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Work-Package 3: “Modeling”

openETCS System Architecture and Design Specification

Modes and Levels Management

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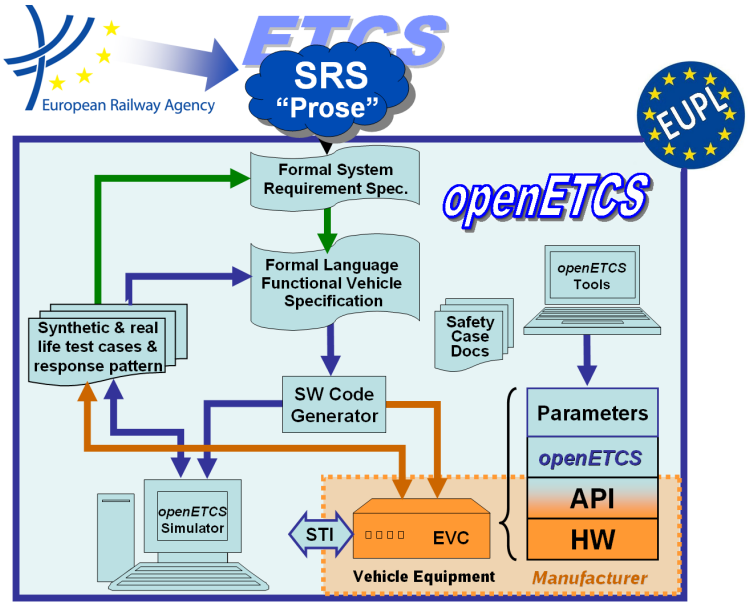
November 2014



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Document approbation

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Architecture and Functional Specification

Prepared for openETCS@ITEA2 Project

Abstract: This document gives adescription to the function "Modes and Levels Management" of openETCS. It has to be read as an add-on to the models in SysML, Scade and to additional reading referenced from the document.

Modification History

Version	Section	Modification / Description	Author
0.1	Document	Initial document providing the structure	Marielle Petit-Doche

Table of Contents

Figures and Tables

Figures

Tables

1 Introduction

This document describes the specification and design of the "Management of Modes and Leves" function for openETCS. The specification is based mainly on [1] chapter 4 and 5.

First Chapter gives the description of the high level architecture of the function. Following chapters describe the 3 main subfonctions :

- Management of Modes
- Management of Levels
- Check and outputs

For each subfonctions, we describe:

- the architecture
- the interface
- allocated requirements
- corresponding formal models

2 High Level Architecture - SysML

The "Management of Modes and Levels" function is mainly described in chapter 4 and 5 of [1]. Modes and levels define the status of the ETCS in regards of on-board functional status and track infrastructure.

