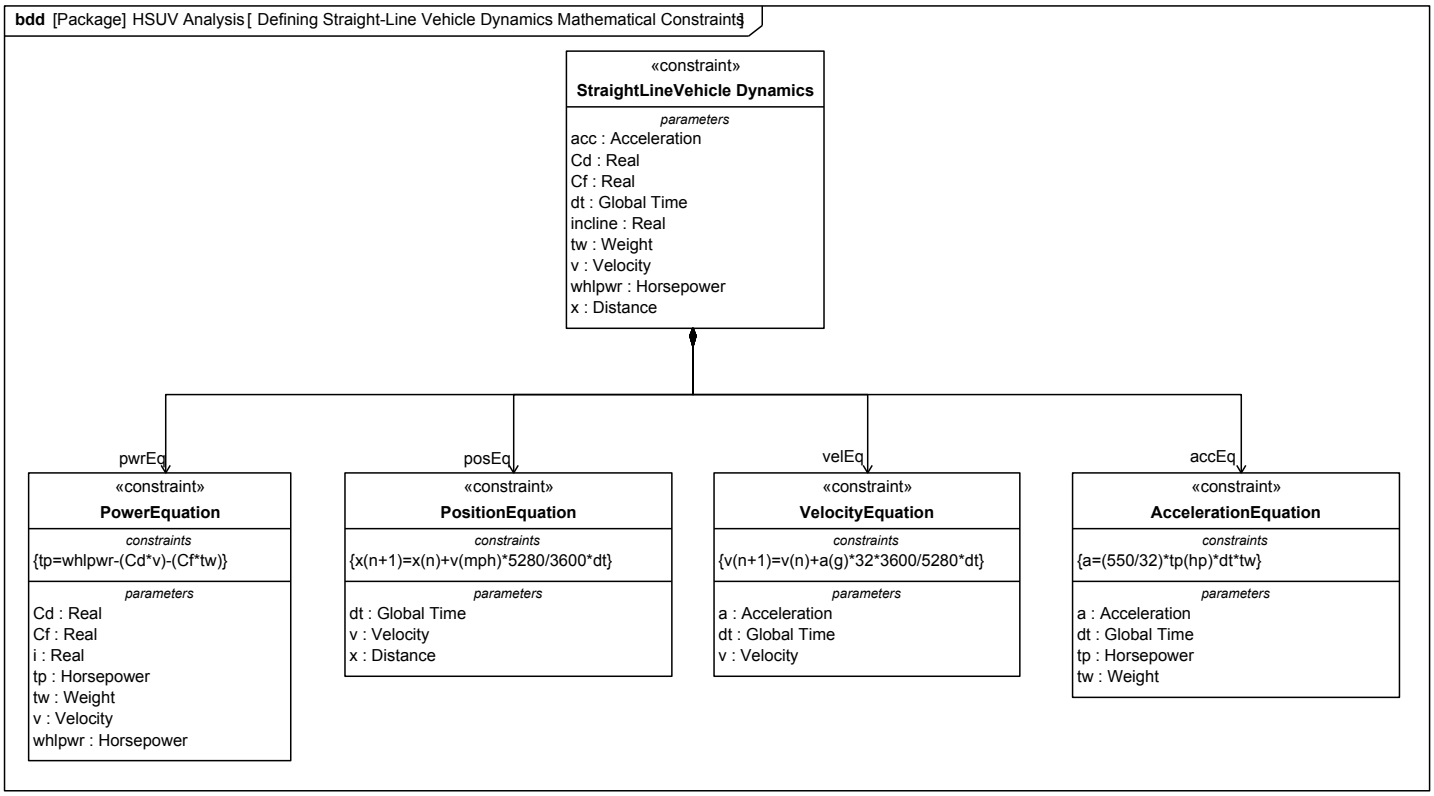


Figure 68. Defining Straight-Line Vehicle Dynamics Mathematical Constraints

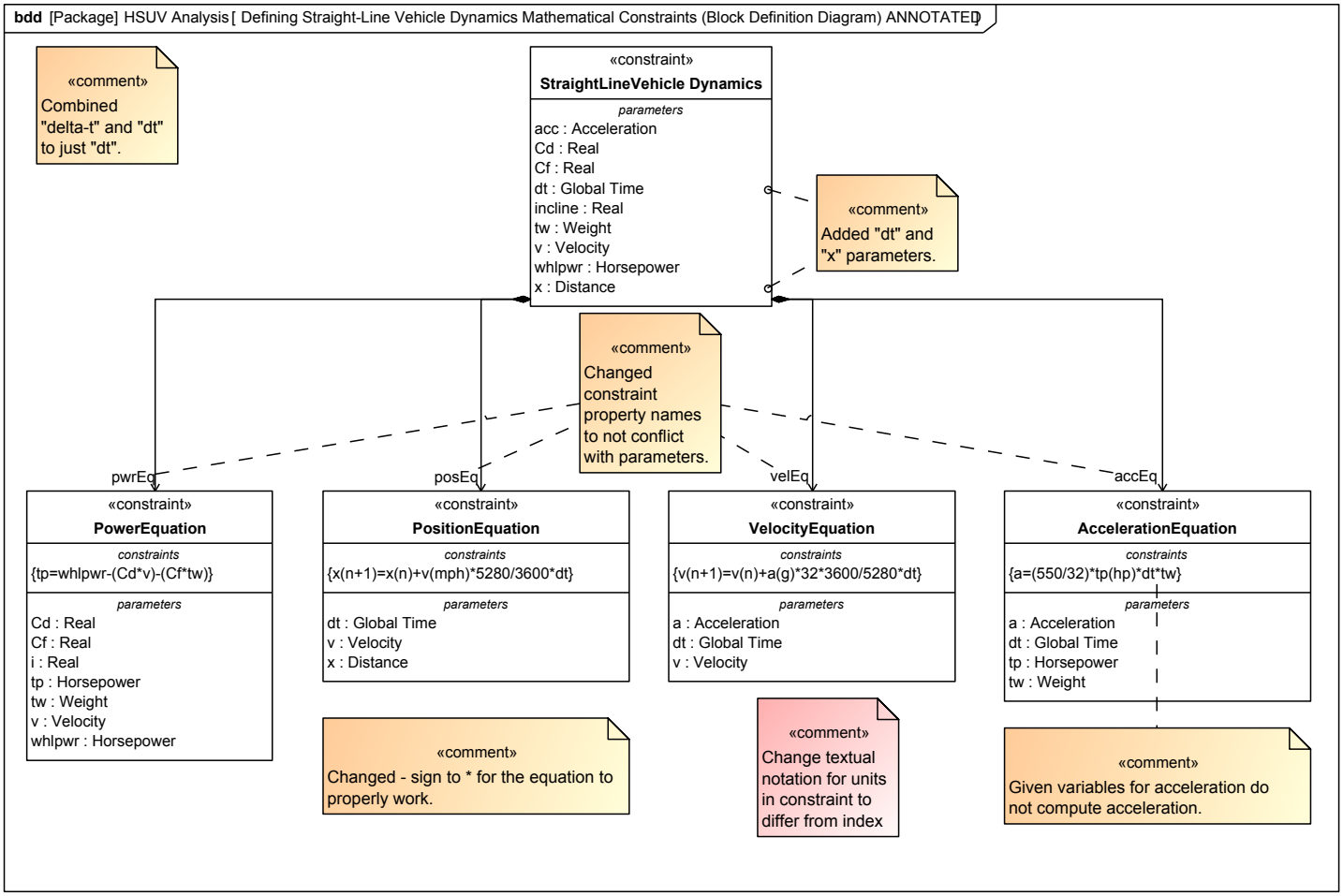


Figure 69. Defining Straight-Line Vehicle Dynamics Mathematical Constraints (Block Definition Diagram) ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.34, with corrections due to model consistency.

