



A New Approach in Software Development: Workflow Model

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Abstract: A workflow management system is a method to define, create and manage the order of execution in software development process. The software development process is one of the major factors for the successful development of any software. In practice, three different approaches have been used by the professionals for development of robust software. The purpose of the current study is to propose a new workflow model which describes what task have to be done and in what order to develop software based on hybrid approach. The hybrid approach of software development may include Top-Down, Bottom-Up, and Prototyping Methodologies. Workflow architecture is also discussed in this paper. The paper analyses processes and models from the perspective of their distinct advantages, disadvantages and suitability for different needs.

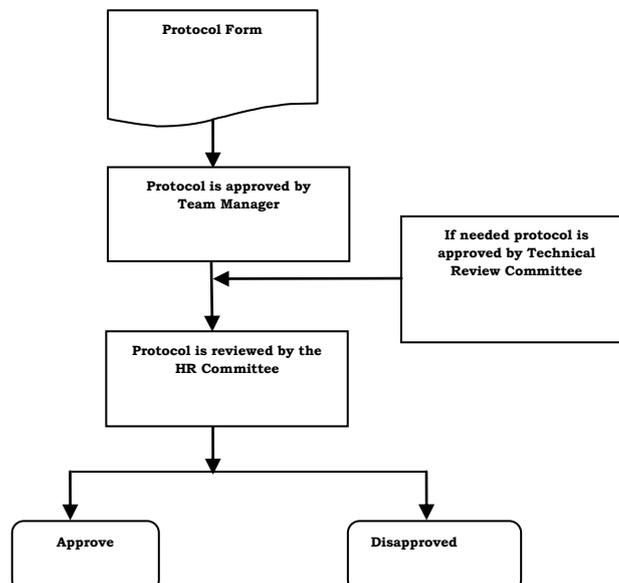
Keywords:-Workflow Model, Workflow Architecture, Workflow Application Development, Waterfall Model, Workflow Modelling Tools.

I. INTRODUCTION:

Workflow model is a young technique used in mission critical applications. It is particularly effective in large, complex applications, where work is distributed among different people located at different geographical area. Workflow model may be viewed as one of the primitive building block of any organization. It is helpful to provide interaction between human and machine by coordinating task between people and systems. The goal of interaction is to improve organizational efficiency, responsiveness and profitability. It makes processes more efficient by ensuring that every process step is clearly defined, monitored over the time and optimized to gain the maximum productivity. When an organization developed software in a distributed manner, then an efficient management of flow of work is required. The main task of workflow management in the software development is to manage different people or different group of people and establish coordination among them. The different tasks may be summarized as- planning and modelling of development process, resource allocation and monitoring control over flow of work and backup plan

II. WORKING PROCESS OF WORKFLOW MODEL:

In computer programming, workflow is an automatic tool to define human to machine interface so that overall process can be monitor. The main components of any workflow model are people, machine and task. The model is proposed to provide communication between these components. The communication is defined in terms of protocol which may vary according to task and organization. In general criteria is defined a communication protocol is described in the following diagram:



The process for communication protocol is started with filling up a simple protocol form which is submitted to the Team Manager(TM). After review of the proposed Protocol Form, the TM forwards the Protocol Form to the technical review committee. The technical committee passes the Protocol Form with appropriate comments to the human resource management committee for further approval.

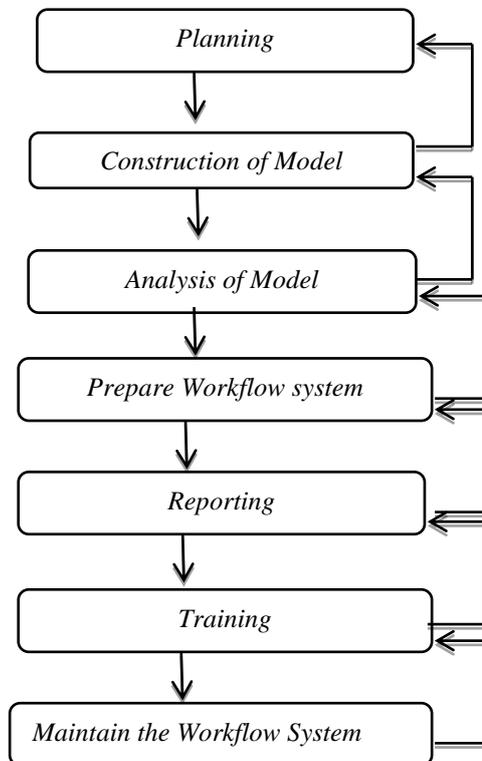
The above framework defines workflow into different levels according to complexity, flexibility and purpose. In workflow model, different categories of workflow are represented by sequential flow, state machine workflow, rules driven workflow, production and administrative workflow. These categories of workflow model are suitable for different types of situations like sequential workflow [1] is a traditional flow chart which represents progress from one stage to next stage and does not step back. Similarly, state machine workflow model [2] represents progress in both directions between two states. The rule driven workflow [3] represents sequential flow based on certain conditions called rules. It is also called conditional workflow model. In case of production and administrative workflow [4] models, high structured programming activities are modelled to automate development cycle.