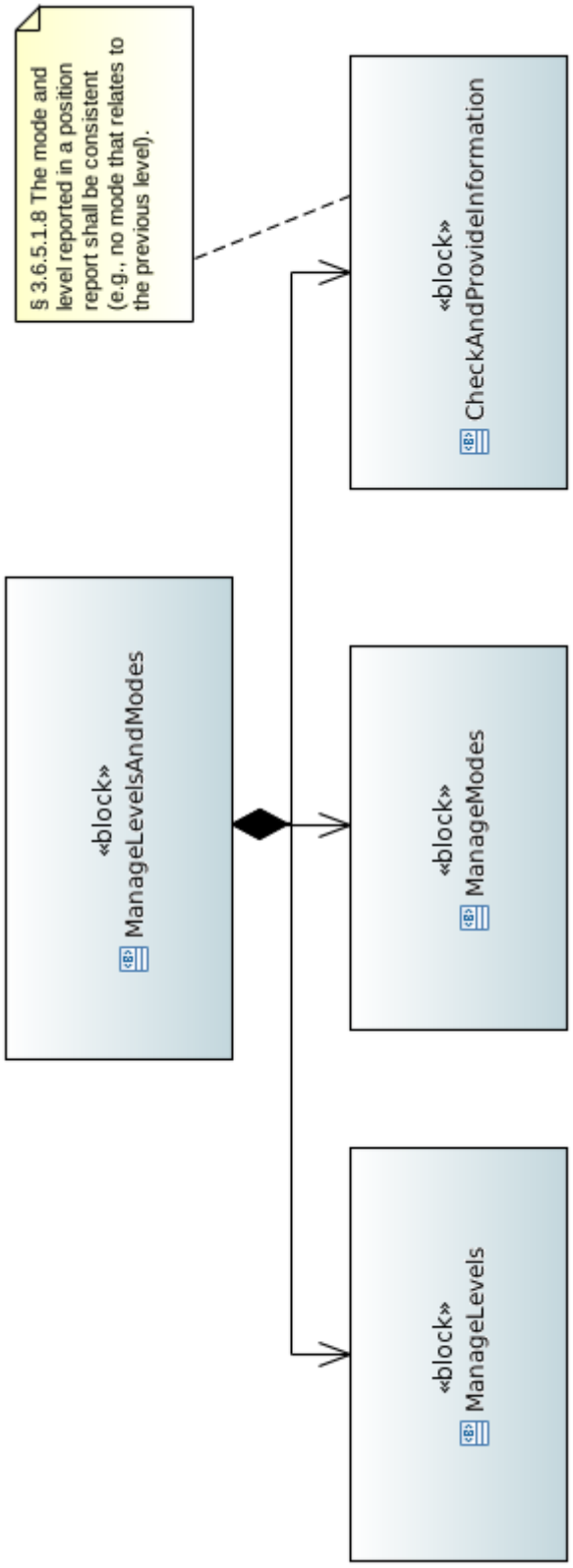

Figure 1. High level Architecture

This function is shared in three subfunctions:

Manage modes computes the new mode to apply according conditions from inputs and other functions (see [1] sections 4.4, 4.6, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.11, 5.12, 5.13, 5.19)

Manage levels computes the new level to apply according inputs (see [1] section 5.10)

Provide output checks compatibility between mode and level and provides outputs (see [1] section 3.6.5)

