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Workflow enabled data processing in a concurrent engineering environment

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Abstract

Knowledge, information and data hold the key for growth and continuous sustenance in any organization. However, flow of this information and data across inter disciplinary departments to authorized personnel ensures the authencity and accuracy of this data while in transit. Workflow can be devised as a tool used purely in electronic data processing environment where data is to be transmitted across heterogeneous departments handled by personnel belonging to diverse engineering backgrounds. This proves itself to have a catalytic effect in product oriented, process oriented and data processing modes of working in an industry through its pre-set rules, procedures and flexible modes of operation. Further, the same workflow methodology can be used in web based applications which only requires installation of the particular tool in server machine, thus providing the freedom from independent client installations. Enhancing the operational ability of workflow can provide information on the approximate time taken for data processing in various inter-disciplinary departments involving process oriented, product oriented and data processing modes of working.

Keywords – Concurrent Engineering; Data Processing; Workflow Management

1. Introduction

Workflow management can be defined as a semi-automated system that effectively communicates, coordinates and controls the information through identified modules and pre-set routes to reach identified resources with least human intervention. It can be mentioned that the success of a workflow system can be attributed to its efficiency in effectively monitoring the processes and systems of an organization where the knowledge sharing environment is distributed, heterogeneous and only partially automated.

1.1 Workflow Design

A workflow is represented as colored, directed graph connected by nodes and arcs which in most cases is acyclic. It encompasses of both conditional and non-conditional activities which are represented by nodes and the dataflow between them represented by arcs preceded by a start and terminated by an end condition. Schematic representation of a preliminary workflow design is shown in Figure-1.
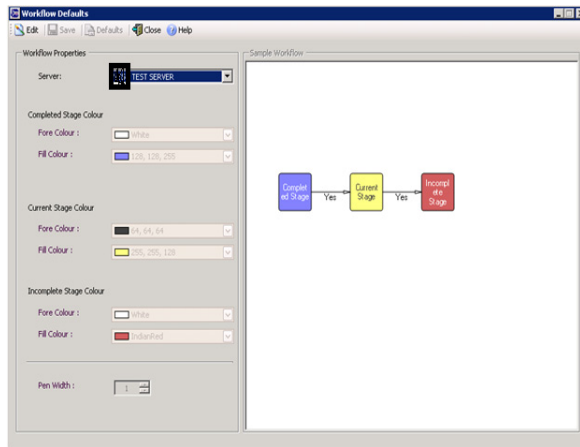
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Figure-1.

1.2 Types of workflow

Typically, a workflow can be defined as Automated and Manual. In an automated workflow, the order of execution of activities is pre-defined with tasks, roles, rules and responsibilities well set in advance. In the case of a manual workflow, the stage resources for the succeeding stages can be selected at random. In both cases, when a particular activity or process is completed, the identified users shall receive mails and the execution of actions is automatically routed to successive stage.

1.3 Workflow Operation

The workflow distinguishes independent work activities into properly defined tasks with identified roles, procedures and pre-set rules which map the working methodology in any organization. Workflow by its pre-set rules will prompt a user to initiate the tasks, reviewer to evaluate it, and the final resource to mention the status of work completion with auto-generated mail setting for default mail intimations. In this process, knowledge which is the innate ingredient of an organization gets managed, shared, transferred and routed with full authentication.

2. Operation of Workflow in various functional modules of a concurrent tool

Workflow disseminates underlying or process in process, product, change management, drawing and document management. In a process oriented mode of working, workflow disperses activities into various related tasks with identified resources and weight age factor being assigned to each stage thereby giving a view of status of work completion. In a product oriented mode, it showcases the status of parts as work-in progress or released based on its present status of life cycle. In a change processing environment, workflow takes the process or document through the entire phase of change management which starts with initiation of change, change approval, version management, change notes and finally revision management. Last, workflow aids as a route map in document and drawing management starting with creation, approval, check-in / check-out operations, updating version history and finally releasing to vault.

### 2.1 Work operations in a Process oriented mode

The key concept of process oriented data management lies in tasks and relationships. This involves sequential mode of product realization where the activities are broken down into number of task with interconnections in terms of initiation and completion. The core of the operation is the Work Break down Structure (WBS) and its interdependency which involves task definition, task assignment, task execution, task monitoring along with task re-scheduling and re-assignment. Representation of a process operation with tasks and subtasks legends depicting various operational milestones like completed, scheduled and work in progress is shown in Figure-2.