5.34.4 Status

DONE. NEEDS REVIEW! review comments, cleanup layout.

5.35 Figure 35

5.35.1 Figure Number

1.7-D.35

5.35.2 Figure Name

Results of Maximum Acceleration Analysis (Timing Diagram)

5.35.3 Figure Diagram

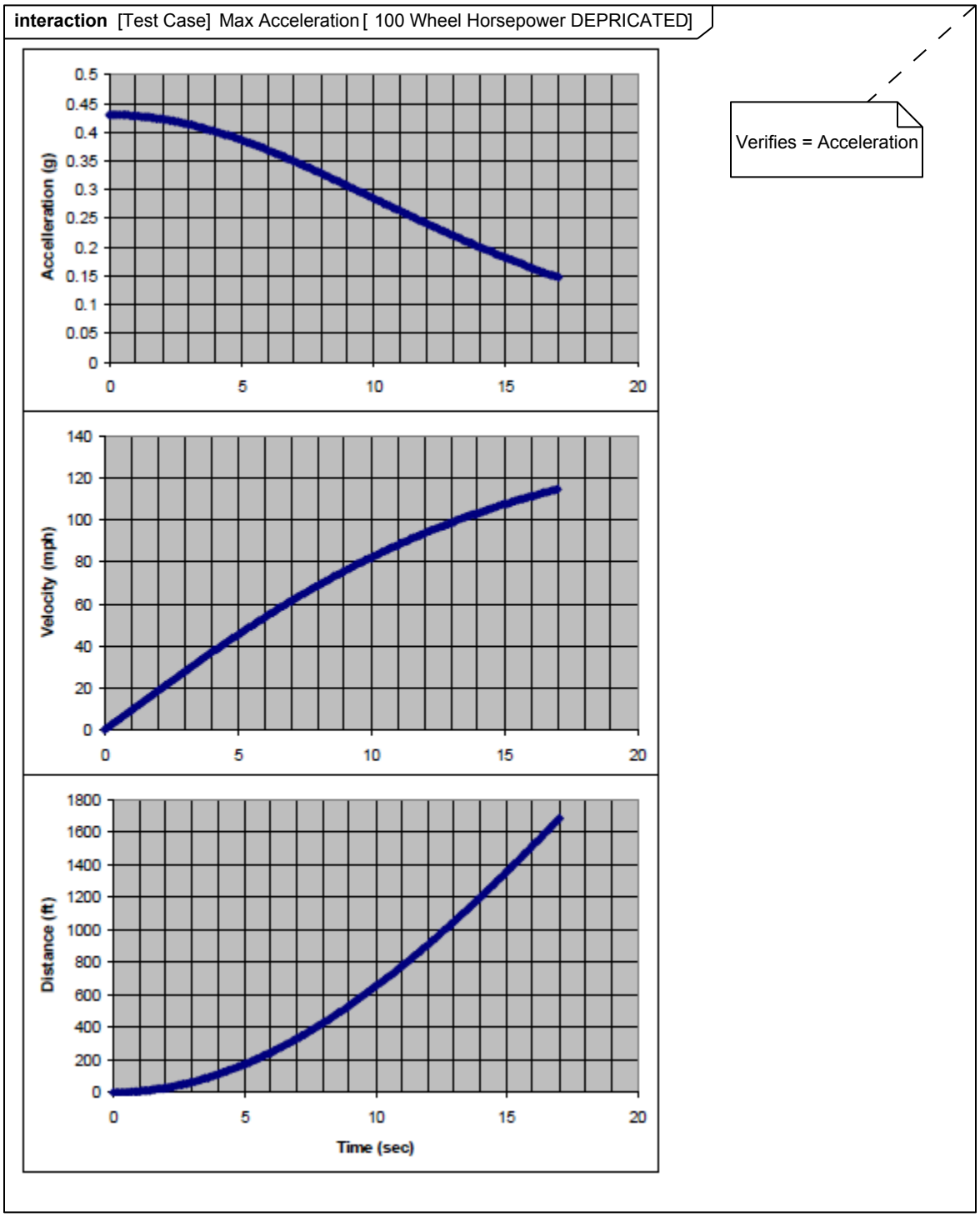


Figure 70. 100 Wheel Horsepower DEPRICATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.35.

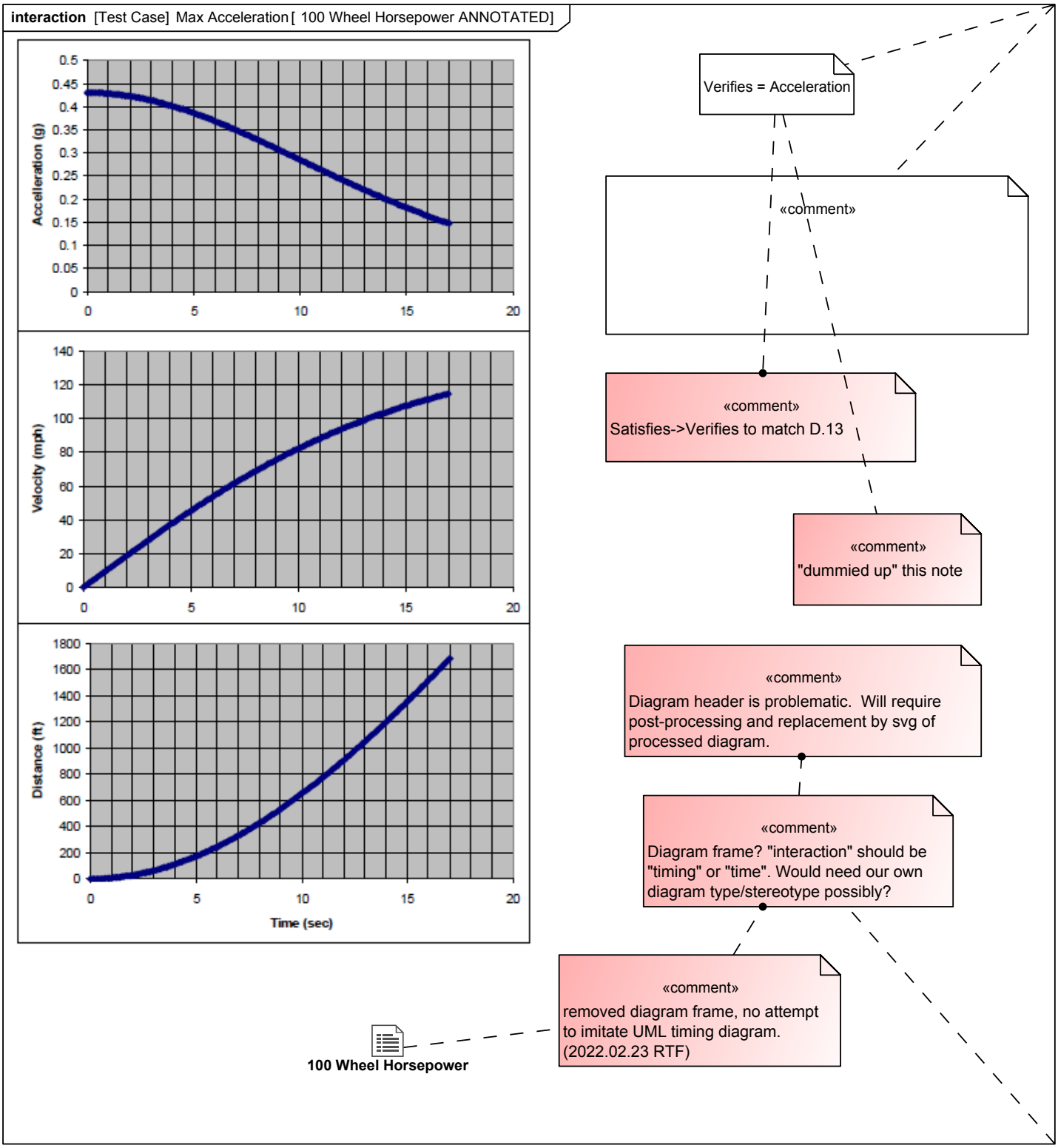


Figure 71. 100 Wheel Horsepower ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.35.