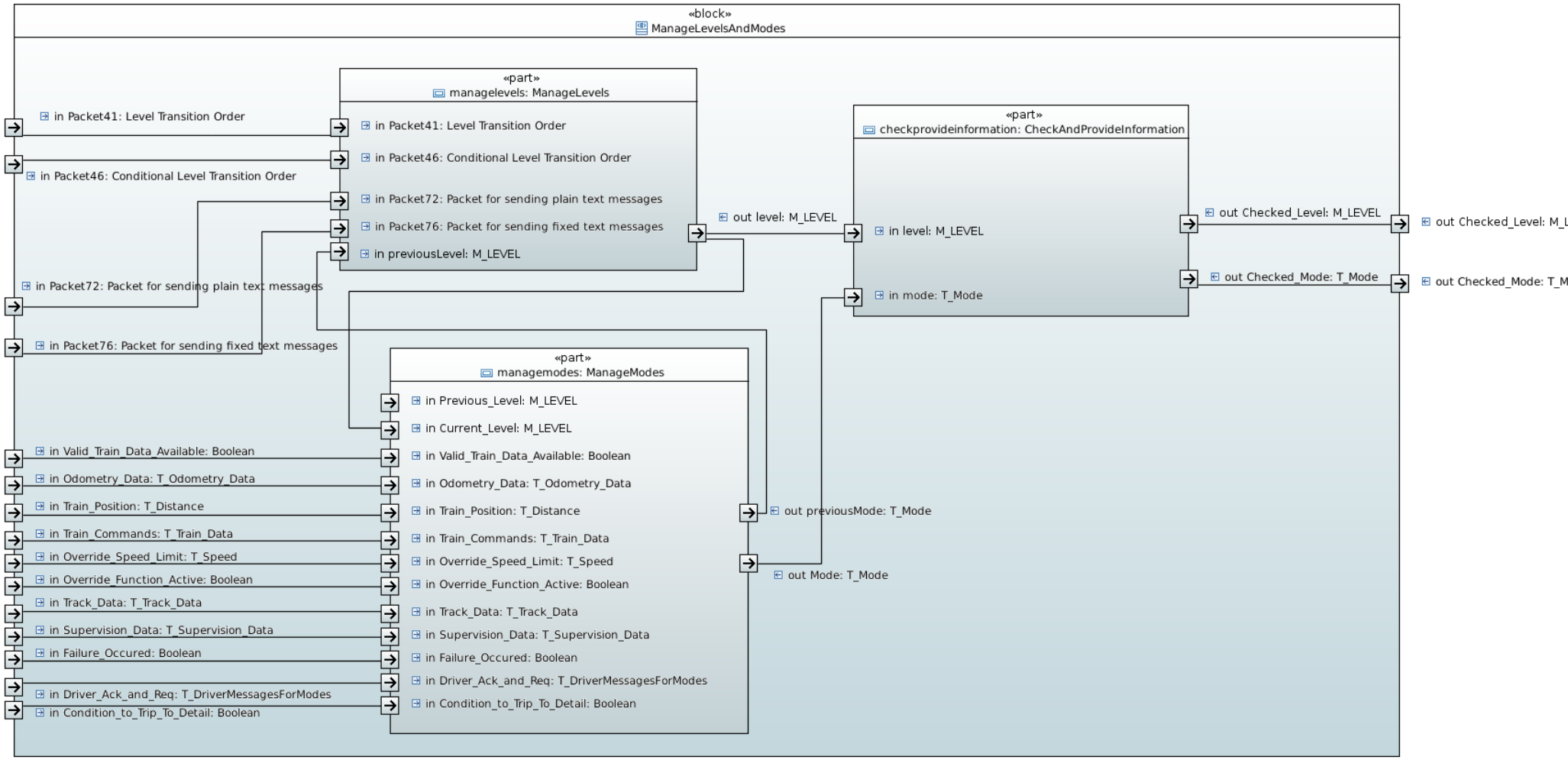

Figure 2. High level dataFlow

The previous figure show the main interface of this function, according to the type defined as follow:

