

Client side customization of Product Lifecycle Management

¹Borul Sawan Sakharam, ²Mule Jaykumar Yoga

Abstract— This paper proposes a novel methodology of PLM system. According to industry need created new application in Teamcenter to capture the product information beyond product development according to various attributes of items which is fundamental objects used to manage the information in Teamcenter. The novel methods systematically search the database according to attributes of items and represent the result in graphical view. The administrator easily analyzes the data which save the time of data collection from cross functional teams. The output of these results is taken into reporting file format i.e. Excel sheet which is used to transfer the information to reporting tools. A case study is conducted of industry which manufactures different types of products to verify the feasibility of our method.

Keypoint— Teamcenter Customization, Customization Methodology, Case Study

1 INTRODUCTION

In this paper propose a novel methodology of a manufacturing industry which manufactures different types of products according to industry need created new application in TC engineering to capture the product information beyond product development according to various attributes of items which is fundamental objects used to manage the information in Teamcenter engineering. The administrator or analyst of the organization requires the information of work performed in the organization for different time period. So that they collect the required information from various department of the organization and analyze this data according to various attributes of items. This a time consuming process and increases the data handling and work of administrator. [1, 2]

All these facts revealed that customize the Teamcenter engineering software to fulfill their requirement and capture the product information from database of software. "Customization of TC engineering by developing an application and linking with database for data analysis and plot the results in graphical representation and generate customized output in excel sheet format."

2 TEAMCENTER CUSTOMIZATION

2.1 Need

Nowadays, PLM is becoming more important as to satisfy the diverse needs of every company to produce excellent product and higher product quality, lower cost in manufacturing process and fulfillment of customers' [3] requirements for the evaluation of work, see the status of the work, audits of objects or capture the product information beyond product development, the administrator or analyst of the organization requires the information of work performed in the organization for different time period. So that they collect the required information from various department of the organization and analyze this data according to various attributes of items. This a time consuming process and increases the data handling and work of administrator. [4]

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2.2 Objective

The objectives of this paper is to review

- Create new Application, for adding and customizing the toolbar, menu bar in applications by using Java API.
- Develop the new portal application in the AIF for data analysis of organization according to various criteria of Items.
- Display the results in graphical way i.e. Pie chart (according to types of Items) and XY chart (Item count vs. creation or released date of item) format so it can be easily analyzed.
- Reduce time to access information from cross functional processes and teams of organization so that organization so that administrator saves the time of data collection.
- Export the results of data analysis in various reporting formats for third party reporting Tools to transfer the information of organizational data.

2.3 Customization Types

Teamcenter can be customized on both the client and server side to deliver integration solution using the Teamcenter APIs and different toolkit. [5]

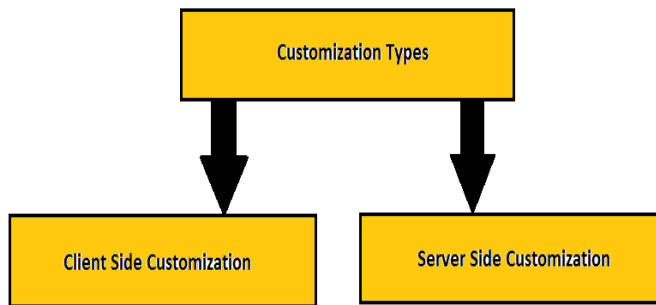


Figure 1: Customization types

2.3.1 Client Side Customization

The client side customization can be performed by using programming language (Java) and wizards available in Teamcenter. The client side customization can be used for adding new Application in Teamcenter, such as Menu bar, Toolbar, UI (User Interface) form on client side. Also it includes the customization for ex- form creation, POM classes creation etc. as per the organization requirement.[6]

2.3.2 Server Side Customization

The server is being customized using Teamcenter API (Application program interface) called as ITK (Integration Toolkit), C/C++. The (ITK) is a set of software tools which you can use to integrate third party or user-developed applications with Teamcenter. The ITK is a set of C functions used directly by Teamcenter and Unigraphics. Also BMIDE can be used for codeless and code full customization.[6]

2.4 Customization Tools

Teamcenter customization can be performed in different ways. There are non- programming and programming customizations.