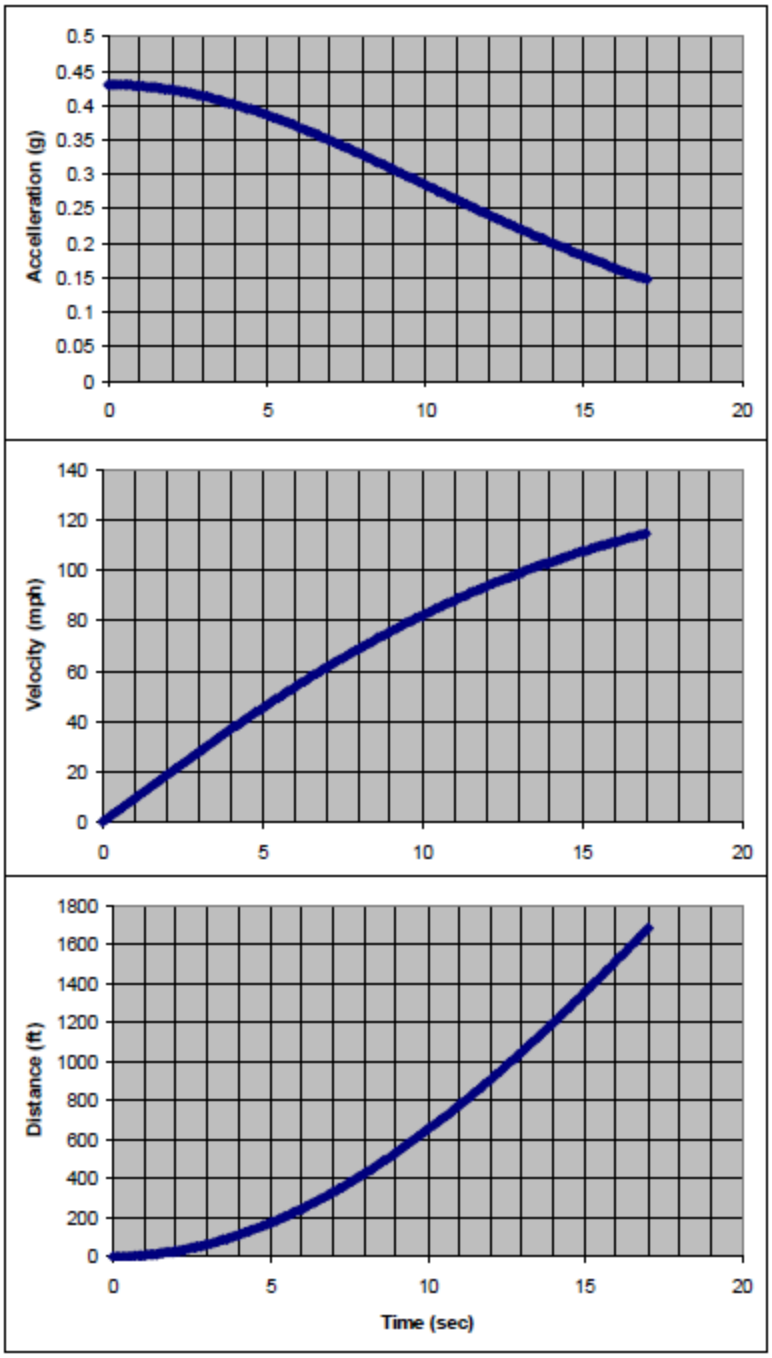


Figure 72. 100 Wheel Horsepower

Please Note: This diagram are not a normative part of the SysML specification. So this diagram is for illustration and reference only.

5.35.4 Status

DONE. This is not intended to be a SysML diagram of any kind.

5.36 Figure 36

5.36.1 Figure Number

1.7-D.36

5.36.2 Figure Name

Behavior Model for “Accelerate” Function (Activity Diagram)