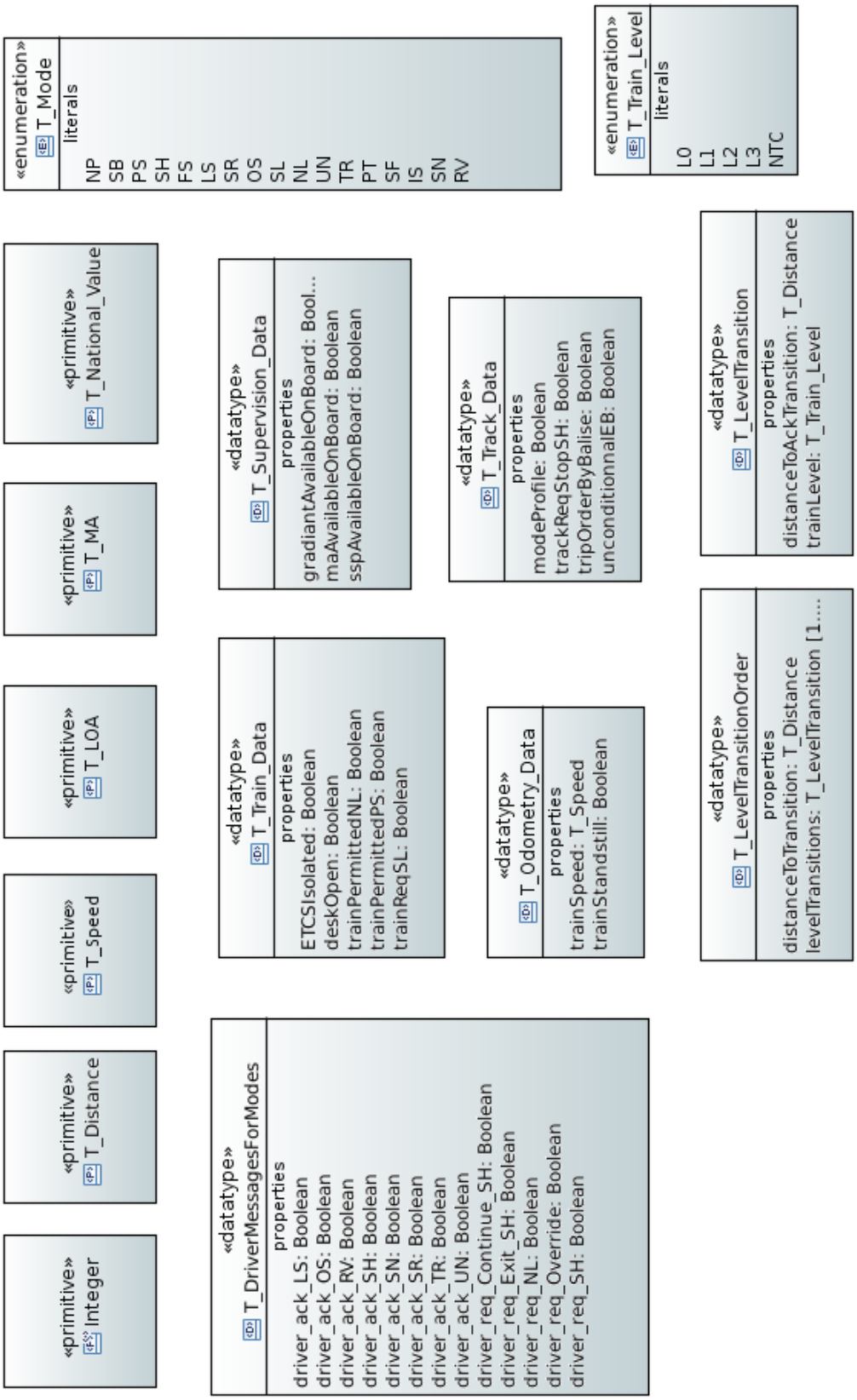

Figure 3. Data Types

3 Modes

3.1 Architecture - SysML

This function is in charge of the computation of new mode to apply in fonction of conditions from inputs and other functions.

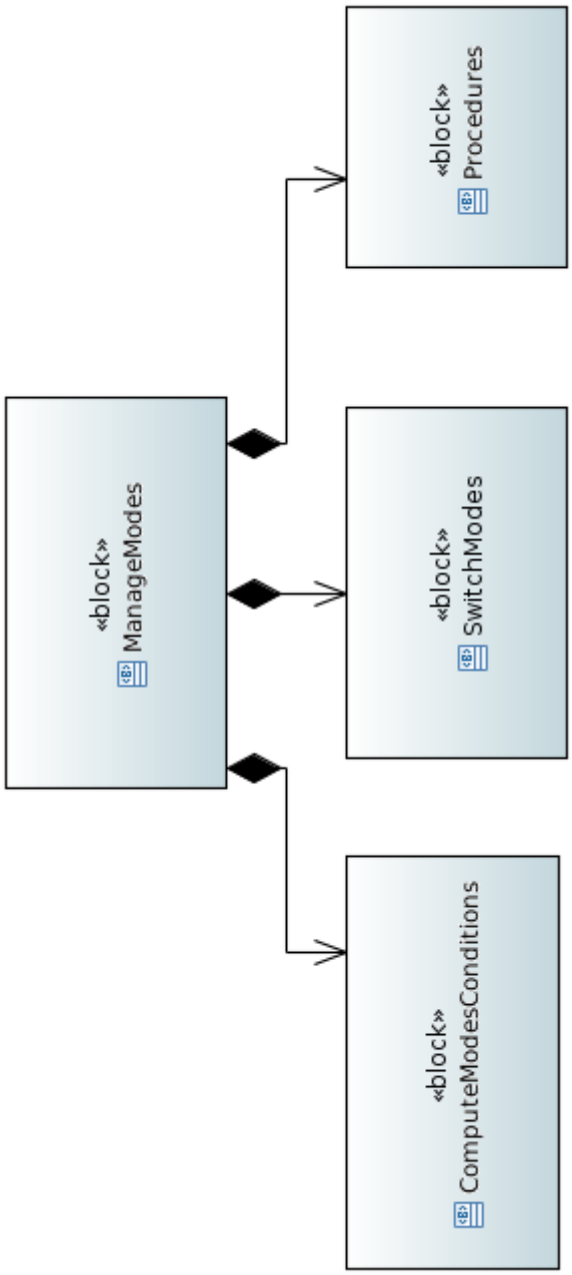

Figure 4. Modes subfubction architecture

Three subfunctions are defined:

ComputeCondition specifies the conditions to define a mode transition according condition table of section 4.6.3 of [1]

SwitchModes performs the mode selection according the conditions and priorities defined in transition table section 4.6.2 of [1]

Procedures performs all specific procedure linked to mode management and defined in [1] sections 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.11, 5.12, 5.13, 5.19.

