

## An Ontological Approach for Product Data Management through workflow A Case Study Approach

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### ABSTRACT

Mother Nature's blunt and brutal punishment on neglecting or taking for granted her incomparable and exhaustive recourses by either destroying or excessively damaging it. When we make mistakes there should be a person who corrects us in the context of what spoken it is the wrath of Mother Nature to be dealt with. Natural disasters are not of the past but more of the future with regularly occurring phenomenon's or occurrences which need to be dealt with utmost care and top of priority in list or else existence of human race will be on the brink. The need of hour is one discussed as the basic theme of this paper and being equipped with all possible ways to prevent an exodus of human grave. This paper emphasizes on creating various classes and subclasses and build properties and operations on these classes of which some of the properties which would exactly differ on its functionality aspect of the ones actually intended to be. The behavioral changes would be reflected if there is execution of certain behavioral traits in an object which is well evident from the original one. The classes and subclasses and various other attributes and values will be designed using protégé tool. And later relevant DL queries can also be applied over it to observe any from any changes exhibited by objects of each class.

**Keywords:** Semantic, Ontology, RDF, Natural Disaster, Class, behaviors..

### INTRODUCTION

In any industry knowledge is the vital factor that can lead it towards greater heights and managing this knowledge becomes the key element for sustenance and development [2,4,5]. To attain this state, organization should understand how this data and information is being assimilated and proliferated across various departments. In this regard, workflow management has a significant role in disbursing vital information across departments, to the right person through pre-defined settings [7]. 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. Eventually, it can be mentioned that 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 [1,10].

### Workflow Design

A workflow is generally represented as colored, directed graph connected by nodes and arcs which in most cases is acyclic. It encompasses both conditional and non-conditional activities which are represented by nodes and the dataflow between them represented by arcs. Workflow can either be simple or complex [2, 8]. While a simple workflow has very limited number of nodes, a complex workflow design contains many split up of processes represented by nested nodes. Essentially, a workflow

consists of a start and end condition. Start condition describes which activity is ready for execution in terms of order of initiation while the exit condition describes its successful completion. The order of execution and looping of the activities are decided by connectors which takes binary conditions of Yes or No to facilitate the flow [6, 11]. Schematic representation of a preliminary workflow design is shown in Figure-1.

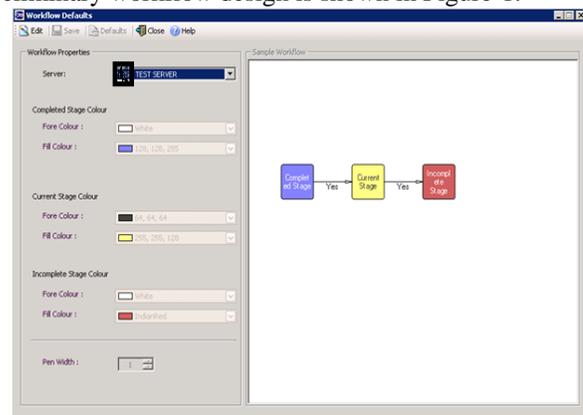


Figure-1- Workflow Design

### Types of workflow

Typically, a workflow can be classified 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. 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 [7, 10]. In the case of a manual workflow, the stage resources for the succeeding stages can be selected at random. Finally when the activity is over, it can be closed by the last resource and completed for that particular operation. However, automated workflow aids to speed up the organizations response time and improves organizational efficiency in terms of minimizing lean time with value added delivery to recipients [13].

### 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. Major processes in any organization can be categorized as material process, data processing and information processing. 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. This mail notification can even be set to personal, official or business mails [7,10]. In this process, knowledge which is the innate ingredient of an organization gets managed, shared, transferred and routed with full authentication. In this way, workflow catalyses an intangible, illusionary concept to a very vital organizational asset [1, 3].

### Operation of Workflow in various functional modules of a concurrent tool

In any functional module of an existing concurrent engineering tool, a workflow disseminates work or process into properly defined task, with assigned roles thereby regulating most of the work or operation in any organization [1]. Even though the prima facie operations of workflow seem to be same, the sublime effect it has on different modules of any tools varies according to the nature of operations being carried out. 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. Finally when this primary element gets merged to the culminating assembly, both status

of part and the total assembly can be understood. 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 [3,4,6]. 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. Workflow also becomes a facilitator in search operations when the desired search result can be routed to identify recipients with default messages [5,7].

