



## DR2.6 PROMISE generic PLM models (version 3)

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<b>ABSTRACT:</b>	This report provides the PROMISE WP R2 deliverable DR2.6: PROMISE generic PLM models (version 3). The report contains PROMISE generic PLM models.

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# 1 Introduction

## 1.1 Purpose of this report

This report describes the final version of the PROMISE generic model. For describing updated features of PROMISE generic model, additional user requirements in relations with decision support system and PROMISE middleware interface are introduced. In addition, use cases, workflow, and information flow reflecting the additional user requirements will be introduced.

## 1.2 Objectives and tasks of task TR2.7

This report reflects work done under activity TR2.7 described in the Description of Work (DoW) of the PROMISE project. The objective of TR2.7 is to refine and complement the proposed generic PLM model in Tasks TR2.6. This has been achieved by reviewing domain-specific models, reflecting updated user requirements, and applying relevant standards through the modelling activity. For this, the following activities have been done.

- Reviewing each domain-specific model,
- Integrating domain-specific workflow models and developing generic workflow model,
- Integrating domain-specific information flow models and developing generic information flow model,
- Integrating common terminologies for building up a generic PLM model,
- Updating generic PLM model based on generic workflow and information flow models..

## 1.3 Process of preparing the deliverable DR2.6

To carry out the above tasks, we followed the following procedure (refer to Figure 1-1.). We update PROMISE generic PLM model (from version 2 to version 3, the final version) by reflecting modifications in application specific models during the implementation works.

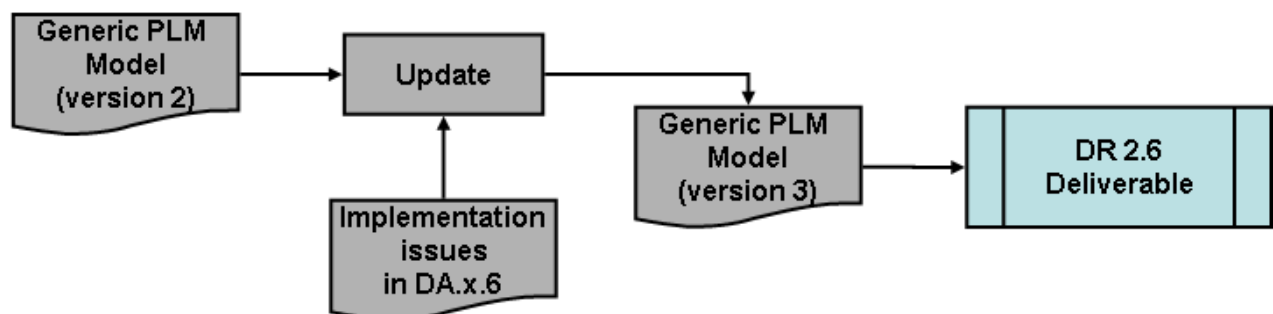


Figure 1-1: Detailed procedure for DR2.6

## 1.4 Organization of this report

This report is organized as follows: In section 2, we describe the analysis and refinement of generic PROMISE-PLM model reflecting additional user requirements. In section 3, we introduce the updated PROMISE generic PLM model (final version). Last, we discuss the conclusion in section 4.

## **2 Analysis and refinement of generic PROMISE-PLM model**

### **2.1 Introduction**

In this section, we analyzed required modifications of the generic PROMISE-PLM model based on the 10 application scenarios. To gather the change of requirements, the application deliverables on the PROMISE-PLM implementation (DA.x.6) are carefully reviewed. These deliverables have been inspected by focusing on the main functions of the corresponding demonstrators.

### **2.2 Updated generic requirements**

Most of the features defined in the previous deliverable DR2.4 require no modification. Some applications use parts of the generic PROMISE-PLM model, and some do not require PEID features. Nevertheless, we consider that unimplemented features in the actual demonstration developments are still required for the future to enhance the performance and the usability of PROMISE-PLM framework. There are two features in relations with decision support system and PROMISE middleware interface.

#### **2.2.1 Decision support system (DSS)**

We observed that the DSS modules of few applications need a kind of fine-tuning. Some DSS parameters involved in the decision making process should be regularly or irregularly updated based on the off-line analysis of collected data in the PDKM. The new derived values of parameters should be set to the PDKM through the PROMISE back-end system, which supports integrated graphical user interface (GUI) with the DSS. For the off-line analysis, the stored data in the PDKM also can be retrieved through the back-end system.

#### **2.2.2 PROMISE middleware interface**

The data exchange among users in PROMISE-PLM was simplified by the new functionality of PROMISE middleware interface (PMI). All data is exchanged through PMI among the PDKM, DSS, back-end system, PEID, and so on. For the extensibility and compatibility, the PDKM handles information based on the extensible markup language (XML).

### 3 PROMISE generic PLM model

#### 3.1 Updated features of use case diagram

Figure 3-1 depicts updated use case diagram reflecting off-line information analysis, the use case for decision supporting parameters (use case 2.8), by the data analyzer (actor 1.6). The actor can be involved in any of the three PLM phases. In the updated PLM framework, data is always passed through PMI. Hence, every use case, which requires data exchange, uses the communication through PMI (use case 2.1). The name of use cases/actors and their numbering are modified to structure their relationship.