5.36.3 Figure Diagram

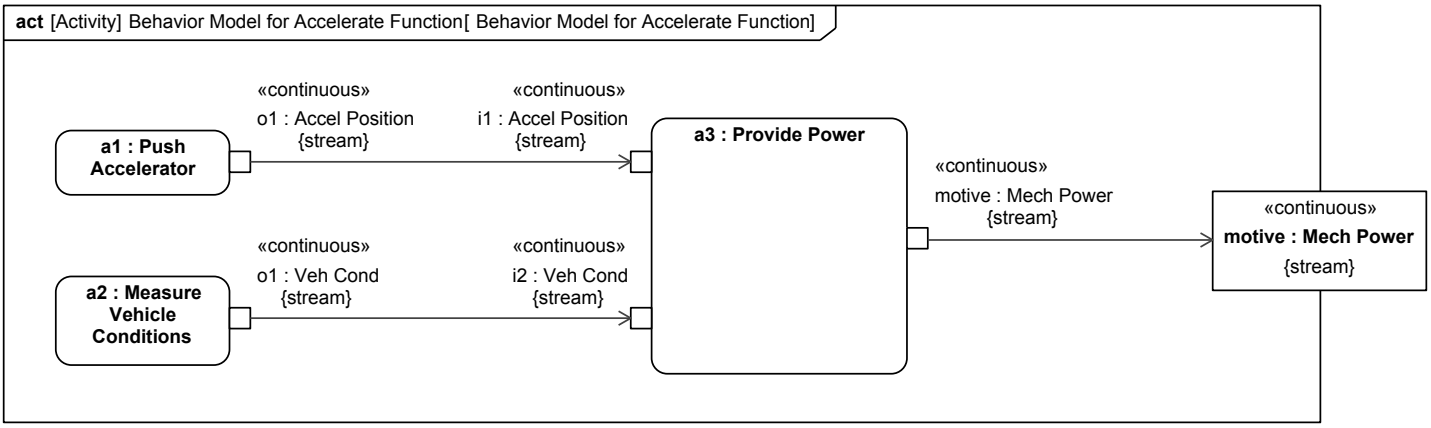


Figure 73. Behavior Model for Accelerate Function

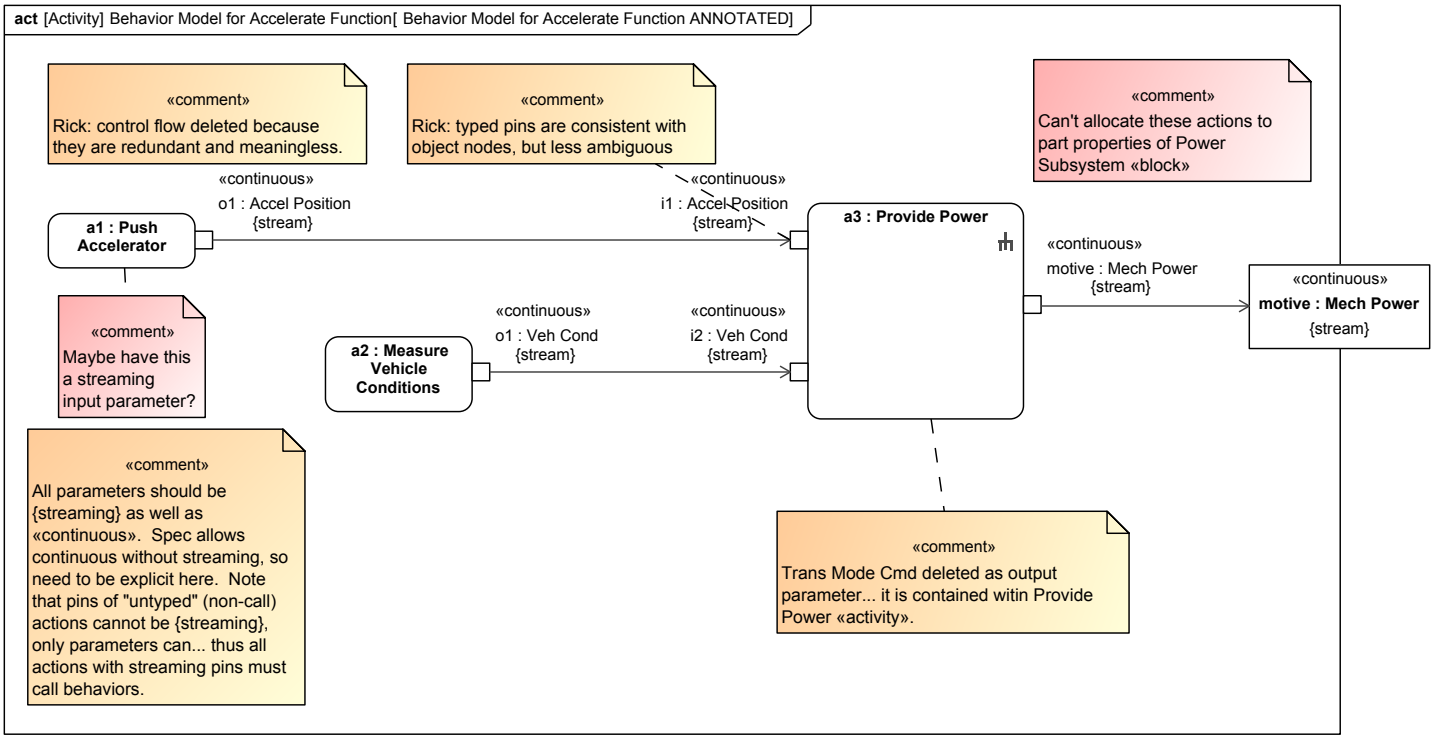


Figure 74. Behavior Model for Accelerate Function ANNOTATED

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.36. Control flow removed for clarity, since it added no value.

5.36.4 Status

DONE. Note change in format. review & hide comments.

5.37 Figure 37

5.37.1 Figure Number

1.7-D.37

5.37.2 Figure Name

Decomposition of “Accelerate” Function (Block Definition diagram)

