Different approaches for Dynamic Requirement Engineering Process Models: Cone and Hour Glass Model

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***Abstract*—Requirements Engineering (RE)[1] refers to the process of formulating, documenting and maintaining software requirements[2] and to the subfield of software engineering concerned with this process. In requirement engineering phase we can gather the requirements from user and use this requirement for software development and produce software products that satisfy the user needs. Various models such as the waterfall model exist and they assume requirements engineering through the lifetime of a system. Even though requirements engineering has a fairly narrow goal – to determine a need and define the external behavior of a solution.[7] This paper presents various approaches to the software requirement engineering models. The different models are CONE model, W model and the HOURGLASS model.**

***Index Terms*—Software Requirements, Processes and models, feasibility.**

INTRODUCTION

Requirements Engineering[1] which is a part of software development process, also known as the software development lifecycle (SDLC), is a structure imposed on development of a software product. It is a subset of systems development lifecycle. There are several models for such processes, each describing approaches to a variety of tasks or activities that take place during the process.

Software development organizations implement process methodologies to ease the process of development. The activities include Planning, Implementation, Testing and Documenting, Deployment and Maintenance. Several models exist to streamline the development process. Each one has its pros and cons, and it is up to the development team to adopt the most appropriate one for the project.[5] Sometimes a combination of the models may be more suitable.

REQUIREMENT ENGINEERING MODELS

Requirements engineering is a process of discovering the needs of stake holders and documenting them for analysis, communication and implementation.[6] The activities involved in requirements engineering vary widely, depending on the type of system being developed and the specific practices of the organization(s) involved[3]. These include Requirements inception or Requirements elicitation, Requirements identification, Requirement analysis and negotiation, Requirements specification, System modelling, Requirements validation, Requirements management. The models proposed are Cone model, W model, Hourglass model.

A. Cone model

We use a cone (fig. 1.1) to explain the process of Requirement Engineering, making it simple and self – explanatory. We divide the cone into various layers, each layer explaining a unique process in the Requirement Engineering Process. The process flows from the innermost layer to the outermost layer and the flow of control is always between two adjacent layers. When the control is in the innermost layer it denotes that the process has just begun and when it comes to the outermost layer it denotes that the process is complete. A common strategy flows through the entire model making sure that the process always satisfies the basic organizational goal. Also a data line flowing through all the layers denotes how data can be extracted after each process and can be processed into useful information.

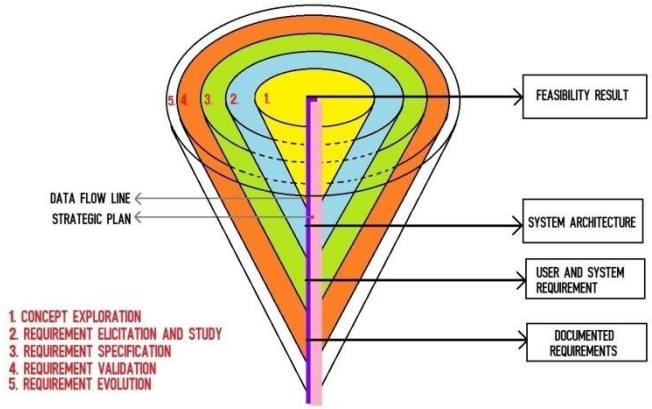

fig. 1.1 Cone model

The model is divided into 5 layers. Namely,

1) **Concept Exploration** - A study has to be carried out before starting the requirement elicitation[4] process, called Concept Exploration which gives us a brief idea about the project's feasibility.

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a. It is seen to it that the organization's missions and standards are satisfied.

b. The technology base of the organization is assessed and it is found out if the current project can be carried out or not.

c. Environment of the system where the project is to function is assessed.

d. Constraints of the organization are considered.

e. Current market trend of the organization.

f. Effectiveness of the system to be developed is estimated.

g. Trade off analysis is carried out.

2) **Requirement Elicitation and study** - Once the Concept Exploration is carried out, the Elicitation and Study of Requirements is done. The requirements are collected from the user by various methods which include methods like Interviewing, use of system models etc. Once the requirements are collected, the requirements for other general things like stakeholders of the system to be developed, User Interface required are collected. They are further classified and organized in coherent groups. Prioritization of requirements can also be done for implementation methods like incremental delivery. As all requirements of the user cannot be satisfied, negotiation of requirements takes place between the customer and the vendor. After the final set of requirements become available with the developer, the outline of the system is designed called system architecture.