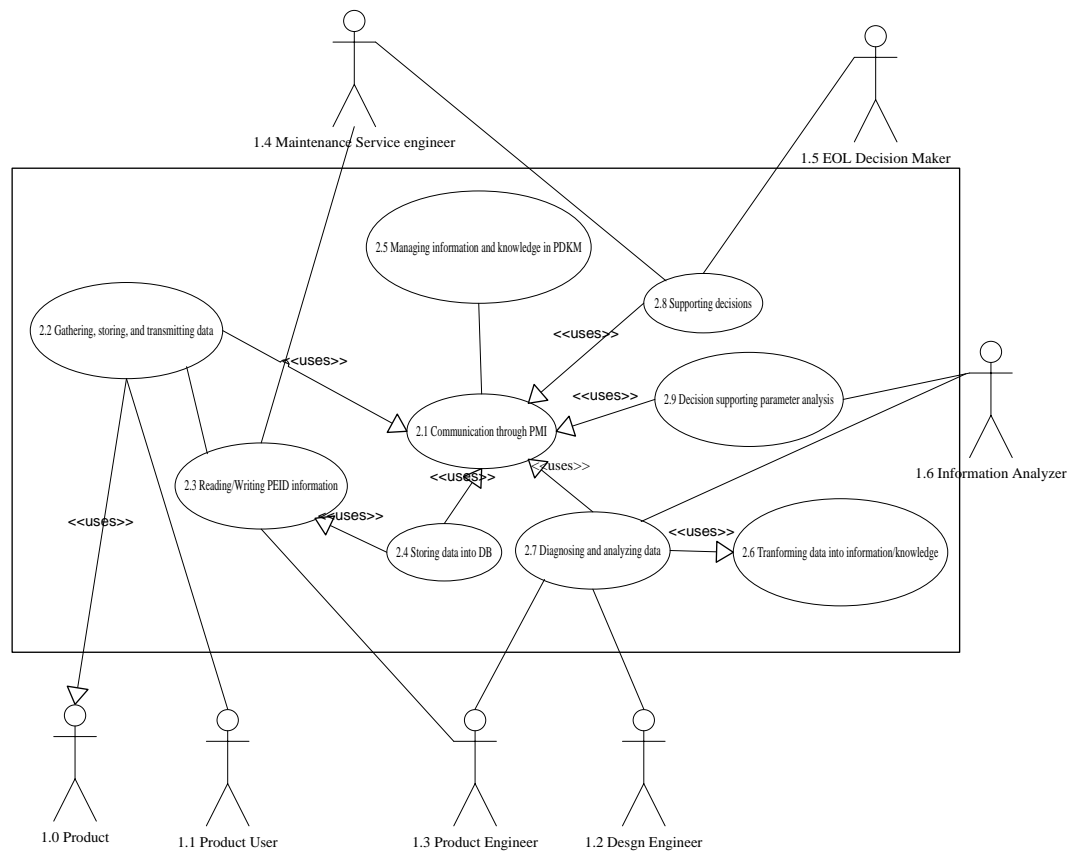


Figure 3-1: Use case diagram for generic *closed-loop PLM*

### **3.2 Generic workflow and information flow model**

Following the additional requirements presented above, the workflow model and the information flow model are updated. In the workflow model is added the process P9 - off-line data analysis. In the information flow model, P9, DSS parameter tuning, is added. The detailed level 2 descriptions are also added in the Figure 3-11 and 3-21 together with their corresponding description tables. Although both processes are triggered by updating the PDKM, the event of information change in the workflow and the output information in the information flow are not generated always. Because the DSS parameters can need no change in case of the analysis result fits with the current parameter setting.

### 3.2.1 Generic workflow model

- Level 1 workflow modelling

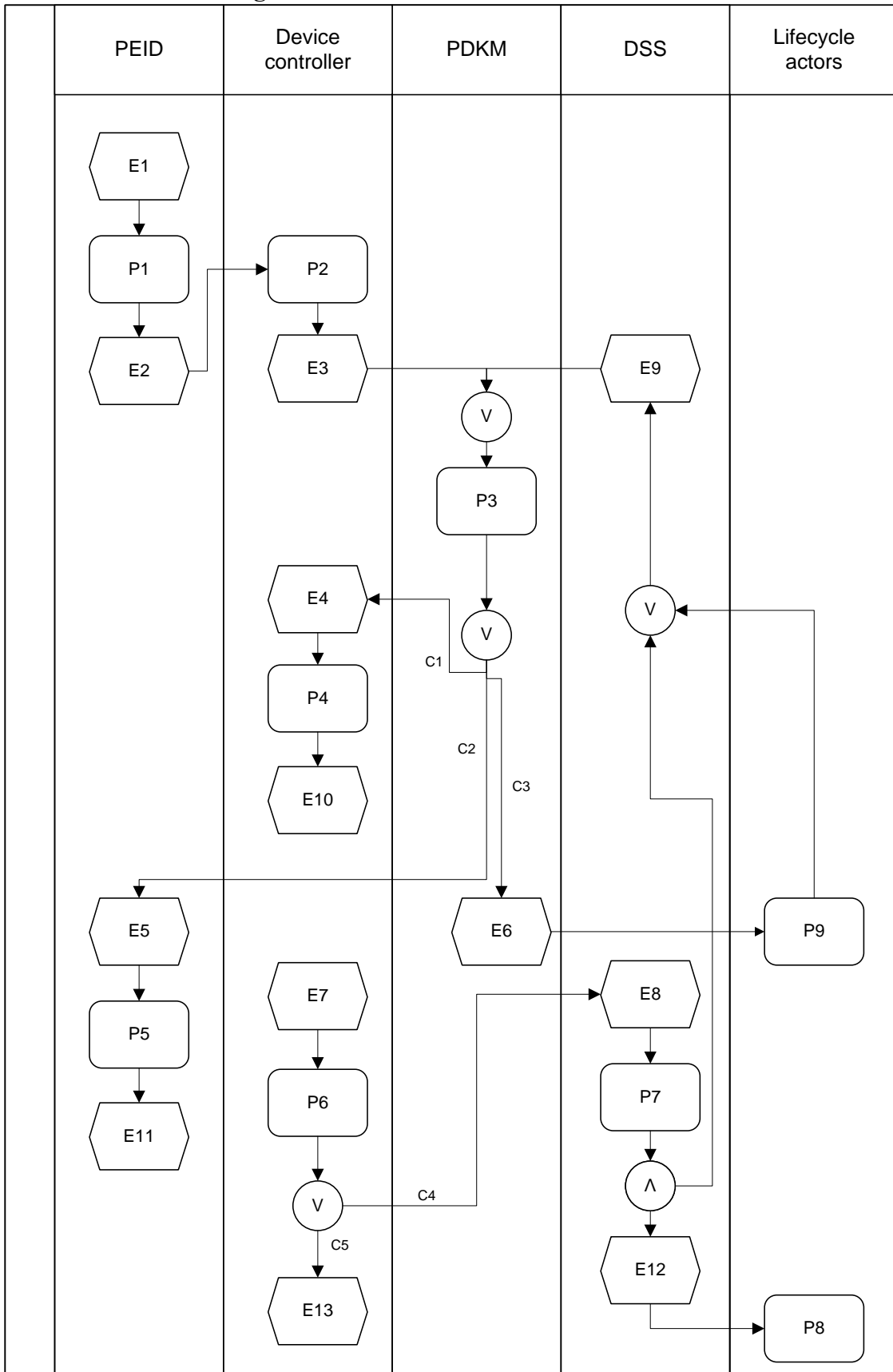


Figure 3-2. Level 1: Workflow diagram (Overall)