5.37.3 Figure Diagram

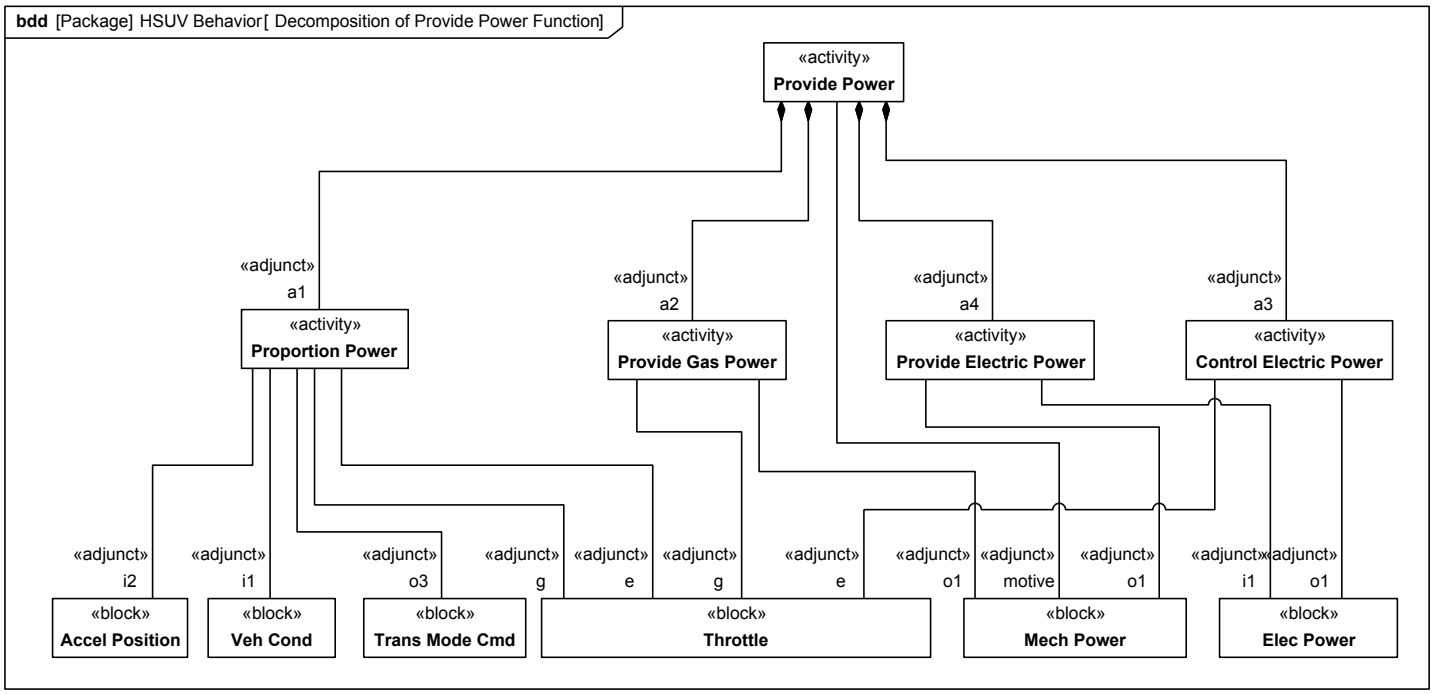


Figure 75. Decomposition of Provide Power Function

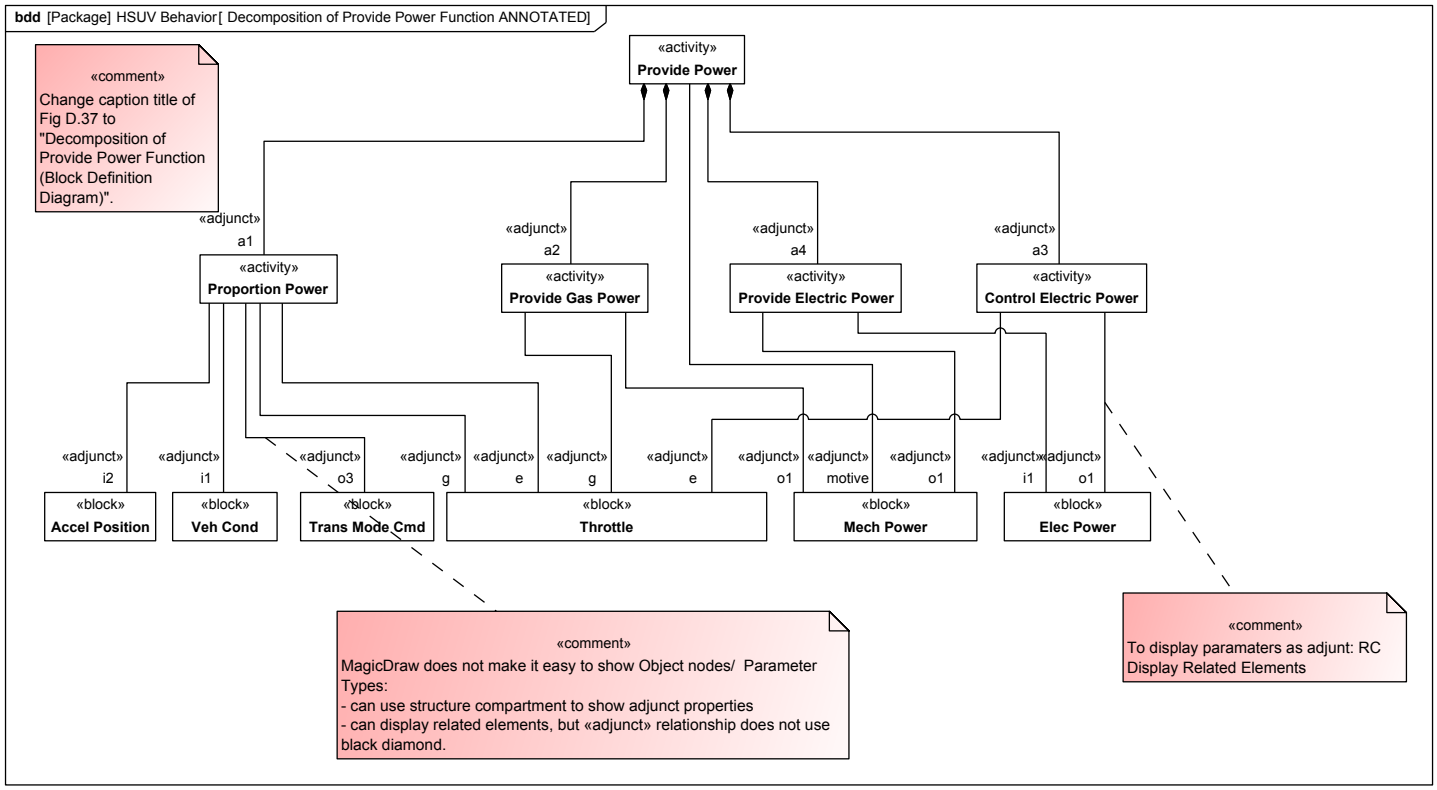


Figure 76. Decomposition of Provide Power Function ANNOTATED

Notes: This diagram is a subset of SysML 1.6 Figure D.37, focusing only on the Provide Power activity. The text related to this figure will need to be updated.

5.37.4 Status

DONE. review & hide comments.

5.38 Figure 38

5.38.1 Figure Number

1.7-D.38

5.38.2 Figure Name

Detailed Behavior Model for “Provide Power” (Activity Diagram)

5.38.3 Figure Diagram

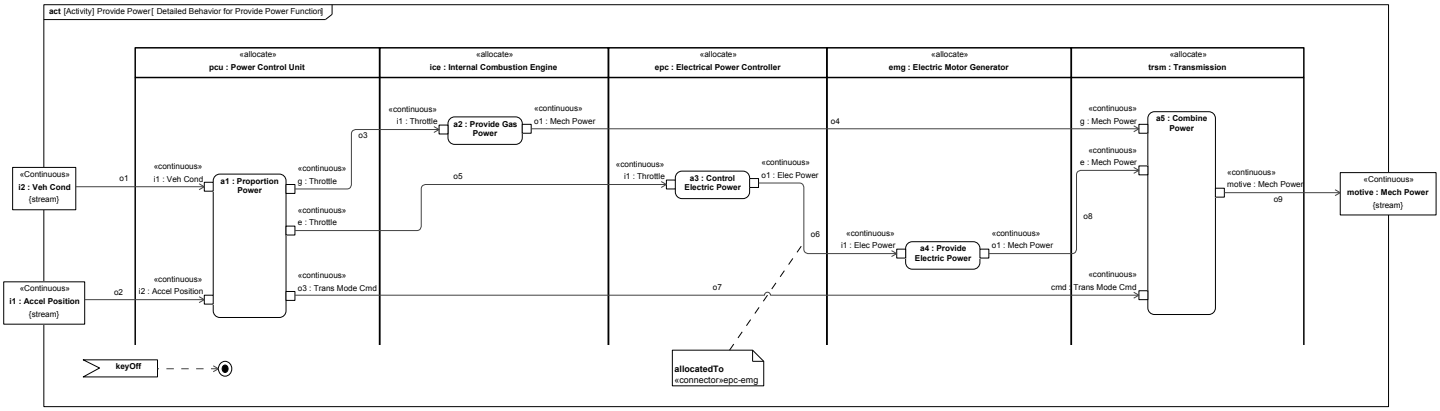


Figure 77. Detailed Behavior for Provide Power Function

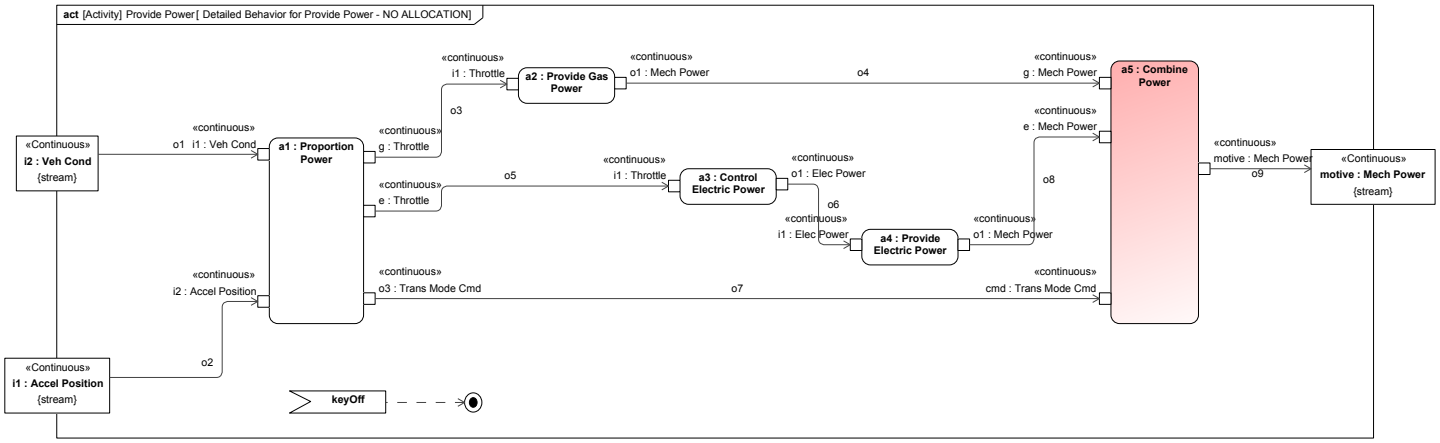


Figure 78. Detailed Behavior for Provide Power - NO ALLOCATION

This diagram was generated as a first step toward SysML 16 Figure D.38. It is not to be be included in the 1.7 specification.