See below section "Detailled model" for details.

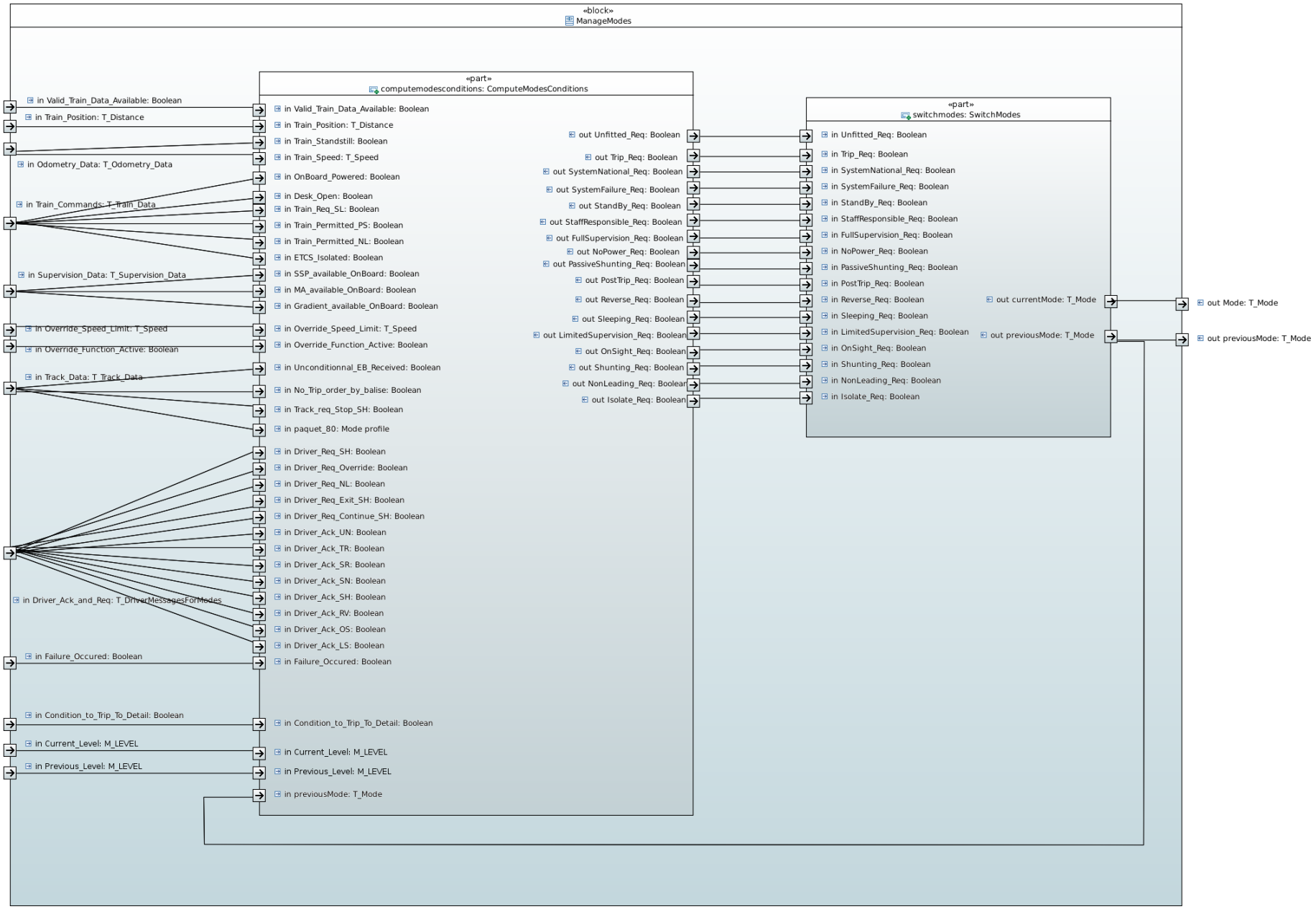

Figure 5. Modes subfunction dataflow

3.2 Interface

3.2.1 Public Types of Modes

Name	Type	Comments
T_Cab	enum {A, B, unknown}	Assumption : Train has exactly two cabins see [**?**]
T_Level	enum {L0, L1, L2, L3, LNTC}	Tocheck with level section
T_Mode	enum {NP, SB, PS, SH, FS, LS, SR, OS, SL, NL, UN, TR, PT, SF, IS, SN, RV}	M_MODE can not be used: No power mode is not defined.
T_MA	enum {Profile_OS, Profile_LS, Profile_SH, No_Profile}	M_MAMODE can not be used: No Profile is not defined.
T_Mode_Profile	Structure {Distance : int, Mode : T_MA, Speed : int, Length : int, Length_Ack : int }	To check with filtering function and internal structure.

3.2.2 Inputs of ManageModes

Name	Type	Consummers	Comments
Ack_Req_LS_Display	bool	To Dmi	procedure ?
Ack_Req_OS_Display	bool	To Dmi	procedure ?
Ack_Req_SH_Display	bool	To Dmi	procedure ?
Ack_Req_SN_Display	bool	To Dmi	procedure ?
Ack_Req_SR_Display	bool	To Dmi	procedure ?
Ack_Req_UN_Display	bool	To Dmi	procedure ?
Cab	T_Cab	From TIU	•
ConditionToTrip	bool	To clarify	•
Continue_Shunting_Function_Active	bool	Procedure ?	•
CurrenT_Level	T_Level	Internal from Level Management	•
Desk_A_Open	bool	From TIU	•
Desk_B_Open	bool	From TIU	•
Driver_Ack_LS	bool	From DMI	procedure ?