Table 1: Generic overall workflow

Modelling components		Description	Remarks
Process	P1	Gathering data from products	
	P2	Updating data to PEID device controller	
	P3	Updating data to PDKM (forward)	
	P4	Updating data into PEID device controller (backward)	
	P5	Updating data into PEID (backward)	
	P6	Requesting DSS	
	P7	Executing DSS	
	P8	Informing relevant DSS result	
	P9	Doing off-line data analysis	
Event	E1	'gathering data' condition is activated.	
	E2	'transferring time or condition' is activated.	
	E3	Transferring to PDKM is requested.	
	E4	Updating is requested.	
	E5	Updating is requested.	
	E6	Data storing is completed.	
	E7	Decision support is required.	
	E8	DSS request is received.	
	E9	New data and information related to DSS are generated.	
	E10	Updating is completed.	
	E11	Updating is completed.	
	E12	Decision support is provided.	
	E13	Decision support has been provided by device controller's function	
Condition	C1	If device controller updating is required.	
	C2	If PEID updating is required.	
	C3	If there is no request on updating.	
	C4	When DSS should be done in a remote place	
	C5	When DSS can be done within the device handler	

**- Level 1 P1 workflow modelling**

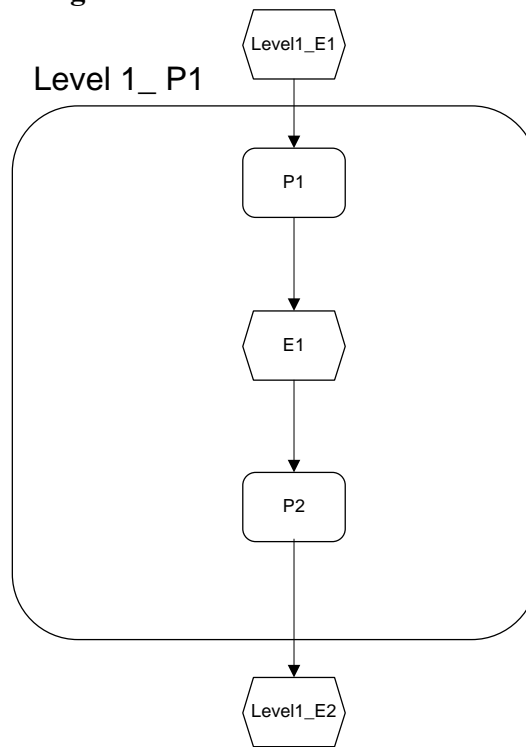


Figure 3-3. Level 2: Workflow diagram (P1)

Table 2: P1 workflow

Modelling components		Description	Remarks
Process	P1	Filtering and processing data to transform raw data into meaningful data.	
	P2	Storing the data into PEID memory	
Event	E1	Gathered data is verified.	

**- Level 1 P2 workflow modelling**

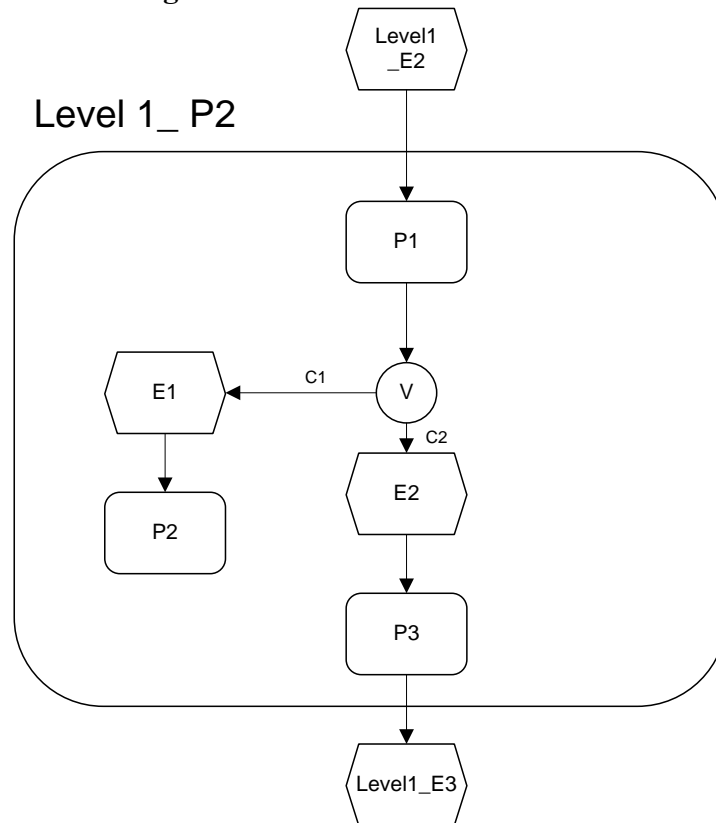


Figure 3-4. Level 2: Workflow diagram (P2)

Table 3: P2 workflow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting and storing data into PEID device controller	
Event	E1	Network is not connected	
	E2	Network is connected	
Condition	C1	If network is not connected	
	C2	If network is connected	