2.4.1 Non-programming

Non-programming customization can be performed by using the wizards available in Teamcenter and making the entries in the registry files.[6]

2.4.2 Programming customization

Programming customization can be performed by using programming languages i.e. C, C++, Java. This can be classified into server side and client side customization. Client side is customized using Java language and server side is by using ITK. The detail about different tools is given as follows.[6]

3 CUSTOMIZATION METHODOLOGY

Teamcenter engineering portal is based on client-server architecture both the client and server layers can be customized. The client is the user interface (UI) layer and is built and customized using the Java language. This Figure shows the detailed communication between this layers by using various programming and scripting languages. The portal customization can be performed by using Java API. The detail of using Java is give as follows. One of the main reasons for using Java is platform independent. The Java platform has two components.[7]

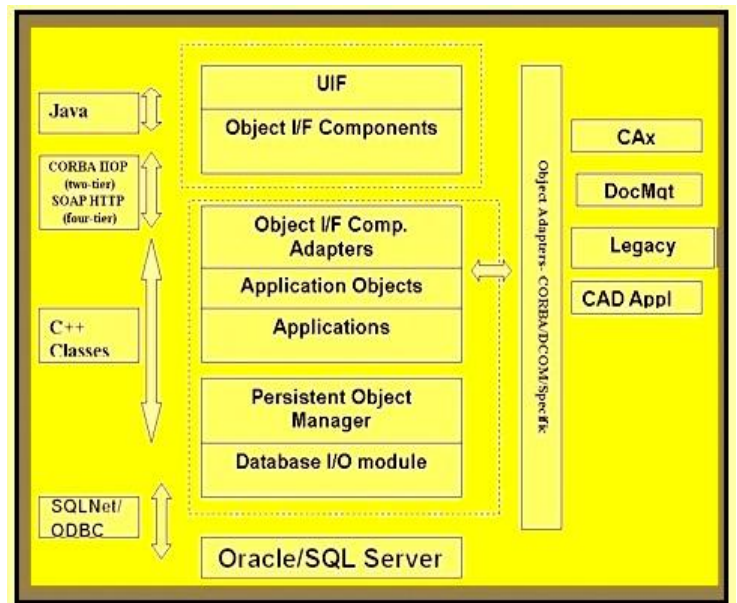


Figure 2. Rich client Architecture [7]

1. Java Virtual Machine (JVM)

The output of Java compiler is not executable code, it is byte code. Byte code is a highly optimized set of instructions designed to be executed by the Java run-time system, which is called the Java Virtual Machine (JVM). JVM is an interpreter for byte code.[7]

2. Java application programming interface (Java API)

Java API is collection of ready-made software tools that provide useful functionalities i.e. Graphical user interface (GUI). JFC/swing packages are used for development of GUI. The environment setting for customization is given as follows.[7]

3.1 Tool Used

- Teamcenter Engineering V 9.1.0
- Application wizard
- Query builder
- JBuilder

- JCommon
- POI
- JFree Chart

This free chart Library depending on following environments

- JDK 1.3.1 or higher
- JCommon
- GNU JAXP- standard XML processing APIs for Java.
- Servlet.jar- classes in the org.jfree.chart.servlet package require this file.
- JUnit- A unit testing framework.

3.2 Client Side Customization

3.2.1 Class Definition

In this sample code are given to understand the general structure of the java files for creation of new application. The following class definitions are used to create the [8,9]

MyApplication application

The customized code for application customization or creation is added in this base structure of these java files [8,9].

MyApplication.java

In this class Abstract AIFUIApplication class is extended by MyApplication class to add the default desktop functionalities in new application.[8]

MyApplicationMenuBar.java

This class extends the JMenuBar class depending on which menu bar items you want to inherit in existing one [8,9].

MyApplicationToolBar.java

This class extends JToolBar class depending on which Toolbar items you want to inherit or add into that[8,9].