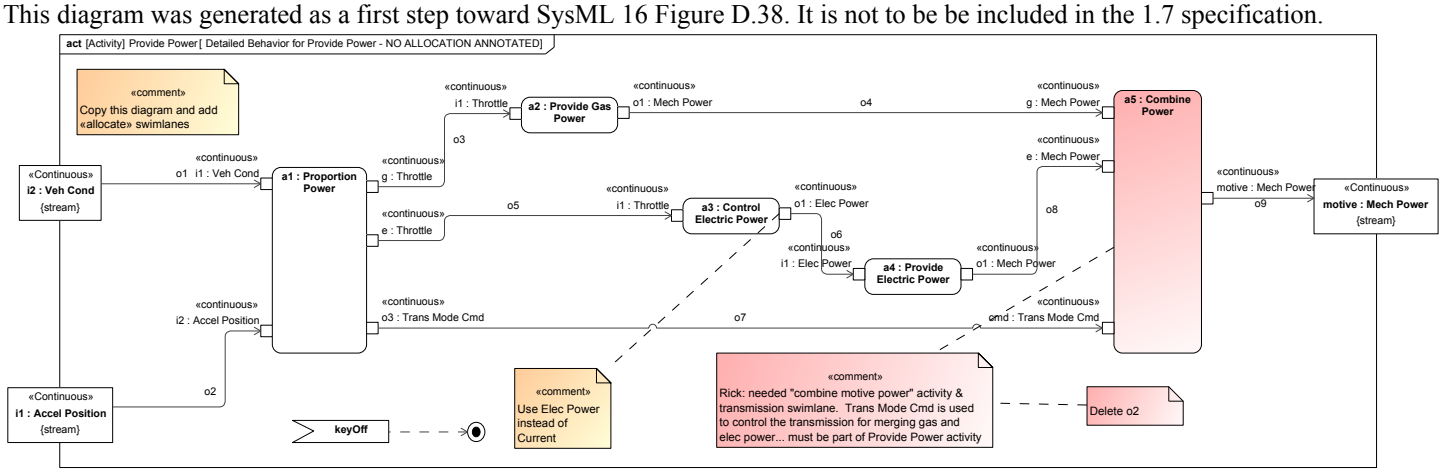


Figure 79. Detailed Behavior for Provide Power - NO ALLOCATION ANNOTATED

This diagram was generated as a first step toward SysML 16 Figure D.38. It is not to be be included in the 1.7 specification.

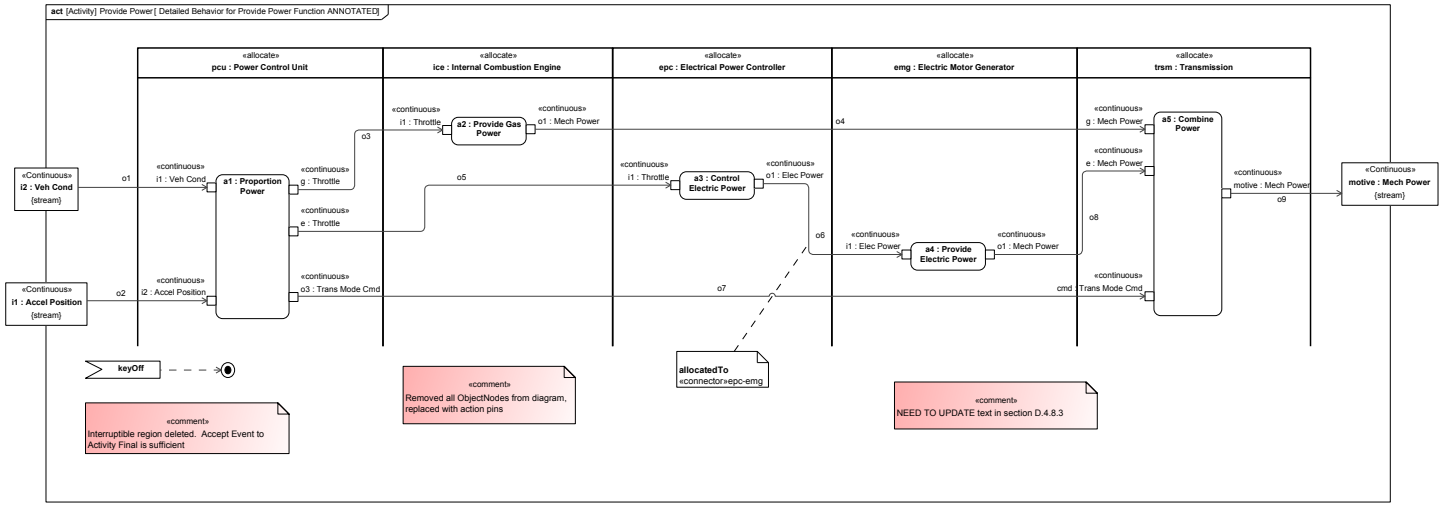


Figure 80. Detailed Behavior for Provide Power Function ANNOTATED

Notes: This diagram was refined to replace SysML 1.6 Figure D.38. A trsm swimlane was added, along with a5. See comments... Note that the text related to this figure will need to be updated.

5.38.4 Status

DONE. use swimlane version. review & hide comments.

5.39 Figure 39

5.39.1 Figure Number

1.7-D.39

5.39.2 Figure Name

Flow Allocation to Power Subsystem (Internal Block Diagram)

