

EXAMPLE - DOMAIN REQUIREMENTS ENGINEER

This document contains the example of the SMartyPerspective technique for the Domain Requirements Engineer (DRE) scenario by defect detection of the diagram with embedded defects of the Software Product Line (SPL) Mobile Media (MM) use case diagram.

1. Mobile Media Software Product Line

Mobile Media (MM) is an SPL composed of applications (products) that manipulate music, videos and photos for mobile devices such as smartphones and tablets. Provides support for managing (creating, deleting, viewing, executing and sending) different types of media (Young, 2005; Geraldi and OliveiraJr, 2017).

Part of the description of the Mobile Media use cases was taken from the work of Choma (2017) and are presented as follow:

UC1: Log in

Category: mandatory

Description: User enters login and password and the system validates the data.

UC2: Send Media

Category: optional

Description: User selects and sends a certain media to another device.

UC3: Manage Album

Category: mandatory

Description: User performs general control of album entries. It encompasses the operations of creating, deleting and listing albums.

UC4: Manage Media

Category: mandatory

Description: User performs general control of media records. It encompasses the operations of creating, deleting and listing records.

UC5: Manage Favourite Media

Category: optional

Description: User performs control of favorite media. It encompasses the operations of setting favorite media and listing favorite media.

UC6: Play Media

Category: mandatory

Description: User execute a media according to the possibilities of the product.

UC7: Add Media to Album

Category: mandatory

Description: User selects a media and links it to a certain album stored in the system.

UC8: Link Media with Address Book Entry

Category: optional

Description: User links media to a particular contact so that it plays when there is a call from that contact.

UC9: View/Hear Media from Incoming Caller

Category: optional

Description: When receiving a call, the system plays the media linked to the contact.

UC10: Label Files

Category: optional

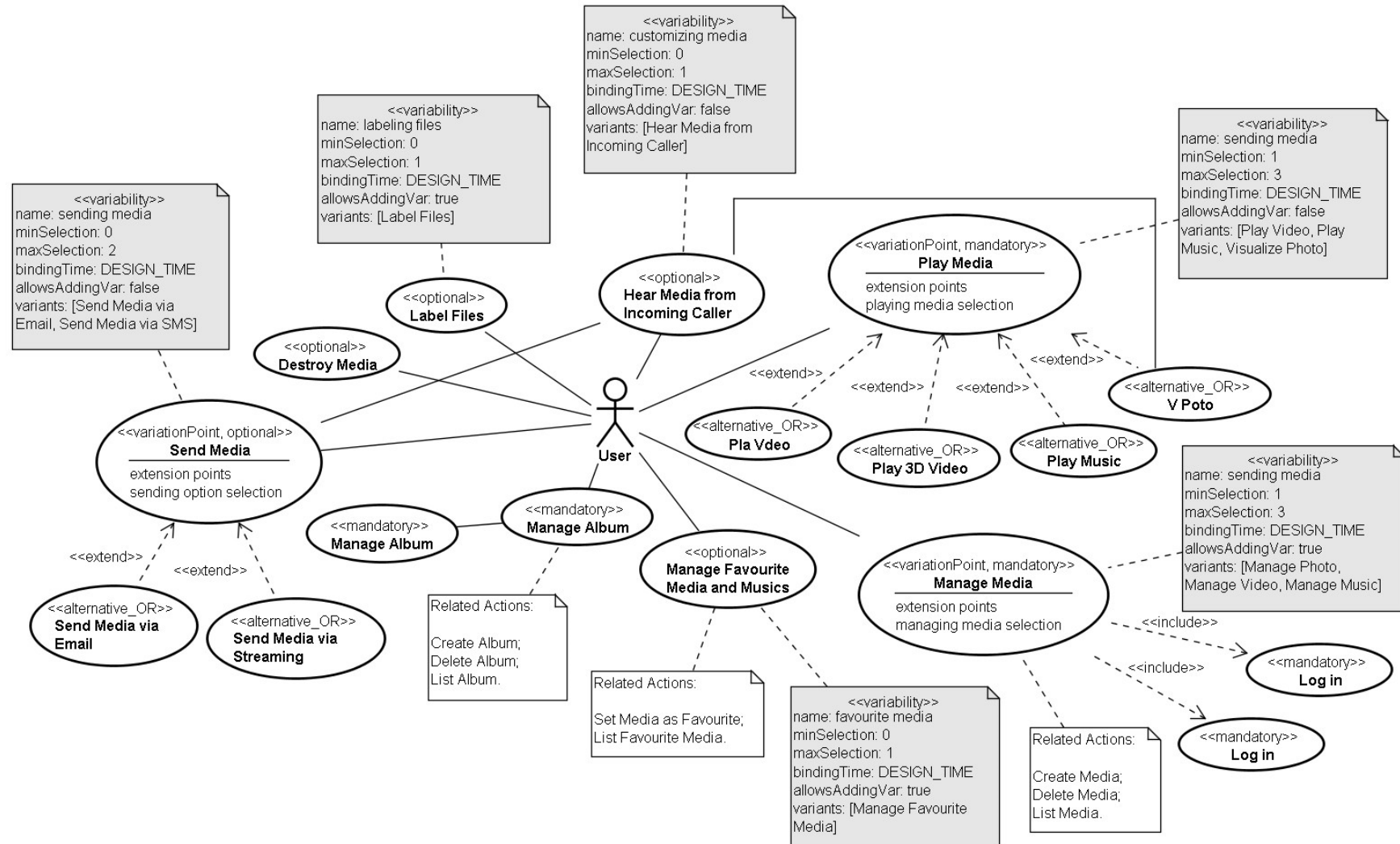
Description: User inserts a label for a certain media, which can be video, photo or music.