### 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 [4, 5, 6]. This is followed by co-ordination which involves task monitoring, work initiation, auto-generation of reminders and forwarding. Ultimate aim here is to integrate the product realization operation embedded with task management and utilize the workflow technique to control and monitor the task management process. In case of unpredictability in operational sequences, manual workflow can be used which can be changed according to needs. A change should be made possible in the pre-defined sequence with flexibility to change both the schedules, documents and resources [7]. An overview of individual documents should be provided on each stage of workflow so that identified resources can access to the right documents in appropriate stages of workflow. In addition, there should be linkage to all related documents in each task of the WBS which facilitates easy decision making. Representation of a process operation with tasks subtasks and legends depicting various operational milestones like completed, scheduled and work in progress is shown in Figure-2.

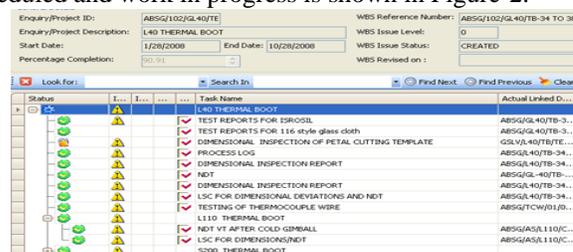


Figure-2 Task Management with Legends

### Workflow operations in product realization

Product realization is an evolving process which is characterized 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. This involves core factors such as user specifications, product design specifications, reverse engineering aspects, drawings and documents pertaining to each part and product as a whole. The ultimate aim is here to involve design aspects with the product realization sequences. Using workflow technique, the design status and part / product status can be amalgamated. 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[5,8]. 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 in Figure-3



Figure-3. Life Cycle of a Part

Here, workflow essentially acts as a path for the part towards its final realization as a released part from the work-in-progress status. It allows for the creation and re-use of unlimited number of parts and assemblies to provide for many different variants from a basic structure.

**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 [1, 2]. Completion of BOM includes identifying the items to be added to the product hierarchy, routing the structure through a workflow and bringing the status to ‘work completed’. Release of BOM involves finalizing the Product hierarchy for productionisation after completion.

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. This simplifies organizational procedures, document routing and email notification thereby providing more efficient distribution and control of information, files and records in an organization [11,12]. This expedites business processes by allowing instant access to information, greater collaboration within and among departments, enhanced security for files and records and application of procedures. A typical document management status depicted by workflow is shown in Figure-4.

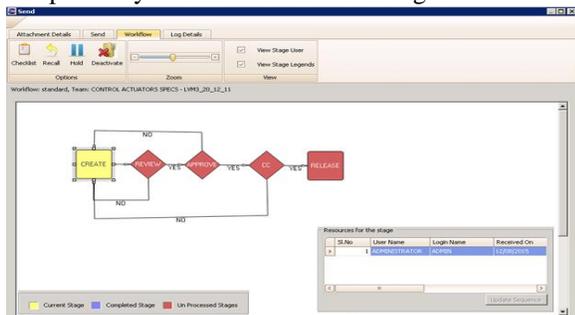


Figure-4. Document Status in workflow

For a concurrent engineering tool, it can be customary that document management is integrated with all other modules, so that users can retrieve existing documents directly from document management system repository, make changes, and save the changed document properly vaulted without leaving the parent application.

**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. This can even be done in two ways, one including an

elaborative change management process involving a board for change, and a fast track mode of incorporating changes. Incorporating change management with detailed board involves change initiation by an authorized user. The user may enter the request details in CR Request [7, 8]. 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. In contrast to board routing, change management in fast track mode involves change initiation by an authorized user and on approval of the same by the next person in the hierarchy, can be routed through a workflow for incorporating changes. 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 in Figure-5.

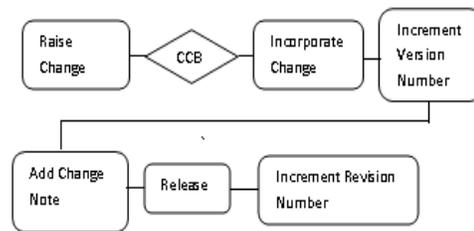


Figure-5- Change Management Workflow

**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 [2, 5]. Access to data is adapted to each user’s role. 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-6.