III. PROPOSED WORKFLOW MODEL:

The proposed model is based on hybrid approach [5-6] of software engineering in which basic construct/features of *top down Approach*, *bottom up approach* and *prototyping approach* are incorporated.

The proposed model is developed to meet the current requirements of software development and also overcome the limitations of previous developed models.

Methodologies: The development methodologies of workflow model are based on seven steps of software development. The seven step process of workflow model which includes features of three software development approaches is demonstrated in the figure below:



1. *Planning:* Planning phase defines overall requirement of the software which includes information gathering, defining objectives and planning to meet the requirements of the user.
2. *Construction of Model:* The model is constructed by the experts based on historical data of the organization. Constructed model is referred back to the planning phase to compare the suitability according to the requirements.
3. *Analysis of the Model:* The constructed model is simulated with hundreds of alternative configurations and analyzes the outcomes. If the model is failed in analysis phase, then it rolled back to the previous phase.
4. *Prepare Workflow System:* After analysing the data, suitable workflow system is prepared to implement the constructed model and monitor the workflow. If the prepared workflow system is not working as per the requirement, then analysis phase should be conducted again to overcome the problem.
5. *Reporting:* The reporting phase includes the performance based on parameters of interest and suggests changes to improve efficiency. If there is a need to improve the software in reporting phase, then workflow model can be reconstructed to improve the efficiency in reporting phase.
6. *Training:* The proposed system passes through training phase in which a prototype system is provided to the staff to check real time performance of the system. The performance of the prototype is evaluated and report is send back to the reporting phase.

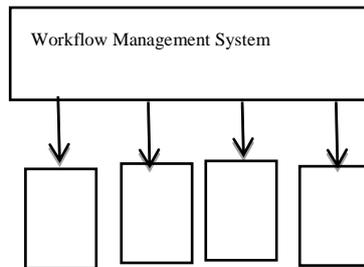
7. *Maintain the Workflow System:* The final product is deployed to the customer and working is evaluated at real time environment. The maintenance is carried out through regular checkups and a log file is maintained. The log file is forward back to training phase after a regular interval.

Activity diagrams for modelling workflows:

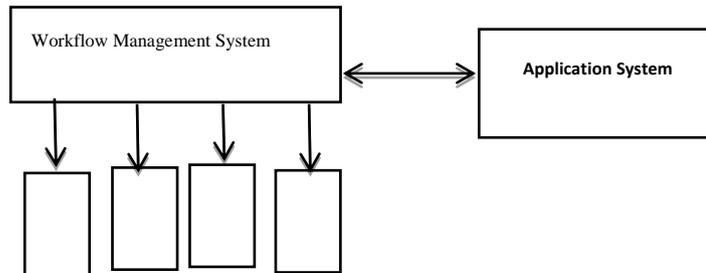
The activity diagrams are used as basic constructs to represents the working of above seven steps. The major constructs [9] for workflow modelling are sequence, parallel path, horizontal path, iterative path. The different types of flows are used to represent single workflow management system, single workflow management system with horizontal workflow, multiple workflow management system with horizontal and vertical workflow.

The following diagram shows different types of workflow management system.

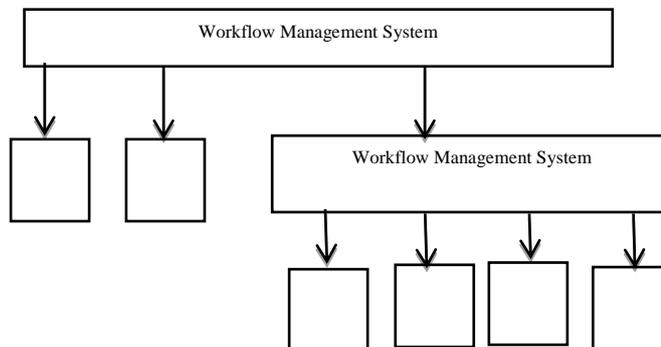
a). *Single Workflow Management System*



b). *Single Workflow Management System with Horizontal*



c). *Multiple Workflow Management System*



d). *Multiple Workflow Management System with Horizontal*

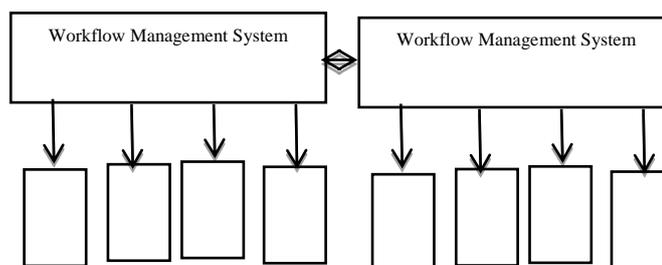


Fig.3 Workflow Architecture

IV. ACITIVITY DIAGRAMS:

The activity diagram constructs are start, end, fork, task, results, and language, actor, and decision, backward and forward arrows. The constructs are shown below:

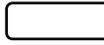
| | | | |
|-----------|---|--------------|--|
| Forward |  | Back-forward |  |
| Start |  | Task |  |
| Result(s) |  | Decision |  |
| Actor(s) |  | End |  |
| Forward |  | Back-forward |  |

Fig.4 Activity diagram Constructs

The activity diagram can be mapped to workflow model to represent different task and flow of work. The following activity diagram shows different actions performed by different actors to accomplish a common task.