Driver_Ack_OS	bool	From DMI	procedure ?
Driver_Ack_RV	bool	From DMI	procedure ?
Driver_Ack_SH	bool	From DMI	procedure ?
Driver_Ack_SN	bool	From DMI	procedure ?

Name	Type	Consummers	Comments
Driver_Ack_SR	bool	From DMI	procedure ?
Driver_Ack_TR	bool	From DMI	procedure ?
Driver_Ack_UN	bool	From DMI	procedure ?
Driver_Req_ExiT_SH	bool	From DMI	procedure ?
Driver_Req_NL	bool	From DMI	procedure ?
Driver_Req_Override	bool	From DMI	procedure ?
Driver_Req_SH	bool	From DMI	procedure ?
Emergency_Stop_Message_Received	bool	From Balises ?	•
Estimated_Front	int	Train position ?	•
ETCS_Isolated	bool	From TIU	•
Failure_Occured	bool	Internal ?	•
Previous_Level	T_Level	Internal from Level Management	•
MA_SSP_Gradiant_Available	bool	From supervision ?	•
Max_Safe_Front	bool	Train position ?	•
Mode_Profile_On_Board	T_Mode_Profile	Stored from packet 80	•
No_Trip_Order_Given_By_Balise	bool	From Balises ?	•
OnBoard_Powered	bool	From TIU	•
Override_Function_Active	bool	Procedure ?	•
Shunting_Granted_By_RBC	bool	Radio ?	•
Stop_Shunting_Stored	bool	Procedure ?	•
Train_Permitted_NL	bool	From TIU	•
Train_Permitted_PS	bool	From TIU	•
Train_Req_SL	bool	From TIU	•
Train_Speed_Under_Override_Limit	bool	From supervision ?	•
Train_Standstill	bool	From supervision ?	•
Train_Speed	int	From supervision ?	•
Valid_Train_Data_Stored	bool	Internal ?	•