3) **Requirement Specification** - After fetching the requirements from the user, the user and system requirements are described considering the capacity of the system and its components. Many factors affect the design of the user and system requirements like the domain of the software to be developed, the components required, the product line requirement, the business requirement etc. Once these requirements have been designed, they are further documented for the Validation Process.

4) **Requirement Validation -** A final check is done on the designed requirements for the system, by carrying out various tests using Test Cases or Scenarios.[5] If the requirements are not valid that is if any defect is detected the process is pushed back again to the previous layers for modification and improvisation. For the validation process along with the requirement documentation, the organizational knowledge and knowing the organizational standards is also important. A prototype is also developed to give and overview of the requirements being imposed or implemented in the proposed system.

5) **Requirement Evolution -** Requirements of the customer may change or evolve throughout the phase of the system's development especially during process like incremental delivery, where the project's requirements are divided into small increments, the Requirement Evolution comes into the picture. The proposed changes are checked if they are in the scope of the project, if they are, the requirements are prioritized again and the changes are incorporated. If they aren't the demands are compromised and the documents and updated.

B. The W Model

The W Model (as in fig. 1.2) as the name suggests is built on the design of the letter 'W'. The model is divided into 3 levels. Level -1, Level 0 and Level 1. The Level 0 being the Controlling layer from where the entire process is controlled. It binds around the Company principles and strategic plan of the project. The Level 1 contains the pre and post processes. Namely, the feasibility study which talks about the practicality of the project and the validation and maintenance which takes care about the evolution of the requirements. At Level -1 the main process of requirement elicitation[4] and requirement specification takes place. The negotiation takes place and finally the requirements are classified into user and system requirements. Thus, the main feature of this model is that it classifies the sub processes of Requirement Engineering into various levels and helps us in understanding[8] how the process is to be monitored continuously so that the aim of the project is fulfilled effectively without deviating from the initially drawn plan.

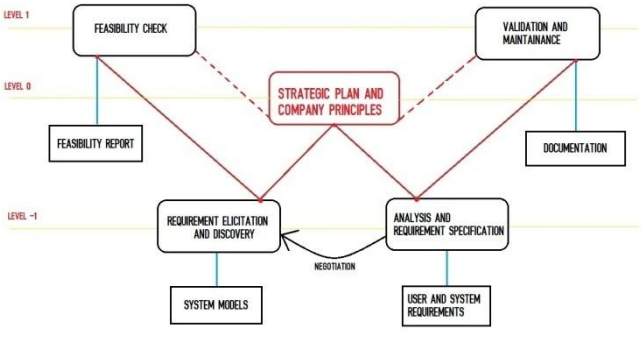
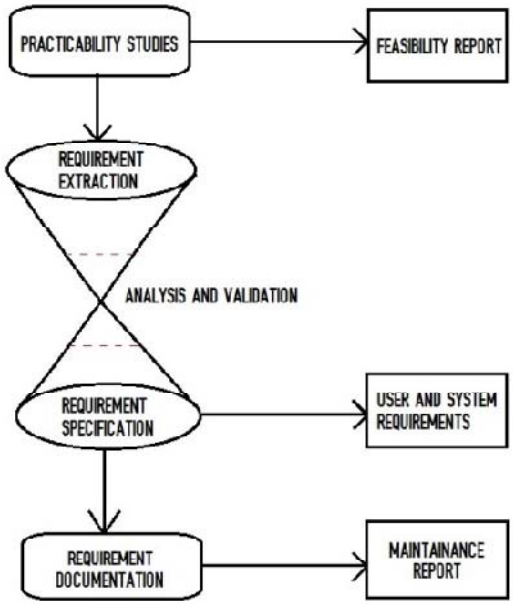


fig. 1.2 W model

c. Hourglass Model

The Hourglass Model mainly shows us how the refinement of the requirements takes place through the Requirement Elicitation [4] phase to the Requirement Specification phase. As all requirements cannot be satisfied, this model shows us how the Analysis and Validation phase takes user requirements and how only the requirements which are feasible and which can be fulfilled by the system are negotiated and are designed and documented into user and system requirements. The prime focus here is the phase

of Analysis and Validation where main focus is given so that the right requirements are picked for better system development.



HOUR GLASS MODEL

fig. 1.3 Hourglass model

CONCLUSION

Several models exist to streamline the development process. Each one has its pros and cons, and it is up to the development team to adopt the most appropriate one for the project. Sometimes a combination of the models may be more suitable. The above model proposes new techniques that can be used in software development.

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