MyApplicationPanel.java

This class extends JPanel class for construction of UI of the new application. By adding the code in this file the UI of application is developed. [8,9]

3.2.2 Creating the Application Registry Files

The Registry files are used at Runtime in Teamcenter engineering. These are used for Non-programming customization. The Registry files must match the package name. The Registry files hierarchy of the com.ugsolutions.myapplication package is as follows [8,9]

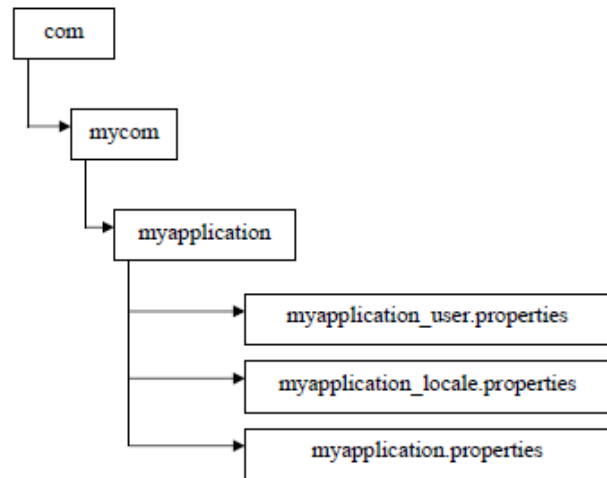


Figure 3: Registry files hierarchy [8]

Base properties files

This file contains the non-locale specific information and gives property required in package [8, 9].

Locale properties files

This contains only localization entries. This files separate localization keys from other. If customization is deployed on more than one client then this file provides convenient separation between them [8, 9].

User properties files

This contains properties that can be modified by user. Modifications to portal always make them in these files. These files are always consulted first for registry look up [8, 9].

3.2.3 Registry File

The registry uses properties files to define classes, icons, internationalized text, inheritance, search order, and appearance. The registry file i.e. myapplication.properties file portal_user.properties file and add the entries to define the application with its group, title, and tool tip and rollover icon. add the entries to define the application with its group, title, and tool tip and rollover icon [8,9].

3.2.4 Registering the Application

Once the application is created, it must be registered with portal. There are two methods for creation of new application

1. Manually create all these file structure
2. Using the Teamcenter engineering utilities i.e. application wizard to create all the class files and registry files. Use the application wizard for creating basic class files structure for TCProject application as follows [4,8,9].

Step1: Give the application title and the icon for new application in application wizard and select the next button to proceed further.

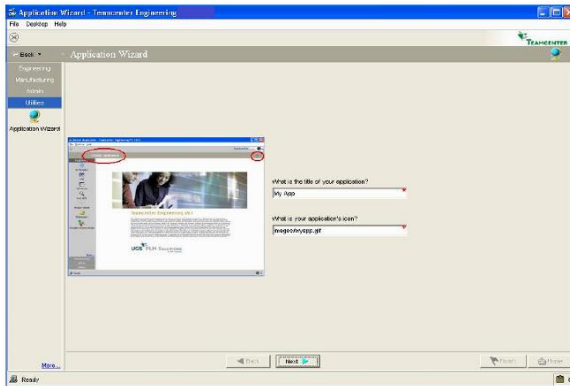


Figure 4: ApplicationWizard-Enter the application title and icon

Step2: Select the group of application, and add the entries for tool-tip and rollover icon

Step3: Give the package name select the location for class files and session for start of the application which

Step4: Define the required class names for the different classes as explained in

Step5: Select the basic directory i.e.(LSE0910) to locate the class files after compilation



Figure 5 Application Wizard- set base installation directory path

Step6: After selection of directory the application is created successfully

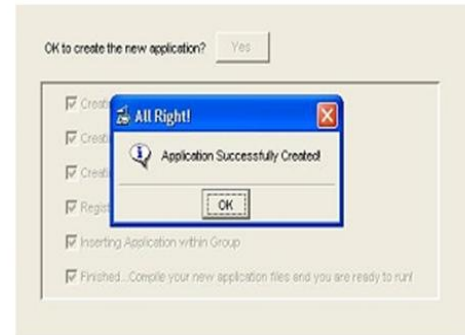


Figure 6 Application Wizard- message of application creation

After compilation and execution of these files in JBuilder environment gives the user interface of TCProject application after logging into application is as follows.