2. Use Case Diagram

In Figure 1, the use case diagram for Mobile Media is presented with defects incorporated by Geraldi and OliveiraJr (2017). Use the scenario for your perspective described in Document 5 of this instrumentation to inspect this diagram for defect detection.



Figura 1: SPL Mobile Media Use Case Diagram with Embedded Defects



3. Resolution for use case diagram

The DRE inspects the use case diagram in order to identify all the defects that compromise the system's functionality to be transferred to the team. It must ensure that all functions are described in the use case and that the variabilities are defined correctly so that the components and future configuration are correctly developed in the Application Engineering process.

The DRE scenario starts with the instruction presenting the importance of the diagram for the role and then asks the reader to actively participate in the inspection and make a list from the descriptions of the system features described in the requirements document, considering here that the specification is correct and reflects the needs of SPL's customers.

The reader is free to make a list with stereotype tags in a way that is easier for them to understand while reading the diagram. Figure 2 presents an example Mobile Media specification item list.

With the list ready, the inspector should follow the steps defined for this diagram and perspective. As previously stated, the reading of the use case diagram for the DRE must be done in 2 steps: the first goes through all the elements and the second checks the specifics of variability management.

Figure 2: List with SPL MM requirements

<i>Log in</i>	- <i>Mandatory</i>
<i>Send Media</i>	- <i>Optional/Variation Point</i>
- <i>Email</i>	- <i>Alternative</i>
- <i>SMS</i>	- <i>Alternative</i>
<i>Manage Album</i>	- <i>Mandatory</i>
<i>Manage Media</i>	- <i>Mandatory/Variation Point</i>
- <i>Video</i>	- <i>Alternative</i>
- <i>Music</i>	- <i>Alternative</i>
- <i>Photo</i>	- <i>Alternative</i>
<i>Manage Favourite Media</i>	- <i>Mandatory</i>
<i>Play Media</i>	- <i>Mandatory/Variation Point</i>
- <i>Video</i>	- <i>Alternative</i>
- <i>Music</i>	- <i>Alternative</i>
- <i>Photo</i>	- <i>Alternative</i>
<i>Add Media to Album</i>	- <i>Mandatory</i>
<i>Link Media with Address Book Entry</i>	- <i>Optional</i>
<i>View/Hear Media from Incoming Caller</i>	- <i>Mandatory</i>
<i>Label Files</i>	- <i>Optional</i>

For each element of the diagram, the inspector must read all the questions of the step that is, and only then proceed to the next element, except when the question directs that the reader can stop the inspection and proceed to the next element, or, questions that do not fit the type of element. For example, a subset of questions for optional elements and the element under inspection is mandatory.

The inspection for the use case diagram by DRE starts in Step 1. It must be completed for all elements of the diagram (Figure 1), whether it is of the actor or use case type, and only then, proceed with the scenario (Step 2), because the next step may need information that has already been analyzed previously, such as question 2.3 that detects elements omission, by checking those that have not yet been crossed out from the list and, consequently, were not described in the diagram.

The reader is free to start the inspection by whichever element they prefers. For this example, the inspection was started from the **LabelFiles** use case, however, after following the entire procedure in Step 1, that is, reading all the questions in this step, no inconsistencies were found between the diagram and the requirements specification , because for all the questions the answer was negative, that is, no defects were found in the element.

Destroy Media was the next element inspected for the example. In question 1.2 of Step 1, the reader was asked to analyze whether this use case represents a system functionality, however, when analyzing Figure 2, none of the items in the list match this functionality, so a defect was identified.

When finding a defect, the inspector must fill in the information on the Defect Identification Form (DIF) correctly so that later the element is found and the diagram is corrected. The defect found in **Destroy Media** was described in the DIF in the first line (Table 1) with the following information:

- Diagram: use case;
- Question Number: 1.2;
- Element: Destroy Media;
- Identified Defect: This use case has not been defined in the requirements specification.