**- Level 1 P3 workflow modelling**

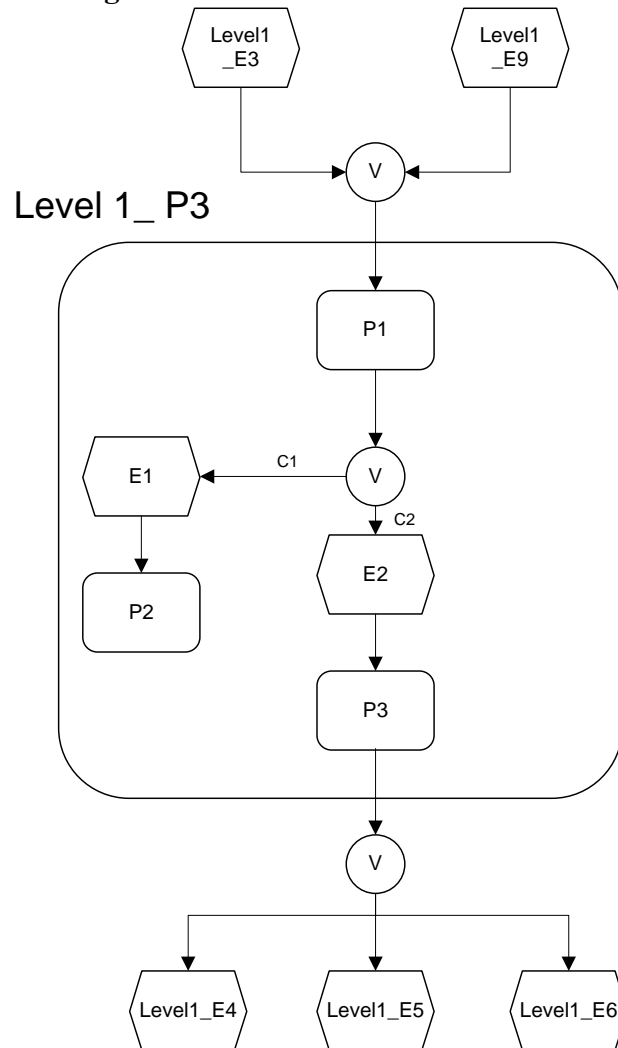


Figure 3-5. Level 2: Workflow diagram (P3)

Table 4: P3 workflow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting and storing data into PDKM	
Event	E1	Network is not connected	
	E2	Network is connected	
Condition	C1	If network is not connected	
	C2	If network is connected	

**- Level 1 P4 workflow modelling**

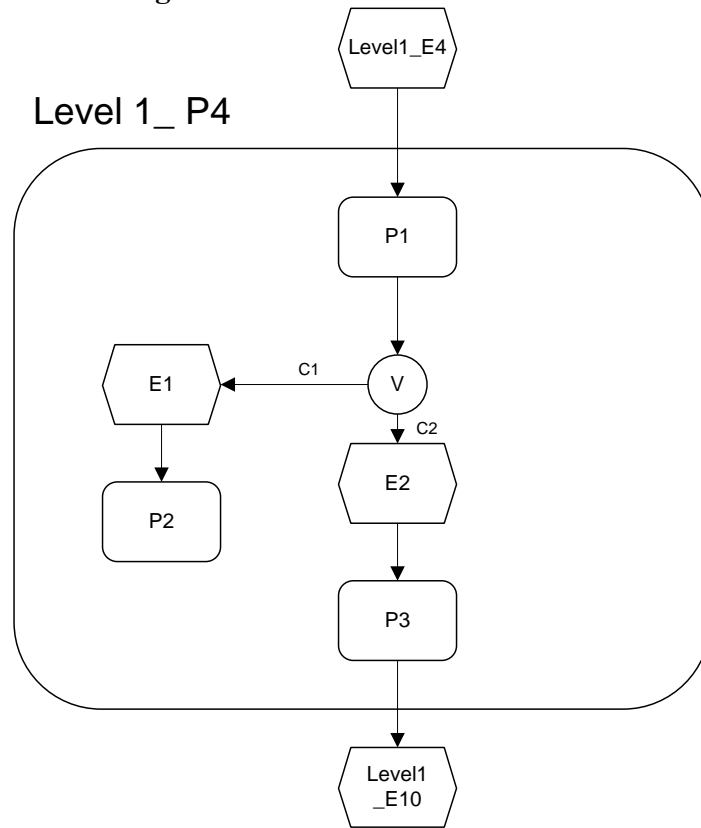


Figure 3-6. Level 2: Workflow diagram (P4)

Table 5: P4 workflow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting data into PEID device controller	
Event	E1	Network is not connected	
	E2	Network is connected	
Condition	C1	If network is not connected	
	C2	If network is connected	

**- Level 1 P5 workflow modelling**

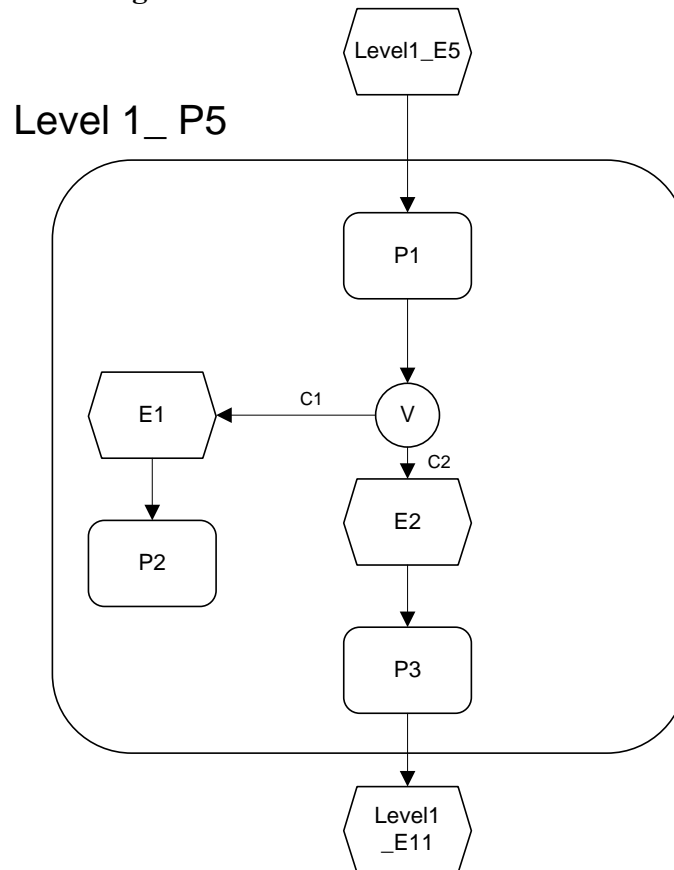


Figure 3-7. Level 2: Workflow diagram (P5)

Table 6: P5 workflow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting data into PEID	
Event	E1	Network is not connected	
	E2	Network is connected	
Condition	C1	If network is not connected	
	C2	If network is connected	

