

EXAMPLE – PRODUCT MANAGER

This document contains the example of the SMartyPerspective technique for the Product Manager (PMG) scenario for detecting diagram defects with embedded defects of the Software Product Line (SPL) Mobile Media 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

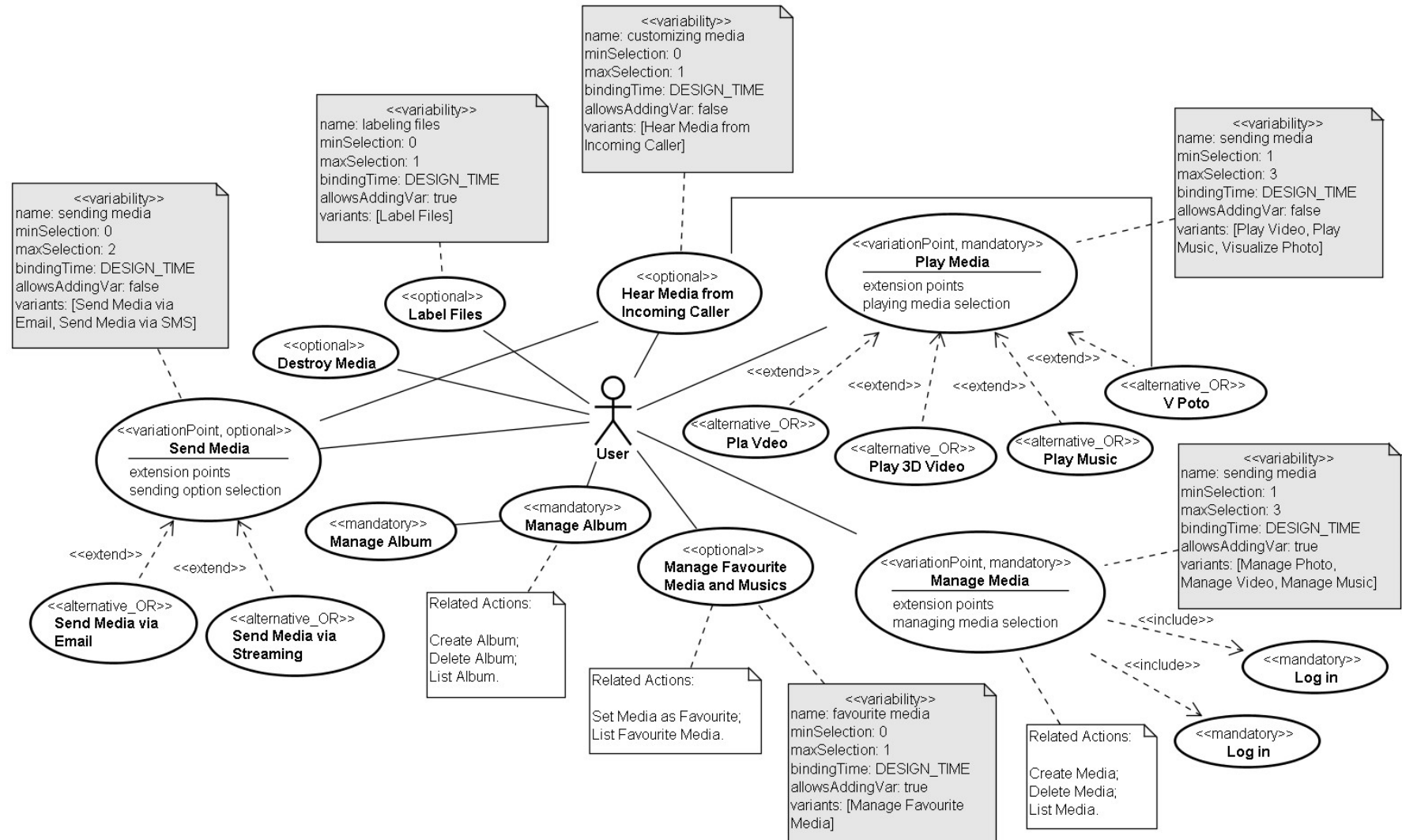
Description: User inserts a label for a certain media, which can be video, photo or music.

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.



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



3. Resolution for use case diagram

The use case diagram supports PMG with full functionality modeling, acting as an extension of the feature diagram. Because, in the features diagram, the SPL characteristics are presented, while in the use-case diagram, they are presented as system features, allowing the PMG to have a better view of the business and thus be able to create the SPL strategies.