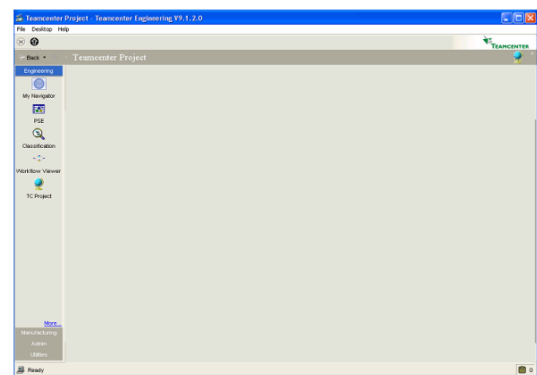


Figure 7: User Interface of TCProject Application

3.3 Design of Application User Interface

As per the requirement of the application UI of TCProject is designed. The panel design of application is as given in Figure

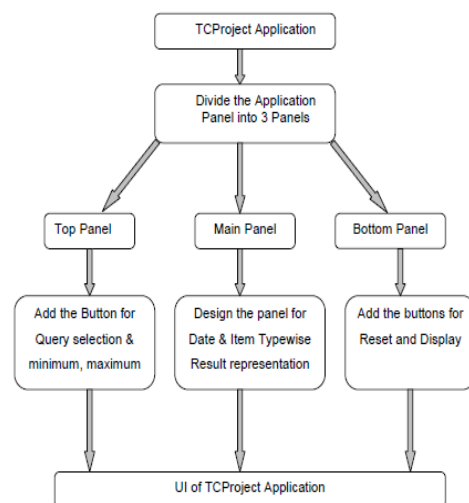


Figure 8 Flow Diagram of UI Design of TCProject

Application panel is separated into 3 panel's i.e. Top panel, Bottom panel and Main panel. Different GUI components are added in panels by using JBuilder. This gives the GUI of Application TCProject.[4]

3.4 Application and Database connectivity

The working of Application in Backend is represented in Tree Diagram as in Figure 9. The inputs from user in UI are given to newly build query, this query search the database as per search criteria and give the results to application which represent in XY and pie chart form. If there are no results found for given parameters then it will display the message on screen i.e. "No items found for this range". [4]

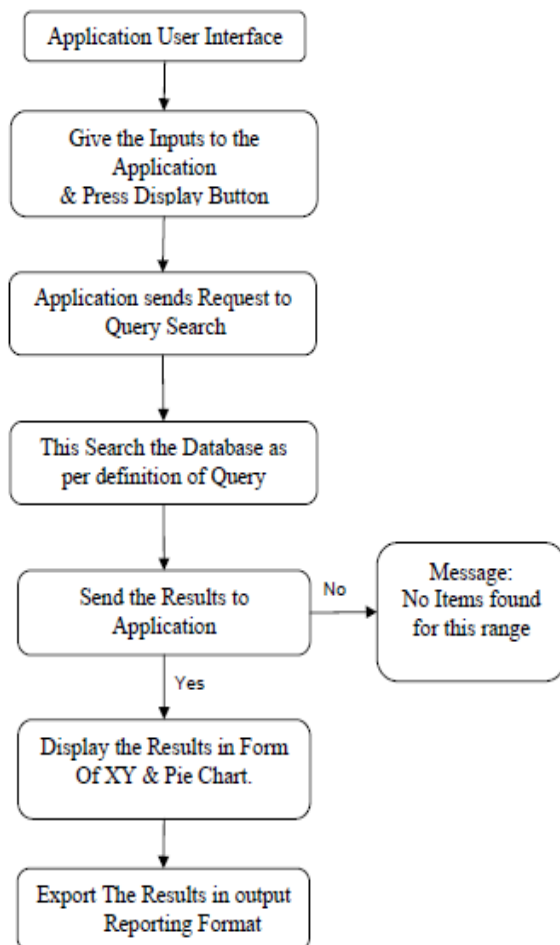


Figure 9: Tree Diagram of Application and Database connectivity

3.5 Execution of Application in User End

The Flowchart of the Execution of the Application in the Teamcenter Engineering is as given in Figure 10 Follow the steps as per the flowchart to run the newly created application. [4]