- Level 1 P6 workflow modelling

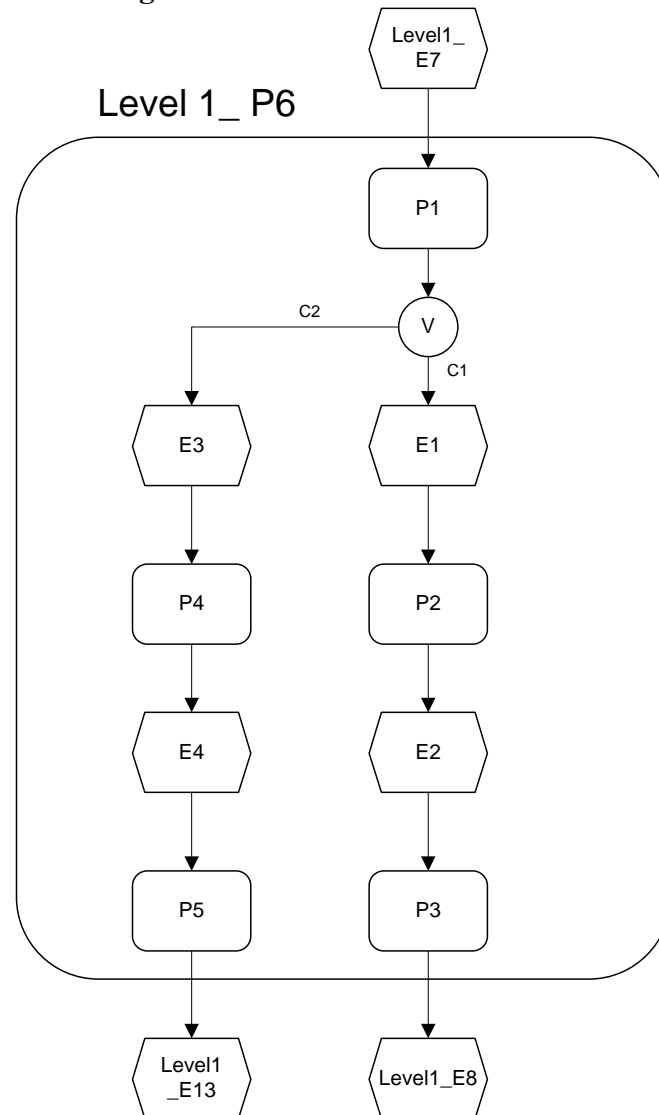


Figure 3-8. Level 2: Workflow diagram (P6)

Table 7: P6 workflow

Modelling components		Description	Remarks
Process	P1	Finding a relevant function in PEID device controller	
	P2	Input relevant data	
	P3	Requesting relevant decision support in a remote place	
	P4	Input relevant data	
	P5	Running built-in DSS module	
Event	E1	Relevant function is selected	
	E2	Input data is provided	
	E3	Relevant function is selected	
	E4	Input data is provided.	
Condition	C1	When decision support should be done in a remote place	
	C2	When decision support can be don within the device controller	

**- Level 1 P7 workflow modelling**

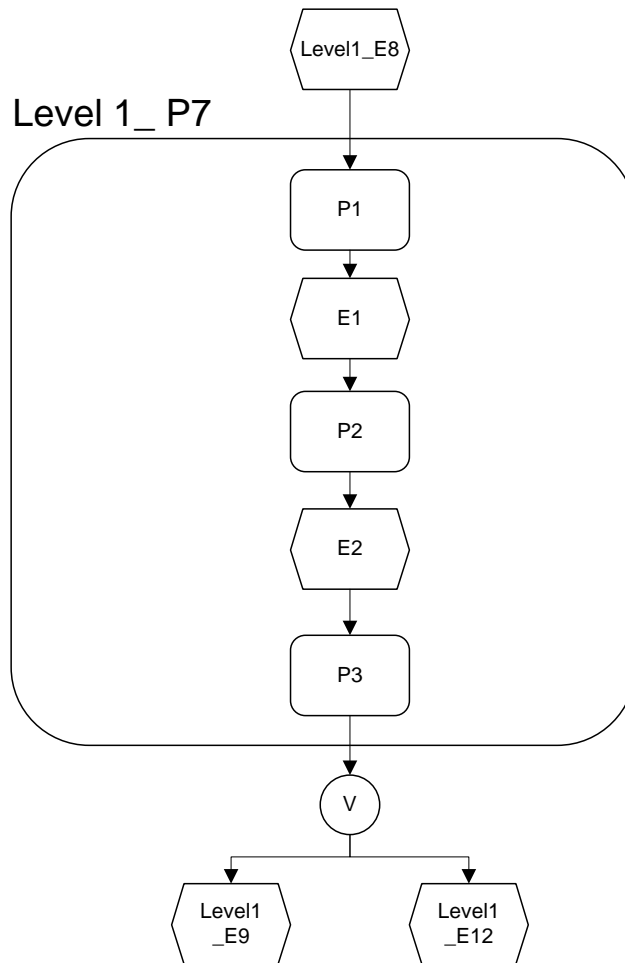


Figure 3-9. Level 2: Workflow diagram (P7)

Table 8: P7 workflow

Modelling components		Description	Remarks
Process	P1	Analyzing current product status with gathered data	
	P2	Proposing alternative actions	
	P3	Taking one action	
Event	E1	Analysis is completed	
	E2	Alternatives are proposed.	



**- Level 1 P8 workflow modelling**

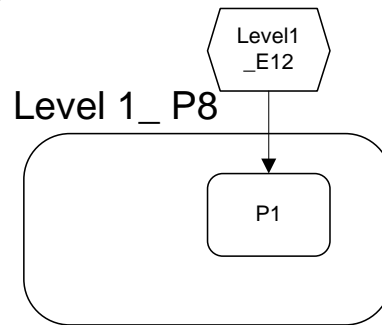


Figure 3-10. Level 2: Workflow diagram (P8)

Table 9: P8 workflow

Modelling components		Description	Remarks
Process	P1	Informing lifecycle actors of DSS result	