When it comes to inspecting the **Send Media** use case, the reader will read the first questions, and when reaching the subgroup of questions 1.7 referring to element relationships, it will be identified that the relationship with **Hear Media from Incoming Caller** does not exist :

- Diagram: use case;
- Question Number: 1.7.1;
- Element: Send Media;
- Identified Defect: There is no relationship between the Send Media and Hear Media from Incoming Caller use cases.

After visiting all the elements in the use case diagram, Step 1 was completed. In Step 2, the inspector must first analyze the optional elements that represent a variation point and then the UML comments associated with these stereotypes, looking for specific defects in variability management.

In the **Send Media** use case, we have an example of a defect detected in Step 2. In the diagram under inspection, it is defined in the variability notation in the variants meta-attribute that the **Send Media via SMS** use case is a variant for the point of **Send Media** variation. When checking the use case diagram this element was not found. In the DIF form (Table 1 - line 11) this defect was reported as follows:

- Diagram: use case;
- Question Number: 2.2.1;
- Element: Send Media;
- Identified Defect: The Send Media via SMS use case has been defined in variants and is not present in the use case diagram.

The last question is analyzed after inspection of the two subgroups of Step 2, which guided the identification of the variants of the optional elements and the notations that indicate a variability. In this question, the reader should look at the list with the features described in Figure 2 and check if any of the items was not represented by any element of the use case diagram, thus characterized as an omission defect (Figure 3).

Figure 3: List with SPL MM requirements after inspection of the use case diagram by DRE

<i>Login</i>	<i>Mandatory</i>
<i>Send SMS</i>	<i>Alternative/Variantion Point</i>
<i>Transfer</i>	<i>Alternative</i>
<i>SMS</i>	<i>Alternative</i>
<i>Manage Album</i>	<i>Mandatory</i>
<i>Manage Album</i>	<i>Alternative/Variantion Point</i>
<i>Album</i>	<i>Alternative</i>
<i>Music</i>	<i>Alternative</i>
<i>Photo</i>	<i>Alternative</i>
<i>Manage Favorites Media</i>	<i>Mandatory</i>
<i>Link Media</i>	<i>Alternative/Variantion Point</i>
<i>Music</i>	<i>Alternative</i>
<i>- Music</i>	<i>- Alternative</i>
<i>Photo</i>	<i>Alternative</i>
<i>Add Media to Album</i>	<i>Mandatory</i>
<i>Link Media with Address Book Entry</i>	<i>- Optional</i>
<i>Move/Remove Media from Incoming Call</i>	<i>Mandatory</i>
<i>Send SMS</i>	<i>Alternative</i>

The Link Media with Address Book Entry use case was not found in the diagram under inspection, as shown in Figure 3. In the DIF form (Table 1 - line 13) this defect was reported as follows:

- Diagram: use case;
- Question Number: 2.3;



- ● Element: Link Media with Address Book Entry
- ● Identified Defect: The use case that relates photo to calendar entry was not identified in the use case diagram.

With the inspection completed and the DIF filled (Table 1), the inspector can move to the next diagram to be inspected.

Tabela 1: DIF após inspeção do diagrama de caso de uso pelo DRE

nº	DIAGRAM					QUESTION NUMBER	ELEMENT	IDENTIFIED DEFECT
	FT	UC	CL	CP	SQ			
1		X				1.2	Destroy Media	This use case was not defined in the requirements specification.
2		X				1.2	Send Media via Streaming	This use case was not defined in the requirements specification.
3		X				1.7.1	Send Media	There is no relationship between the Send Media and Hear Media from Incoming Caller use cases.
4		X				1.7.1	Hear Media from Incoming Call	There is no relationship between the Incoming Caller and V Photo HearMedia use cases.
5		X				1.3	Manage Album	The use case is duplicated.
6		X				1.1	Manage Favourite Media and Musics	This use case does not correctly express its functionality, as it is all media management, with no need for "Musics".
7		X				1.1	Pla Vdeo	The use case name does not correctly express its function.
8		X				1.2	Play 3D Video	This use case expresses a function that was not defined in the requirements specification. There is no "3D" Video.
9		X				1.1	V Photo	This use case does not correctly express its functionality
10		X				1.3	Log In	The use case is duplicated.
11		X				2.2.2	Send Media	The Send Media via SMS use case has been defined in variants and is not present in the use case diagram.
12		X				2.2.2	Manage Media	The Manage Photo, Manage Video and Manage Music use cases have been defined in variants and are not present in the use case diagram.
13		X				2.3	Link Media with Address Book Entry	The use case that relates photo to calendar entry was not identified in the use case diagram.