Modeling used for Software Product Line Engineering

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***Abstract*:-** Software product line is the separation of variant features of all the products which belong to same line. Modeling is the basic foundation of Software Product Line Engineering, that is used for collection of what is similar and what is different between products, but products of same line. Here Line means a set of products those are related and share some commonalities like data structures, software components, some features and architecture etc.In order to managing the variability and commonalties in product line we use modeling in Software product line.So that SPLE is the most powerful approach to which we can use for to increase the efficiency of the software engineering process and we can develop variety of software from a single software product line, that's why if we implement low design that can ripple through many generated software systems.In this paper I represent the relationship between Orthogonal Variability model and various different qualities attributes affecting them., I will also describe some existing metrics which we use to measure these quality attributes.

Keywords *- Software Product Line, Orthogonal Variability Model, Quality, Quality attributes, Metrics*

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1.Introduction

Managing the commonalities sand variability are two major properties of Software Product Line Engineering. For this purpose we use different modeling techniques or models. In international market the developed products must be adjusted according to new conditions and legal environments, and must provide appropriate user interfaces for different languages. But due to cost and time deficiency according to conditions it is not possible for a developer to develop new product from scratch for every new customer. For this purpose we use SPLE to eliminate this type of problem. Software Product Line Engineering(SPLE) is about producing a set of similar products in a particular domain. A variability model is used for documenting the variability between products of product line. The requirement of variability can be extended with quality information, such as quality attributes**[4].**

The main focus of this paper is about the SPLE and Orthogonal Variability Models. This information contained in Section 2 and section 3.In section 4, it focuses on quality concepts and quality attributes of orthogonal variability Model. The Section 5represents quality attributes measures. Section 6 contains conclusion and future scope of work.The last section contains References.

2.Software Product Line:

"Software Product Line (SPL) is a set of software intensive systems that share a common, managed set of features to satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way"[1].SPL usually consists of two parts domain engineering and application engineering. .In domain engineering, the common software artifacts are designed and developed for reuse. In application engineering, the specific products are derived by reusing a set of the aforementioned domain artifacts [3].Application engineering is the part that help its to make use of them for the formation of product line.

3.Orthogonal Variability Model(OVM)

Orthogonal Variability model is an important approach that we use for documenting the variability in product line.In OVM, only the variability of product line is documented. In this model, variation point (VP) documents a variable item and a variant (V) documents the possible instances of a variableitem [6].Variation point identifies a particular requirement of a product line that could be different among different products of a same product line. It is denoted by VP. Variation point is represented by a triangle shape in OVM as shown in diagram below:

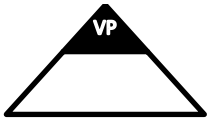

Fig :1

Variant postulates a requirement variant for a variation point which is available for particular product of product line for making the use of it. It is denoted by V.A variant

 ISSN: 2321-8169
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is represented by rectangle shape in OVM as shown in diagram below:

Fig :2

Constraint dependency is also used to documents different constraints on the selection of different variation points (VP) and variants (V).There are generally two types of constraints used in OVM like Excludes and requires.Require constraints are generally represented by dashed line with single arrow, while excludes constraints are generally represented by dashed line with double arrow. These both constraints are shown between variation points and variants.

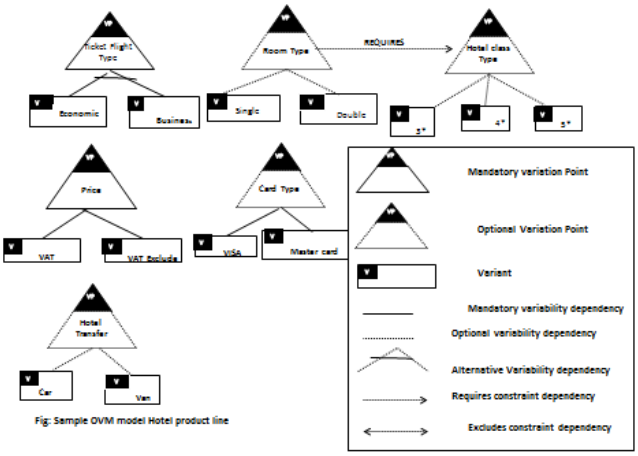

Fig:3 OVM model for Hotel Product Line

The OVM model represents the variation points and different variants of product line which have been shown by diagram of Hotel product line.

4.Different Quality Concepts

Software quality is the degree to which software possesses a desired combination of attributes [9]. In our approach, we define the quality attribute as a measureable property of an artifact. We consider only those properties that can be quantified and technically defined [4].We can classify quality attributes into two categories internal attribute and external attributes. We can measure the internal attributes on the basis of products features like size, complication, capability etc. On the other hand we can measure external quality attributes on the basis of products maintainability, efficiency, reliability etc.

Maintainability is the parameter concerned with how the system in use can be restored after a failure, while also considering concepts like preventive maintenance. That's why we can say that maintainability means the capability of the software product to be modified. Modification may include corrections or any improvements of the software according to changes in environment, and in functional specification and requirements. It can be defined in terms of its analysability, changeability, testability and reliability and readability. Analysability characterizes the ability to identify the root cause of a failure within the software. It is the capacity of the model of software product to be analysed for scarcity. Changeability characterizes the amount of effort to change a system. It is the prospect and comfort of change in product model when modifications are essential. Readability is that if the software code is adequately documented and easy to read and understand. Tailorability means the ability to enhance the services available to the end user by configuring component based software products, configuring services of multiple products etc. Much of the maintenance effort for component based systems involves tailoring the functionality to meet evolving user requirements. Tailorability is a loose term used in component-based software development to describe the ability to customize and configure components, but also to add new components to the system and combining services of multiple components in novel ways. Testability is a measure of how easy it is to create test criteria for the system and its components, and to execute these. Efficiency means checking the efficiency of product line like performance, throughput and response time etc. Reliability means how much your product is reliable. We can check its reliability according to its sub characteristics like stability, stress handling, recoverability etc.

If in a single-systems achieving quality attributes is sometimes a challenge, in software product line this challenge is complicated because there is variability on quality attribute requirements and different quality constraints are required [8]

Since external quality attribute are hard to evaluate in early phases of software development process, an indirect measurement based on internal quality attributes is devised. The reason being, that internal quality attributes are appropriate determinants for external quality attributes [2**].**

5.Measures performed on SPL Orthogonal Variability Model

A set of metrics proposed by EbrahimBagheri at al.has used following measures which are given in table 1 for

assessing the maintainability of software product line feature model.

Measure type	Measure name
Size measure	Number of Features(NF) Number of top features(NTop) No of leaf features(NLeaf)
Structural Complexity	Flexibility of changeability(FoC) Ratio of Variability(RoV) Cyclomatic complexity(CC) Cross Tree Constraints(CTC) Coefficient of Connectivity(CoC)

But from above table various values can be generated if we use same metrics in Software product line Orthogonal Variability model. But in case of Orthogonal variability model we will count Variation points (VP) and variants (V) as features but these features are related to only variability For hotel orthogonal variability model we can drive different values like NF=18 ,NTop=6 ,Nleaf=13 ,FoC=0.6 ,RoV=2.16.

6.Conclusion

As we studied the paper of many researchers, they proved that we can improve software quality by measurement. But the available metrics mostly used for to assess the quality of software product line feature models. But in future the requirements of existing metrics using for orthogonal variability model product line should me motivation for researchers for quality assess and should propose more metrics for quality assess of OVM product line.

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