**- Level 1 P9 workflow modelling**

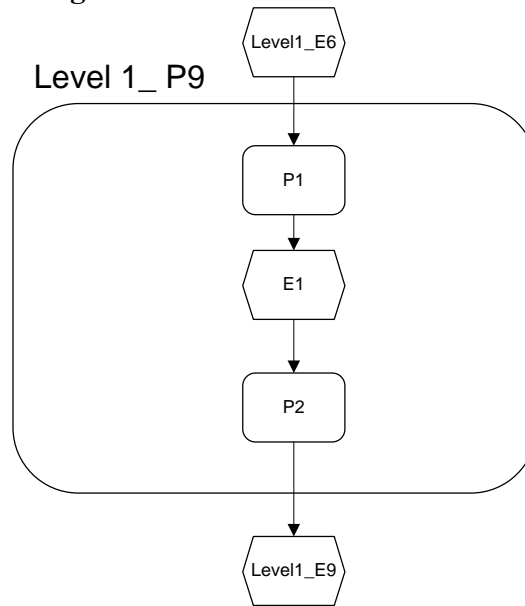


Figure 3-11. Level 2: Workflow diagram (P9)

Table 10: P9 workflow

Modelling components		Description	Remarks
Process	P1	Gathering required data	
	P2	Analyzing data and generating required parameters for DSS	
Event	E1	Information gathered	

### 3.2.2 Generic information flow model

#### - Level 1 information flow modelling

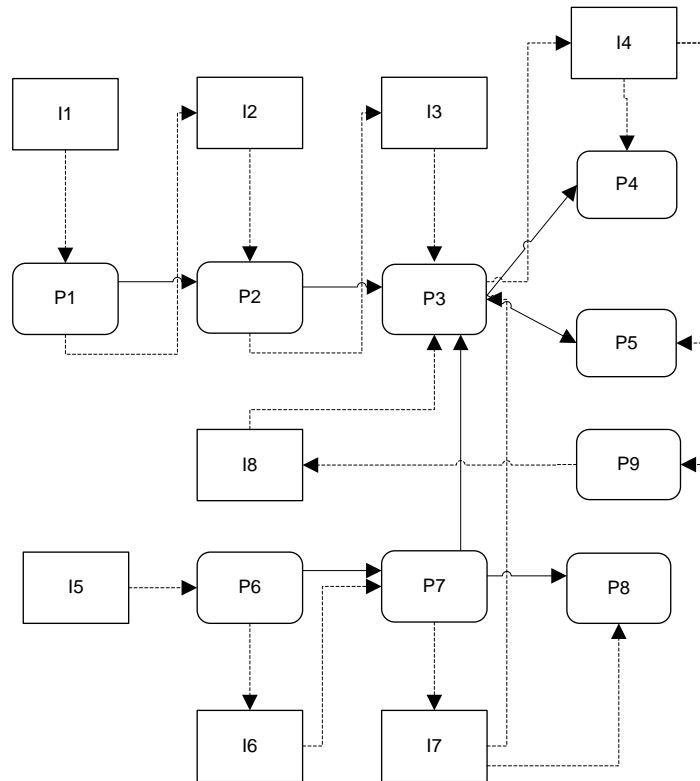


Figure 3-12. Level 1: Information flow diagram (Overall)

Table 11. Generic overall information flow

Modelling components		Description	Remarks
Process	P1	Gathering data from products	
	P2	Updating data to PEID device controller	
	P3	Updating data to PDKM (forward)	
	P4	Updating data into PEID device controller (Backward)	
	P5	Updating data into PEID (Backward)	
	P6	Requesting DSS	
	P7	Executing DSS	
	P8	Informing relevant DSS result	
	P9	Tuning DSS parameter	
Information	I1	Product lifecycle data	
	I2	Gathered product lifecycle data	
	I3	Gathered product lifecycle data	
	I4	Updated data	
	I5	Input data for DSS	
	I6	Input data for DSS	
	I7	DSS result	
	I8	Updated DSS parameters	

**- Level 1 P1 information flow modelling**

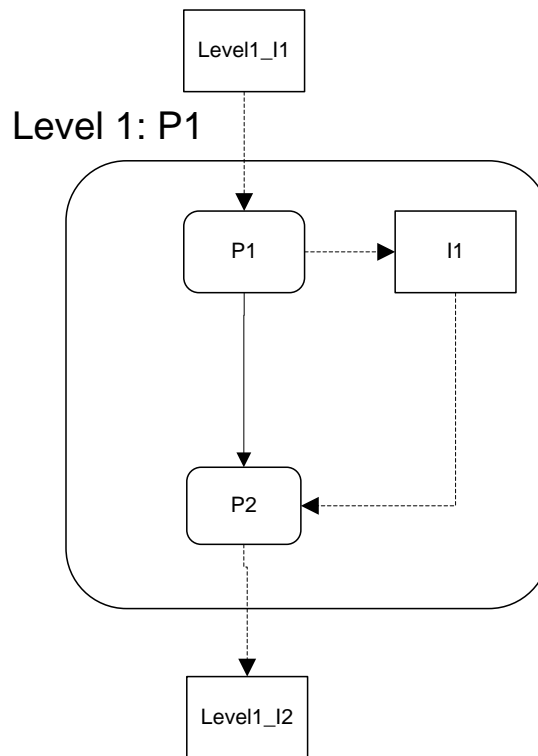


Figure 3-13. Level 2: Information flow diagram (P1)

Table 12. P1 information flow

Modelling components		Description	Remarks
Process	P1	Filtering and processing data	
	P2	Storing the data into PEID memory	
Information	I1	Processed data	

**- Level 1 P2 information flow modelling**

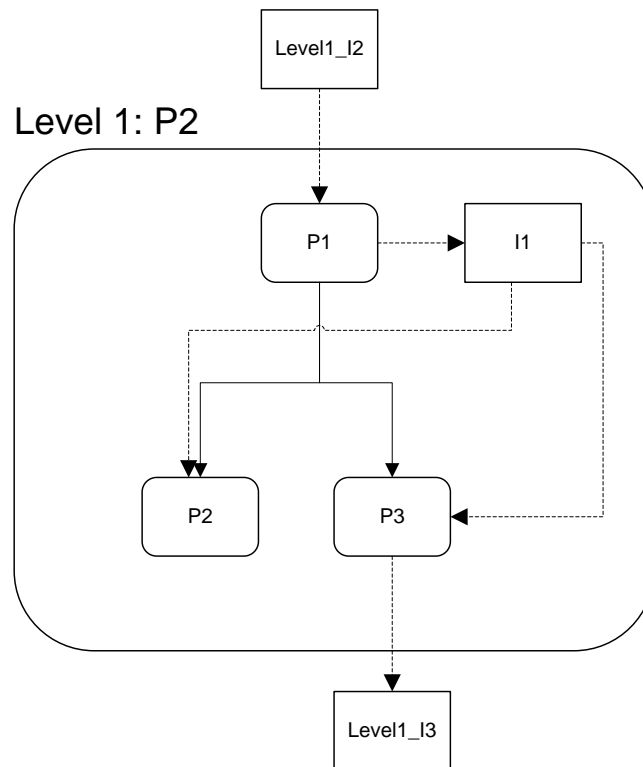


Figure 3-14. Level 2: Information flow diagram (P2)