Figure-2

2.2 Workflow operations in product realisation

Product realisation is an evolving process which is characterised by creativity and uncertainty. It is an evolutionary process which starts with identifying the major components and systems that will combine to form the desired product. Here, the core element is the part. A part could be defined as any physical item which can either be manufactured or procured from a vendor as components, sub-assemblies or assemblies or even as a finished product identified by a unique number. The combination of parts essentially builds up a Sub-Assembly which in turn is combined to form a final assembly. During the course of its metamorphism to a sub-assembly or an assembly lies the life cycle of a part. A typical life cycle of the part is shown below.

| CREATE | — | APPROVE | — | RELEASE | — | REVISE |
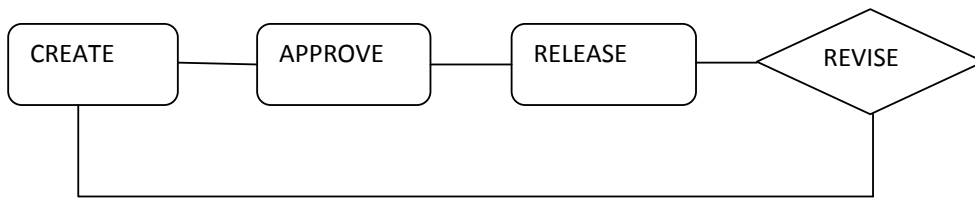
2.2.1 Bill of Material

Bill of Material defines the final set of parts or components arranged in a specific hierarchy which denotes the final assembly. Various operations incorporated on the Bill of Material by workflow include the Completion of BOM and Release of BOM.

2.3 Workflow Operations in Document Management

Workflow management provides authorized personnel with a provision for secure, collaborative and concurrent environment to create, capture, review, manage and complete documents from its work-in progress status to release. A typical document management status depicted by workflow is shown in Figure-3.
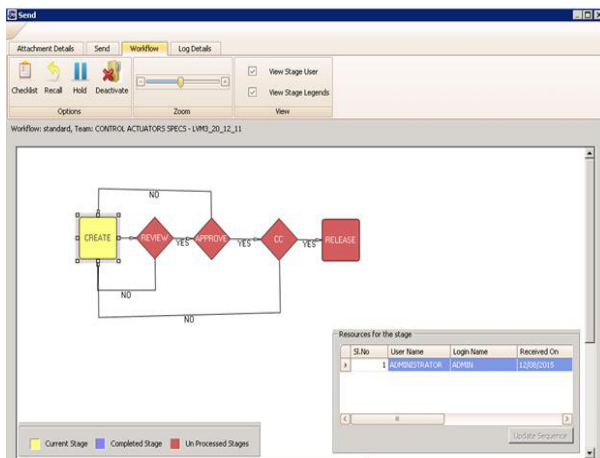

Figure-3

2.2 Workflow in Change Management Process

Change Management is one area where Workflow can be incorporated for raising changes, include comments for change, involve change management board, version control, include comments from members, approve change, incorporate the changes in the new version and finally update to the latest revision. Incorporating change management with detailed board involves change initiation by an authorized user. The selected document must be in released status and the user needs to have revise rights for the selected category. The revision history maintains the changes made during its revision. Adding, deleting and modifying of items are recorded in revision history. The user can also print or export the revision history details to excel. The revision management shall be fully recorded

with the changes being made, consolidated comments and amalgamating the suggested changes. A typical change management process is shown below.
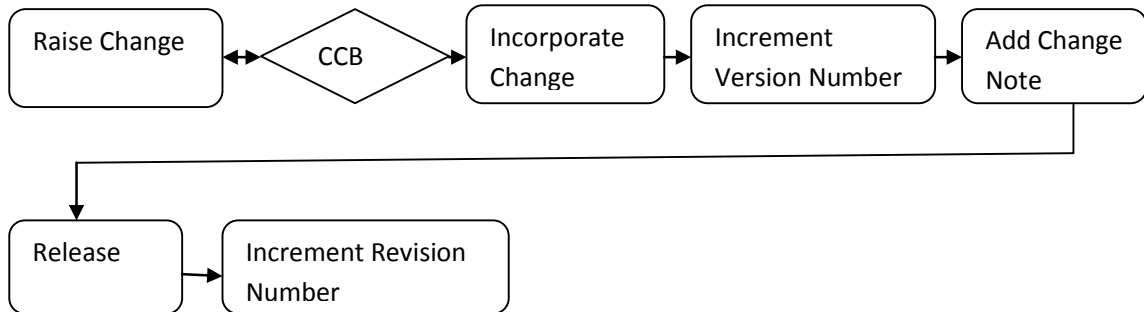
2.3 Security aspects of workflow management