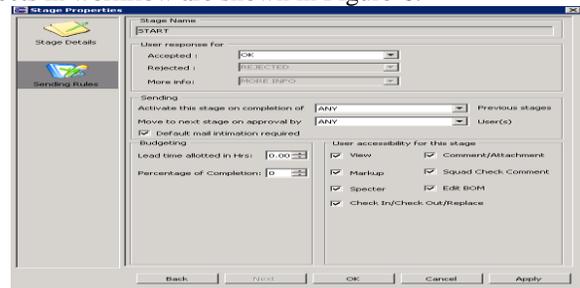


Figure-6 - Security Aspects in Workflow

**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 [1, 7]. Retrieval allows user to specify partial search terms involving identifiers pertaining to documents, tasks or parts and would return results matching the

search criteria. The intended results can then be routed to recipient's workspace with pre-defined mail settings [1, 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. Ensuring safe and secure data transmission can be facilitated by means of encryption and decryption tools at senders and receivers end. In this manner, default workflow operations can be performed without any hassle [11, 13].

### 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 [6, 8]. A screen of the custom properties of workflow from the concurrent tool is shown in Figure – 7.

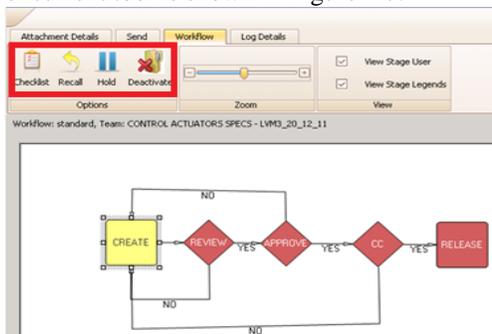


Figure-7. Custom Properties of Workflow

### Disaster recovery and mitigation plans in information explosion

The cutting edge of a technology in a particular domain depends on its ability to successfully foresee the advancements that can occur in its domain and how its existing technology can be credited without drain. This requires innate understanding of the developments it has made over the years and how this can be preserved for futuristic applications. Any lack of understanding in any of its core technology should be sorted out without delay. An innate methodology that can be inhibited to achieve this brainstorming will be an electronic workflow, which can successfully transfer information through preset channels and get valuable information which can be vaulted and extracted for future reference. Technological disasters and tragedies occurred in the world can be attributed to its in-efficiency in coping with the challenge that it is posed before in a totally unexpected fashion. A proper channel of data and information flow can be taken as a roadmap for conducting a postmortem analysis in event of a technological disaster. Some of the technological tragedies of the world include the following [12].

- ❖ The near break-out of a Nuclear World War III (1983) – It was attributed to as a result of a software bug in the Soviet early warning system.
  - ❖ The AT&T network collapse (1990) - In 1990, an error in single line of code caused 75 million phone calls across the U.S. to go unanswered after a single switch at one of AT&T's 114 switching centers suffered a minor mechanical problem and shut down the center. When the center came back up soon afterwards, it sent a message to other centers, which in turn caused them to trip, shut down and reset.
  - ❖ Airbus A380 suffers from incompatible software issues (2006) – This occurred due to a software problem occurred in the CATIA software which was used to design and assemble world's largest aircraft.
  - ❖ Mars Climate Observer metric problem (1998) – Through navigation error, two spacecraft, the Mars Climate Orbiter and the Mars Polar Lander, caused the lander to fly too low in the atmosphere and it was destroyed.
  - ❖ EDS and the Child Support Agency (2004) – This led to destruction of the U.K.'s Child Support Agency (CSA) and cost the taxpayer over a billion pounds.
  - ❖ The two-digit year-2000 problem (1999/2000) – This was an unwanted worry that the millennium bug would crash the computer systems and unnecessarily wasted billions of amount spent out of fear.
  - ❖ When the laptops exploded (2006) - The bursting of a Dell laptop at a trade fair in Japan was attributed to an issue with the battery/power supply on the individual laptop that had overheated and caught fire.
  - ❖ Siemens and the passport system (1999) – This occurred as the passport agency deployed a new Siemens computer system without sufficiently testing it and training staff first.
  - ❖ LA Airport flights grounded (2007) - Some 17,000 planes were grounded at Los Angeles International Airport earlier this year because of a software problem which attributed to a cause of low, inexpensive equipment.
  - ❖ The explosion of the Ariane 5 (1996) - In 1996, Europe's newest and unmanned satellite-launching rocket, the Ariane 5, was intentionally blown up just seconds after taking off on its maiden flight from Kourou, French Guiana. The European Space Agency estimated that total development of Ariane 5 cost more than \$8bn (£4bn). On board Ariane 5 was a \$500 million (£240 million) set of four scientific satellites created to study how the Earth's magnetic field interacts with Solar Winds.
- 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](http://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.

## 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 concurrently. 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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