Table 13. P2 information flow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting and storing data into PEID device controller	
Information	I1	Connection result	

**- Level 1 P3 information flow modelling**

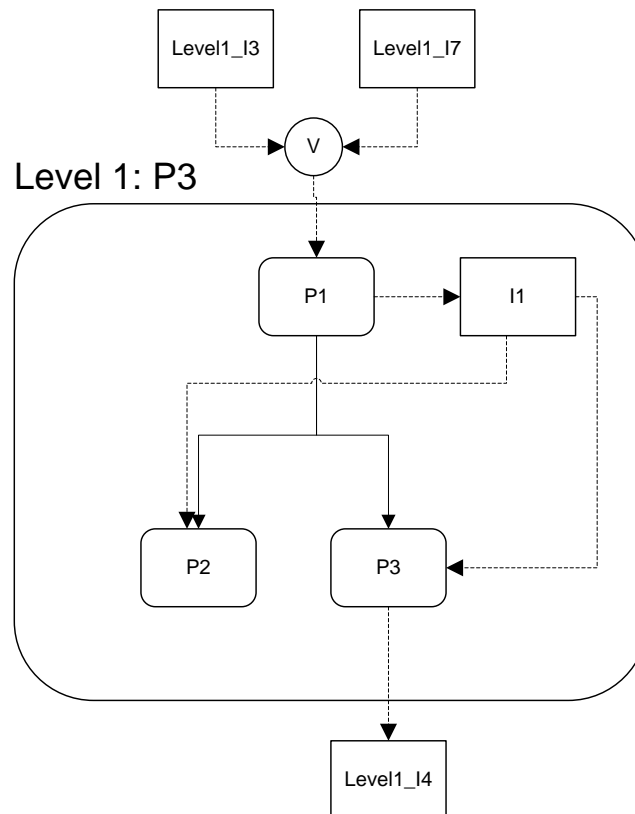


Figure 3-15. Level 2: Information flow diagram (P3)

Table 14. P3 information flow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting and storing data into PDKM	
Information	I1	Connection result	

**- Level 1 P4 information flow modelling**

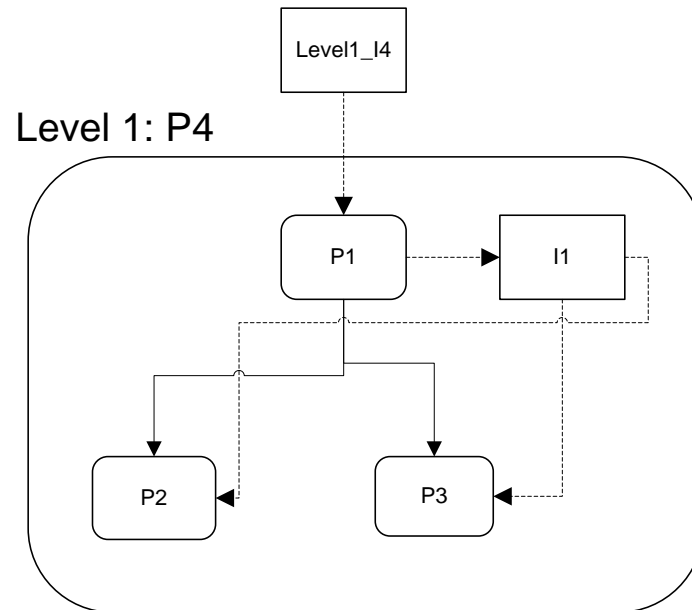


Figure 3-16. Level 2: Information flow diagram (P4)

Table 15. P5 information flow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting data into PEID device controller	
Information	I1	Connection result	

**- Level 1 P5 information flow modelling**

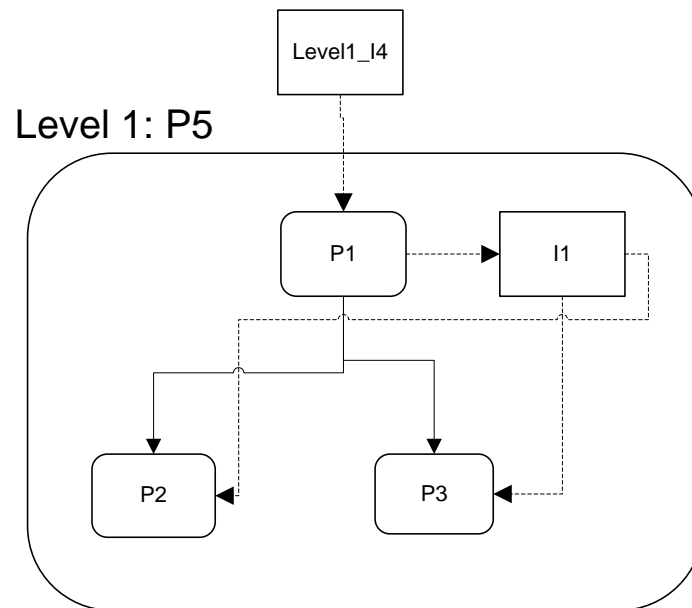


Figure 3-17. Level 2: Information flow diagram (P5)

Table 16. P5 information flow

Modelling components		Description	Remarks
Process	P1	Preparing network connection	
	P2	Informing error messages	
	P3	Transmitting data into PEID	
Information	I11	Connection result	