3.2.3 Outputs of ManageModes

Name	Type	Consummers	Comments
currentMode	T_Mode	•	•
previousMode	T_Mode	•	•

3.3 Requirements

3.4 Detailled model - SCADE

3.4.1 ComputeModesConditions subfunction

3.4.2 SwitchModes subfunction

3.4.3 Procedures subfunction

4 Levels

4.1 Architecture - SysML

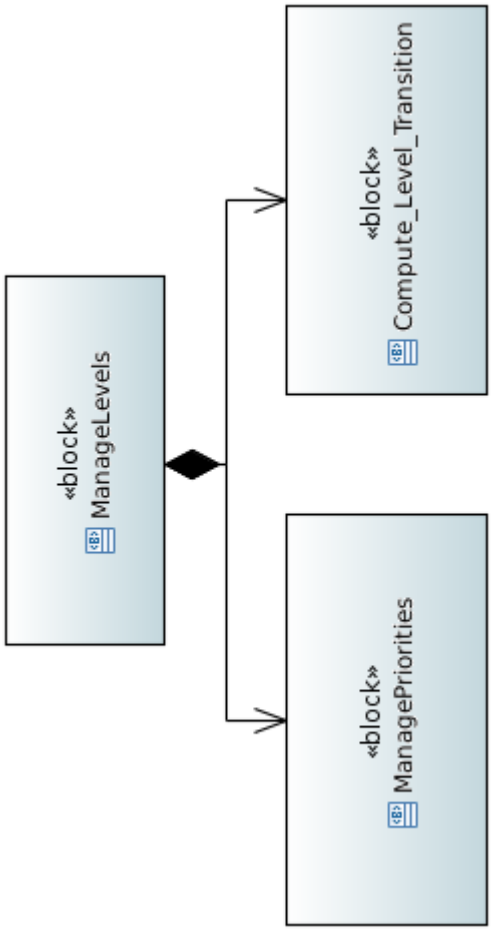

Figure 6. Levels subfunction architecture

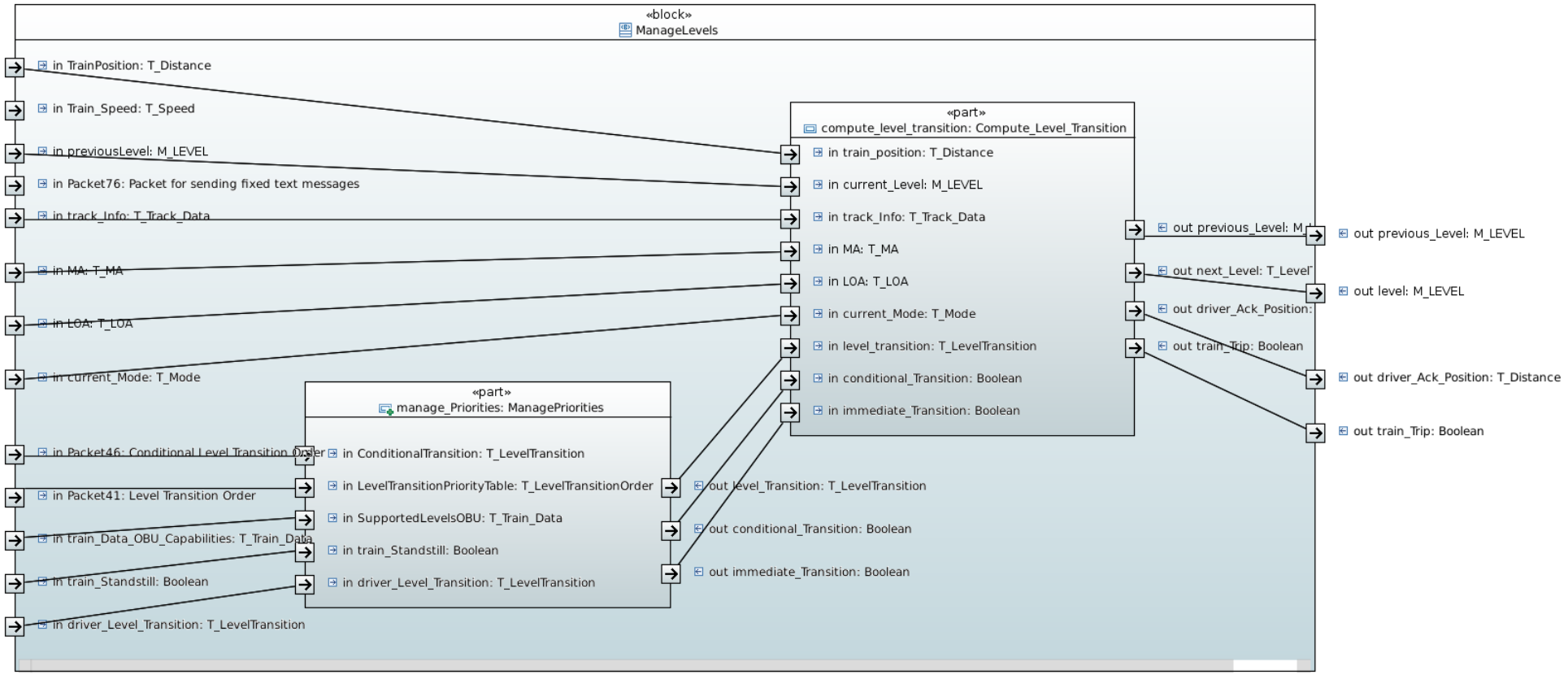