5.39.3 Figure Diagram

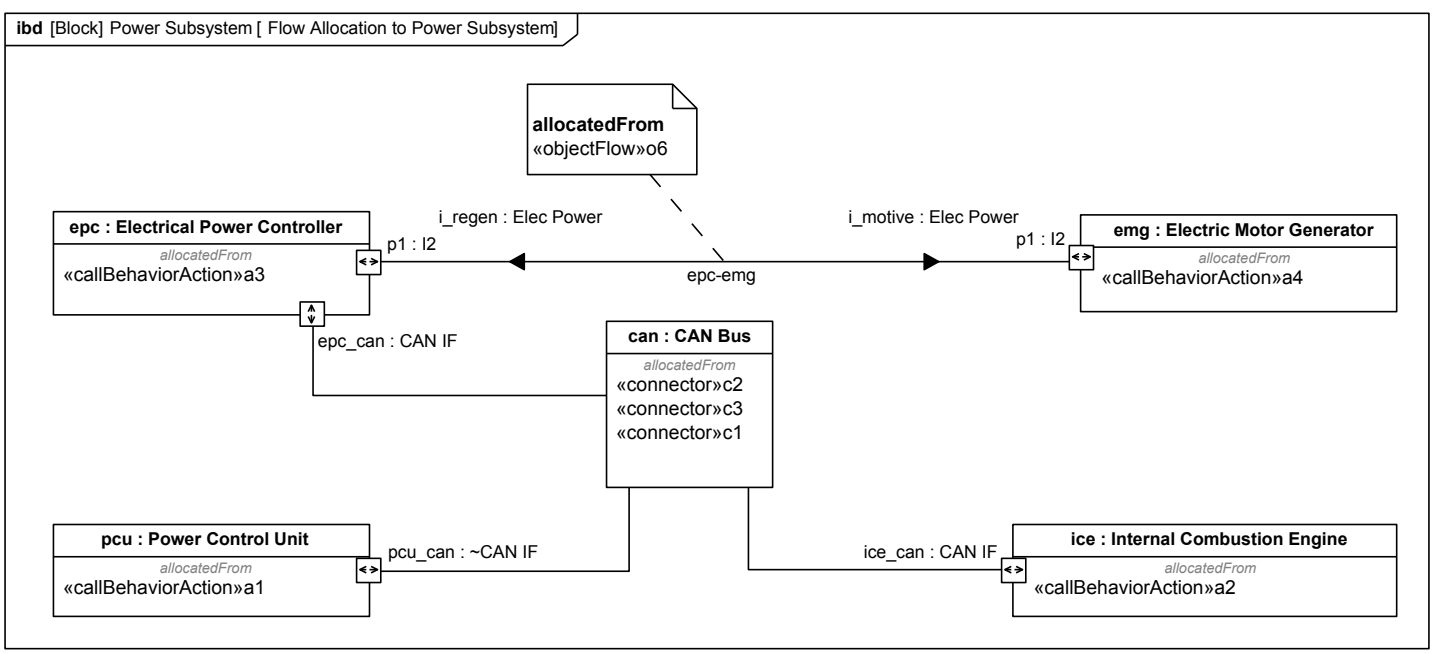


Figure 81. Flow Allocation to Power Subsystem

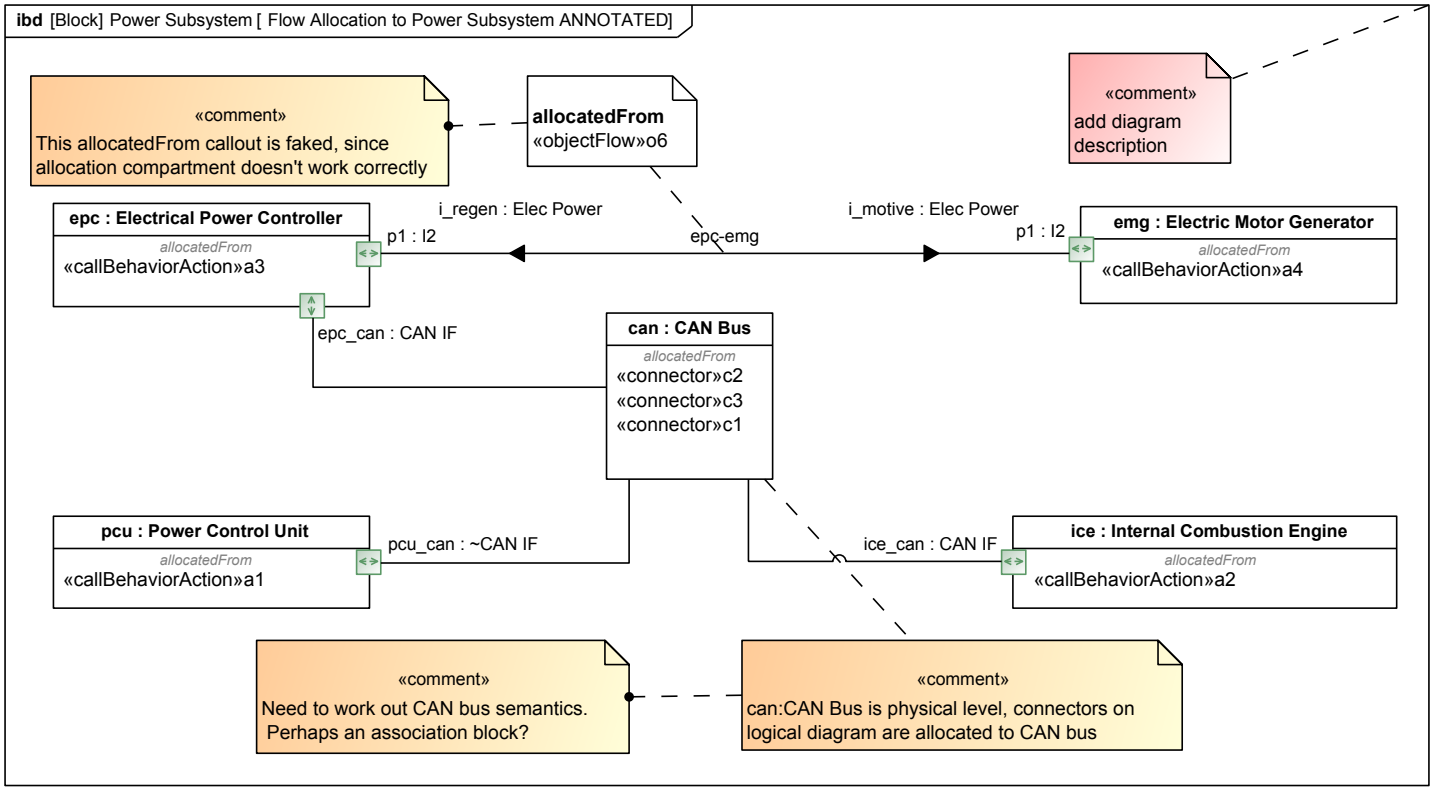


Figure 82. Flow Allocation to Power Subsystem ANNOTATED

Notes: This diagram should be close to to SysML 1.6 Figure D.39, consistent with model updates and revised allocation.

5.39.4 Status

DONE .new CAN bus interfaces, more explicit allocation. review & hide comments.

5.40 Figure 40

5.40.1 Figure Number

1.7-D.40

5.40.2 Figure Name

Tabular Representation of Allocation from “Accelerate” Behavior Model to Power Subsystem (Table)

5.40.3 Figure Diagram

#	Applied Stereotype	Client	Supplier
1	«» Allocate [Abstraction]	a1:Proportion Power	pcu : Power Control Unit
2	«» Allocate [Abstraction]	a2:Provide Gas Power	ice : Internal Combustion Engine
3	«» Allocate [Abstraction]	a3:Control Electric Power	epc : Electrical Power Controller
4	«» Allocate [Abstraction]	a4:Provide Electric Power	emg : Electric Motor Generator
5	«» Allocate [Abstraction]	a5:Combine Power	trsm : Transmission
6	«» Allocate [Abstraction]	Object Flow:o6[o1 -> i1]	Connector:epc-emg[epc.p1 - emg.p1]

Figure 83. Provide Power Behavior Allocation Table

Notes: This diagram should be as close as possible to SysML 1.6 Figure D.40. Unfortunately, the reader will need to rely on colon notation to suss out action from activity, and part from block. Note that "client" and "supplier" are very non-intuitive. These should be renamed. This diagram is a good candidate for post-processing Perhaps a fake pkg diagram is necessary that can contain images of both table and matrix, along with explanatory notes.

#	Applied Stereotype	Client	Supplier
1	«» Allocate [Abstraction]	a1:Proportion Power	pcu : Power Control Unit
2	«» Allocate [Abstraction]	a2:Provide Gas Power	ice : Internal Combustion Engine
3	«» Allocate [Abstraction]	a3:Control Electric Power	epc : Electrical Power Controller
4	«» Allocate [Abstraction]	a4:Provide Electric Power	emg : Electric Motor Generator
5	«» Allocate [Abstraction]	a5:Combine Power	trsm : Transmission
6	«» Allocate [Abstraction]	Object Flow:o6[o1 -> i1]	Connector:epc-emg[epc.p1 - emg.p1]

Figure 84. Tabular Representation of Allocation from "Accelerate" Behavior Model to Power Subsystem (Table)

Please Note: Tables are not a normative part of the SysML specification. So all tables are for illustration and reference only.

5.40.4 Status

DONE. RTF determination to leave as is, a nominal example of normal table generation.