**- Level 1 P6 information flow modelling**

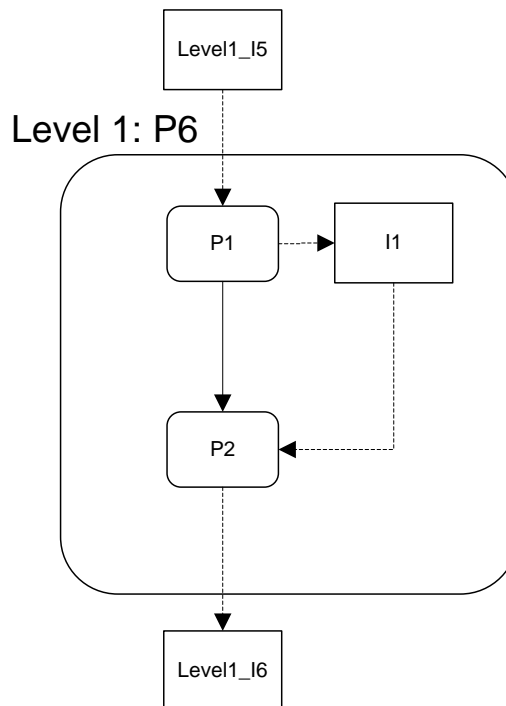


Figure 3-18. Level 2: Information flow diagram (P6)

Table 17. P6 information flow

Modelling components		Description	Remarks
Process	P1	Finding the relevant function in PEID device controller	
	P2	Calling DSS function with relevant information	
Information	I1	Input data for DSS	

**- Level 1 P7 information flow modelling**

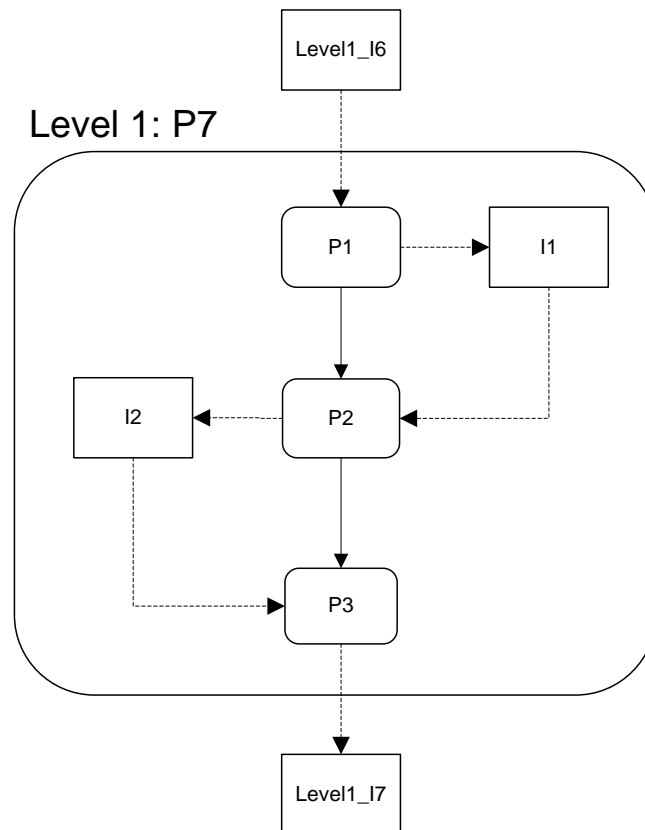


Figure 3-19. Level 2: Information flow diagram (P7)

Table 18. P7 information flow

Modelling components		Description	Remarks
Process	P1	Analyzing current product status with gathered data	
	P2	Proposing alternative actions for maintenance/product design improvement	
	P3	Taking one action	
Information	I1	Remaining life time	
	I2	Alternative actions	

**- Level 1 P8 information flow modelling**

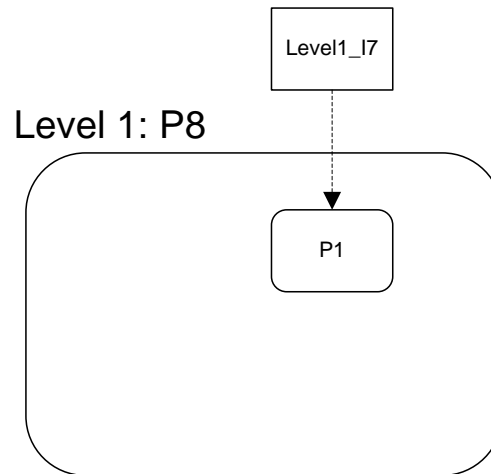


Figure 3-20. Level 2: Information flow diagram (P8)

Table 19. P8 information flow

Modelling components		Description	Remarks
Process	P1	Informing lifecycle actors of DSS result	

**- Level 1 P9 information flow modelling**

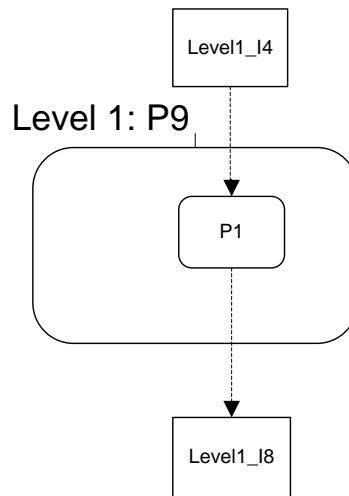


Figure 3-21. Level 2: Information flow diagram (P9)

Table 20. P9 information flow

Modelling components		Description	Remarks
Process	P1	DSS parameter tuning based on PDKM data	



#### **4 Concluding remarks**

This deliverable deals with the generic PROMISE-PLM model (version 3) which is updated from the previous version (DR2.4) considering additional implementation requirements. To describe the detail of the model, use case models, workflow models, and information flow models are used. The final version of PROMISE-PLM model is the foundation template which can be applied to the management of product whole life cycle of any product domain. The new model, updated with the issues observed during the implementation phase of the PROMISE demonstrators offers higher implementation reliability. The PROMISE approach based on the proposed model can realize the embedded benefit of closed-loop PLM: higher lifecycle value, respect of environmental concerns, customer satisfaction, and so on. The PROMISE generic PLM model should be customized for each application. With widening application references, the industry dependent customized model could be derived from the generic model.



## 5 Glossary

<b>Acronym</b>	<b>Full description</b>
DoW	Description of Work
EOL	End Of Life
GUI	Graphical User Interface
PDKM	Product Data and Knowledge Management
PEID	Product Embedded Information Device
PLM	Product Lifecycle Management
PMI	PROMISE Middleware Interface
PROMISE	Product lifecycle Management and Information tracking using Smart Embedded systems
XML	eXtensible Markup Language