The PMG scenario starts with the instruction presenting the importance of the diagram for the role and then asks the reader to list from the descriptions of the system features of 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 mentioned, the reading of the use case diagram for the PMG must be done in 2 steps (Step 3 and 4): the first one goes through all the elements and the second checks the specificities 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 the PMG starts in Step 3. 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 can it proceed with the scenario (Step 4), because the next step may need information that has already been analyzed previously, such as question 4.2, which 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 initiate the inspection by whatever element they prefers. For this example, a work was created from the use case **LabelFiles**, however, after following the entire procedure in Step 3, that is, reading all the questions in this step, no inconsistencies were found between the diagram and the requirements specification , because for all questions the answer was negative, that is, no defects were found in the elemento

Destroy Media was the next element inspected for the example. In question 3.2 of Step 3, 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 correspond to this functionality, therefore, 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 can be 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: 3.2;
- Element: Destroy Media;
- Identified Defect: This use case has not been defined in the requirements specification.

After analyzing the first questions from Step 3, the inspector will analyze the questions from subgroup 3.7. In it, information about the relationships of the use case under inspection is verified. For the **Send Media** use case, a defect of this type was detected when analyzing the relationships of this element, since a relationship with the **Hear Media from Incoming Caller** that does not exist among the functionalities was identified. For this defect, the DIF form was completed as follows (Table 1 - line 3):

- Diagram: use case;
- Question Number: 3.7.1;
- 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 of Step 2, the reader can then move to Step 4. In Step 4, the inspector should first analyze the optional elements that represent a point of variation (subgroup 4.1) and then check if any element is missing from the diagram in question 4.2.

The last question, 4.2, is analyzed after inspection of subgroup 4.1, which guided the reader to identify the stereotypes of the variants of optional elements and points of variation. In this question, the reader should analyze the list with the features described in Figure 2 and verify if any of the items was not represented by any element of the use case diagram, thus characterized as an omission defect.

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

Log in	Mandatory
Send SMS	Mandatory/Inclusion/Exclusion
Send	Optional
- SMS	- Alternative
Manage Album	Mandatory
Manage Media	Mandatory/Inclusion/Exclusion
Album	Optional
Media	Alternative
Photo	Alternative
Manage Favorites Media	Mandatory
Play Media	Mandatory/Inclusion/Exclusion
- Video	- Alternative
- Music	- Alternative
- Photo	- Alternative
Add Media to Album	Mandatory
Link Media with Address Book Entry	- Optional
View/Listen Media from Incoming Caller	Mandatory
Call Log	Optional

For this example, 5 use cases were not defined in the diagram as shown in Figure 3. Therefore, the omission of these items according to question 4.2 should be noted in the DIF form. For the first item in the list (**Send Media via SMS**), this defect was reported in the DIF form (Table 1 - line 11) as follows:

- Diagram: use case;
- Question Number: 4.2;
- Element: Send Media;
- Identified Defect: The use case for the SMS media sending functionality has not been defined.



After question 4.2 and filling out the DIF (Table 1), the inspection for the PMG will be completed for the use case diagram.

Table 1: DIF after inspection of the use case diagram by PMG

nº	DIAGRAM					QUESTION NUMBER	ELEMENT	IDENTIFIED DEFECT
	FT	UC	CL	CP	SQ			
1		X				3.2	Destroy Media	This use case was not defined in the requirements specification.
2		X				3.2	Send Media via Streaming	This use case was not defined in the requirements specification
3		X				3.7.1	Send Media	There is no relationship between the Send Media and Hear Media from Incoming Caller use cases.
4		X				3.7.1	Hear Media from Incoming Call	There is no relationship between the HearMedia from Incoming Caller and V Photo use cases.
5		X				3.3	Manage Album	The use case is duplicated.
6		X				3.1	Manage Favourite Media and Musics	This use case does not correctly express its functionality as it is all media management, so there is no need to write "Musics".
7		X				3.1	Pla Vdeo	The use case name does not correctly express its function.
8		X				3.2	Play 3D Video	This use case expresses a function that was not defined in the requirements specification. There is no "3D" video.
9		X				3.1	V Photo	This use case does not correctly express its functionality.
10		X				3.3	Log In	The use case is duplicated.
11		X				4.2	Send Media via SMS	The use case for the SMS media sending functionality has not been defined
12		X				4.2	Manage Media	The use case for the photo management functionality has not been defined.
13		X				4.2	Manage Media	The use case for the video management functionality has not been defined
14		X				4.2	Manage Media	The use case for the music management functionality has not been defined.
15		X				4.2	Link Media with Address Book Entry	The use case that relates photo to book entry was not identified in the use case diagram.