5.41 Figure 41

5.41.1 Figure Number

1.7-D.41

5.41.2 Figure Name

Special Case of Internal Block Diagram Showing Reference to Specific Properties (serial numbers)

5.41.3 Figure Diagram

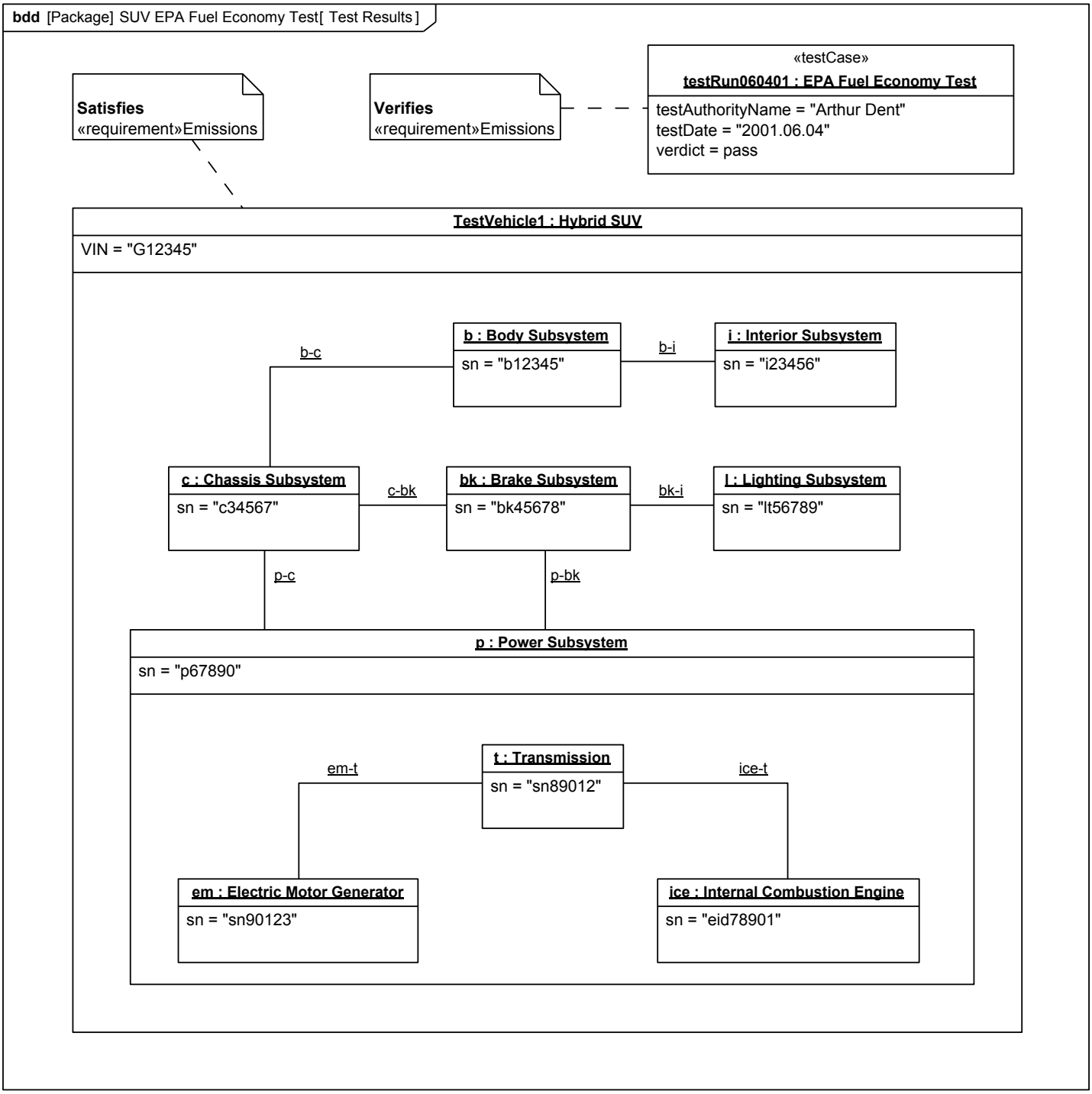


Figure 85. Test Results

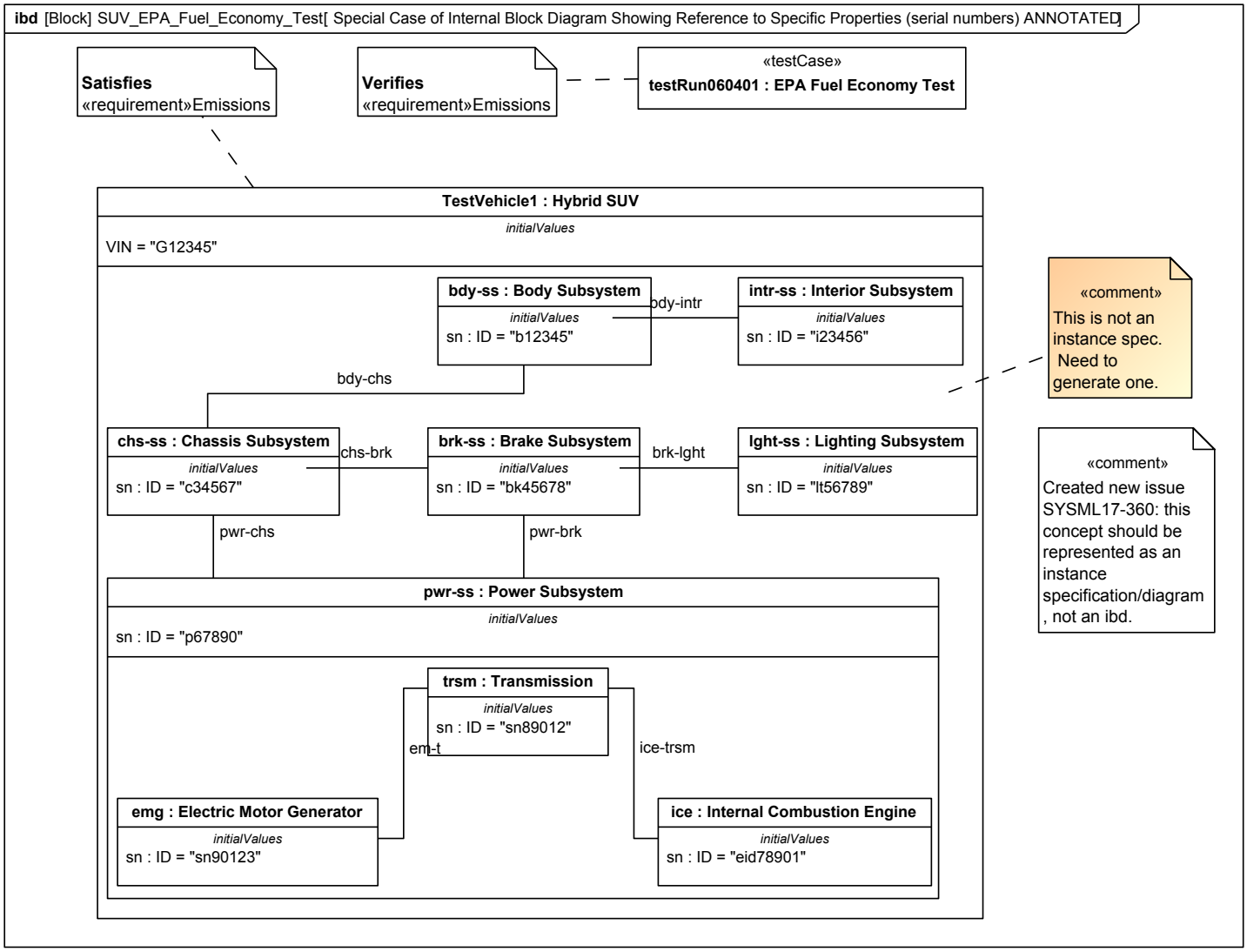


Figure 86. Special Case of Internal Block Diagram Showing Reference to Specific Properties (serial numbers) ANNOTATED

Notes: This diagram is intended to be as close as possible to SysML 1.6 Figure D.41. It does not, however, represent an instance specification and does not really meet the original intent of this figure.

5.41.4 Status

DONE. Used bdd (instance diagram), not ibd!! Cross check with instance table, or build new hierarchal instance table.