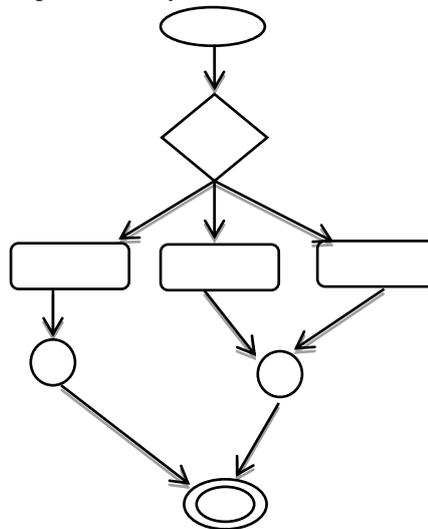


Fig.5 An example of activity diagram

As we can observe in the above diagram, in the activity diagram process start with decision making and different task are classified and assigned to the different actors. After completion of the assigned work, results are assembled to reach at the end point.

In this paper, the activity diagrams are mapped to represent model of seven stage hybrid approach. The following workflow model mapped by activity diagram is demonstrated as:

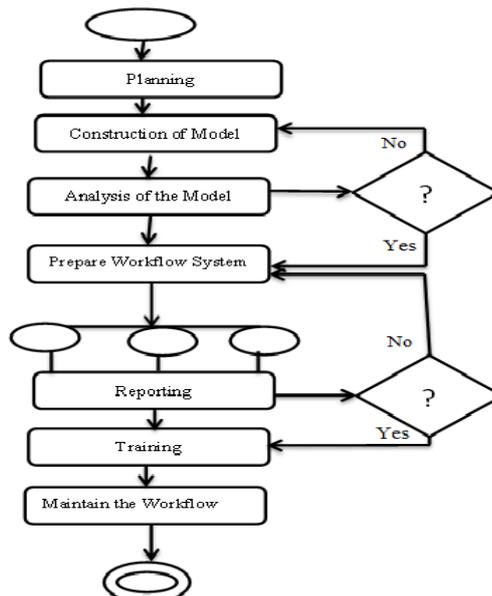


Fig. 6 Proposed Workflow Model Approach

The above activity diagram shows new concept of workflow in development of software by using hybrid approach. The hybrid approach incorporates three basic methodologies i.e. top down, bottom up and prototyping. As we can see in fig. 6, the execution flow is based upon decision making which is a primary characteristic of prototyping model. It also overcomes the limitations of waterfall model as the proposed model has provision to move in both directions. The overall process starts with planning phase in which user requirements are collected and analysed. In the next phase, overall model is constructed according to the requirements and forwarded for analysis phase. In the analysis phase, proposed model is analysed and prepare the workflow system. In workflow system, task is divided into sub tasks and assigned to multiple actors.

Results are collected from multiple actors and prepare a progress report which is further analysed according to the task assigned. After successful reporting, training phase is conducted to check the suitability of the workflow model. The maintenance phase is on going process for the successful software development.

The present study also explores merits of proposed model after detailed theoretical analysis with waterfall model, spiral model and prototyping model. The following variables are used for comparison:

- i. Workflow Management: Workflow model is a process of transferring the information, documents and tasks between people or employee and improve organization's efficiency and profitability. Every employee executes his task according to the predefined procedure. In this model, every task is efficiently divided between employees.
- ii. Networks: Data can move from one desk to another desk quickly. Workflow model operates on LANs which can link employees working on different locations for common task.
- iii. Database: Centralized information database is maintained to keep track different events happening in Workflow model. Stored information can be analysed to upgrade workflow model.
- iv. User Interface: A common interface is provided for communication among different employees working through workflow model.
- v. Tracking Performance: The workflow model analyses the issues raged during working process and provides means to keep track performance of the workflow model.
- vi. Automatic Improvement Measures: It provides an automatic system to keep track the efficiency of each employee so that quality of final product/service can be measured.
- vii. Utilization of Resources/Services: The main responsibility of workflow model is to maintain chain of workflow/services and utilize ideal services or resources. This will reduce ideal time costs in development of any product/service.

V. CONCLUSION:

In the present paper, we have proposed a workflow model for software development which is based on three different well known techniques of software engineering. We have also mapped activity diagrams to the proposed workflow model to demonstrate the implications of the model. A detailed analysis has been conducted to compare the proposed model with waterfall model, spiral model and prototyping model.

VI. FUTURE WORK:

The proposed model is a conceptual model which is required to be implemented in a computer system. The automation of the system provides a graphical user interface to the manager so that workflow process can be easily implemented on the system. The user interface should provide facility to draw different constructs and methods to check the connectivity and flow. We have so far mentioned general language, but we recommend professional general purpose language like *Petrinet* etc.

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