Figure 7. Levels subfunction dataflow

4.2 Interface

4.3 Requirements

4.4 Detailled model - SCADE

5 Provides

5.1 Architecture - SysML

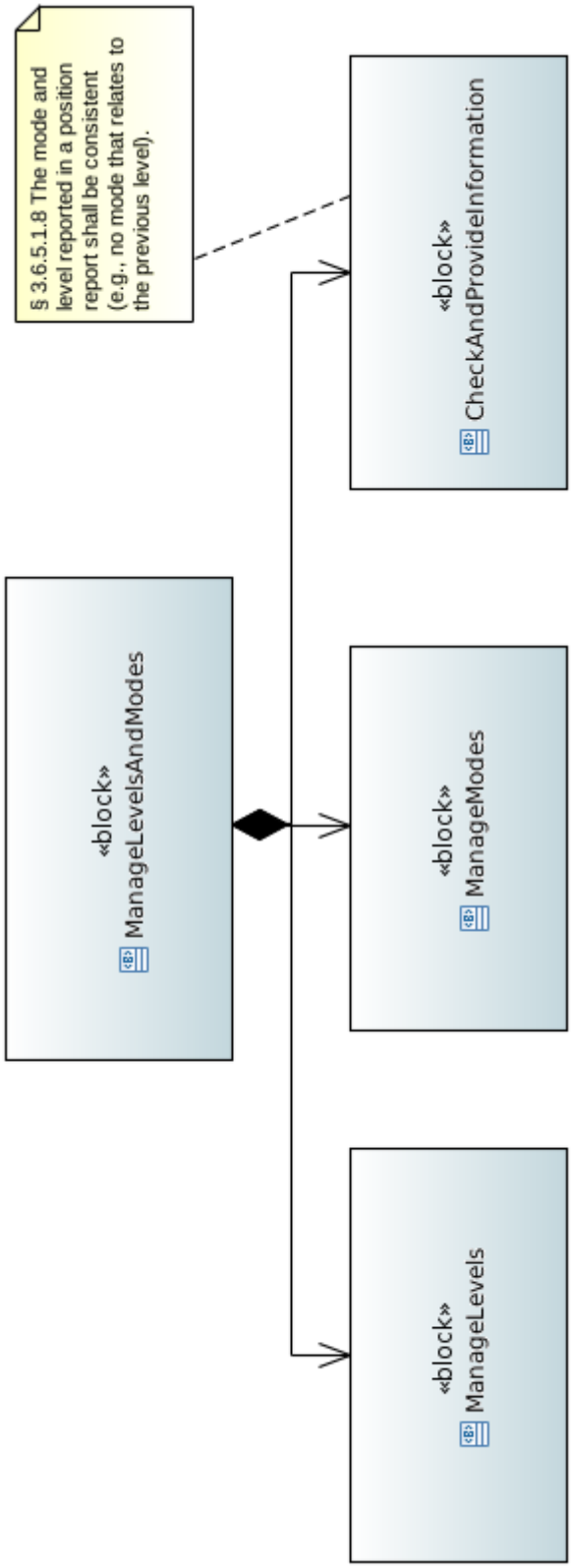

Figure 8. Provide subfunction Architecture

5.2 Interface

5.3 Requirements

5.4 Detailled model - SCADE

References

[1] ERA. *System Requirements Specification, SUBSET-026*, v3.3.0 edition, March 2012.