Workflow also enables several kinds of data handling security mechanisms. Access rights to different users on each stage can be set. There are basis level of access to files, such as reading, writing, deleting, execution and view. They are usually different for each category of users. Users are divided into groups, defined by same priorities, which makes maintenance easier. Automated procedures of documents flow and their approvals as well as procedures in case of a change can contribute significantly to time efficiency. Screens incorporating security aspects in workflow are shown in Figure-4.
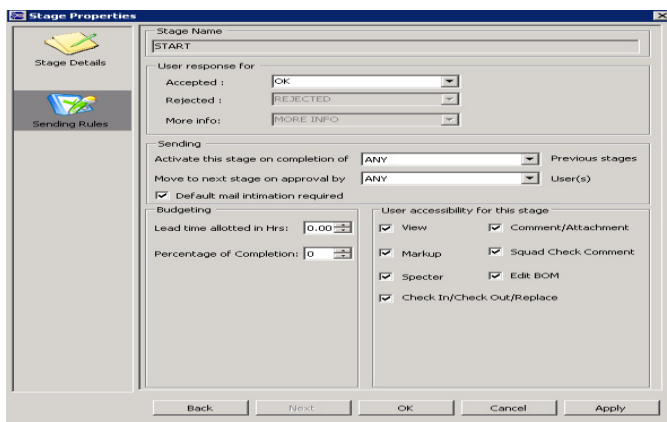

Figure-4.

2.4 Workflow in facilitating Search

Workflow enables the retrieval process which allows search results to be routed to desired recipients. Simple retrieval of search parameters can be supported by allowing the user to specify the unique identifier, and having the

system use the basic index parameter. The intended results can then be routed to recipient's workspace with pre-defined mail settings.

2.5   Workflow in web based applications

As more and more companies are relying on the web for data transactions, it has become obligatory to consider data transmission through internet and its underlying protocols for a safe and secure data transmission. However, the web installation of a concurrent engineering tool doesn't demand any additional software installation at client computers. Instead, only updates need to execute at server machines. In this manner, default workflow operations can be performed without any hassle.

2.6   Custom properties in workflow design

Every workflow will have default settings assigned to it, which can provide inputs at every stage of it. This includes weight age factor set on each individual stage, provision to recall the initiated actions, provision to hold the data transmission at the current stage for want of more data / clarification and checklist provision to confirm the mandatory documents / checks to be confirmed before proceeding to the succeeding stage. A screen of the custom properties of workflow from the concurrent tool is shown in Figure – 5.
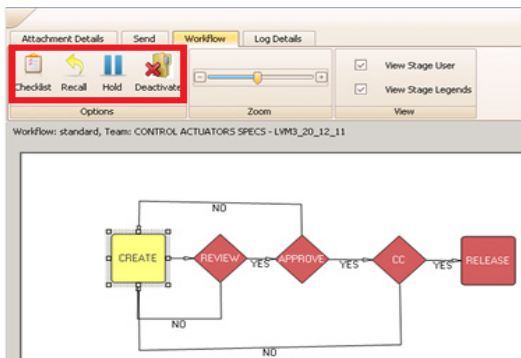

Figure-5

3   Technology paradigm - Concurrent Engineering

A collaborative scientific workflow paradigm allows participating users to design and compose common scientific workflows in concurrent mode. Concurrency control has become the major challenge to enhance collaborative scientific workflow composition, which aims to facilitate collaboration thus ensuring correctness and consistency of the generated results. This advanced technology has enabled companies to achieve correctness and consistency in data processing operations thereby achieve a lead in quality and delivery of products to market which eventually receives utmost customer satisfaction. A schematic representation of the advantage gained through concurrent engineering practice is depicted below in comparison to the traditional mode.
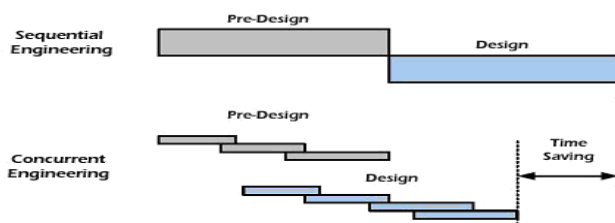
4   Software used for Study – WRENCH Enterprise PLM

The software used for this study is WRENCH Enterprise PLM. This is a flagship product by M/s. WRENCH Solutions (P) Ltd. (www.wrenchglobal.com). This company is into providing customized information technology solutions to EPC and CPD companies throughout the globe.

5   Scope of further study and advancement in Workflow Management

Workflow management can give a precise idea of the approximate time consumed by each operation for its successive completion. For an organization where process and product oriented activities occur in random, this data can give a clear picture of the time consumed for every operation. This can provide valuable insight into the lead times that has to be set for every operation and will demonstrate the bottlenecks that can come up. Further, when a new process activity or product oriented activity is created from an existing one

6   Conclusion

In any industry, ability to effectively disseminate information and data holds the key for development and sustenance. Achieving this involves understanding of basic data flow in an organization and data traverse modes. Workflow can be defined as a tool which can facilitate processing of information across inter-disciplinary departments in concurrent manner. Through the successful implementation methodology being carried out in a concurrent engineering tool, its efficiency could be estimated in process oriented, product oriented and data processing activities. To sum up, it can be mentioned that workflow management can spearhead the concurrent engineering activities being implemented in any organization.

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