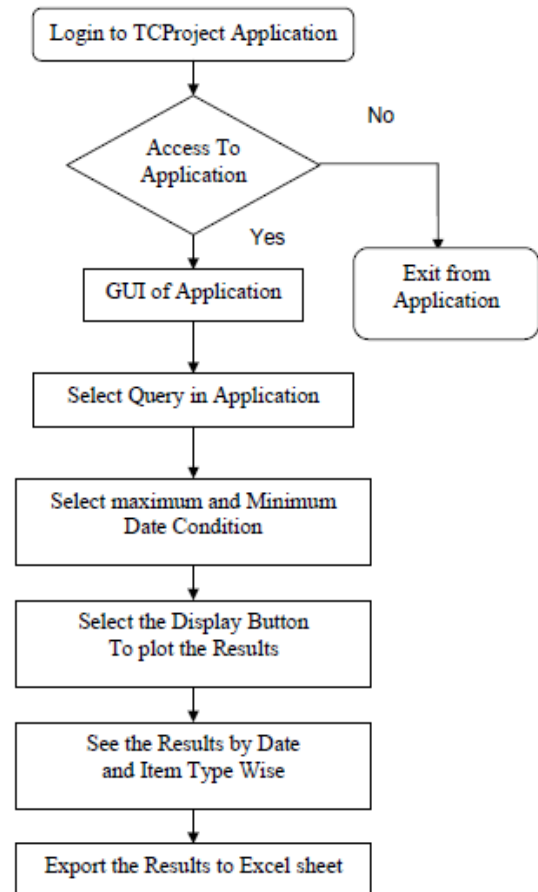


Figure 10: Flow chart of Execution of TC Project Application

4 CASE STUDY

The case study is taken of a industry to checking the compatibility of newly created application for data analysis. Compare the results of the application with the manual data collection and verify the results. Company which uses Teamcenter engineering for product data management. The company is in design and manufacture of 4 types of different products. Company requirement is to store the parts of this product under their parent product name. So that company organizes this data with some naming conventions for the parts of these products. As see above there is naming rules can be constructed as per the requirement by using the BMIDE. Attach this rule for naming conventions to items. In this case study taken 4 types of products. The format of naming rule as per the product type are given in Table 1.[4]

Table 1: Naming Rules for Product Parts

Product Name (Item Type)	Naming Rules For Parts of Products
Product A	PA-0001 To PA-.....
Product B	PB-0001 To PB-.....
Product C	PC-0001 To PC-.....
Product D	PD-0001 To PD-.....

Data analyst or administrator of the organization requires the information of parts created according to the various attributes of items for analyzing the organization data. The new application named TC Project is used for collection of data from the Teamcenter database according to following attributes of items.

1. Release date of items.
2. Creation date of items.

For this case study take the time period for 3 days (i.e. 29 May 2007 to 31 May 2007) and test the application for that time period according to above attributes of items. And plot the results from the application according to type and date of creation

of item in the graphical way and generate the output in excel sheet. The results are discussed in detail as follows

4.1 Results & Discussion

Analyst analyzes the data according to Creation date of item. Get the output result as follows. [4]

A. According to Creation date of Item

This output gives the information of how many items are created for a specific time period in the XY chart format. The X axis represents the date of creation and Y axis represents the count of item created for that date. In this case study the items created for a given period are given in a table format in

Table 2

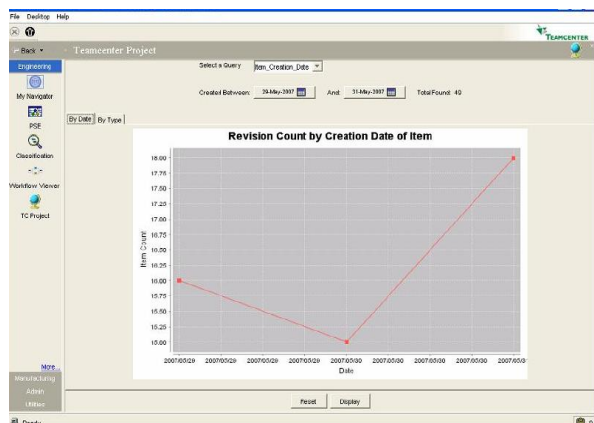


Figure 11: XY Chart According to Creation Date of Item

By observing the above graph analysts reach to the result which are listed as follows .

Table 2: Results of Number of Items Created

Creation Date of Item	No of Items Created
29 May 2007	16
30 May 2007	15
31 May 2007	18

The table represents the quantity of items created for a specific time period.

B. According to item type

This output gives the information of count of items according to type of item in the pie chart format. In this case study 4 types of products are available. The following pie chart represents quantity of items according to types of items.

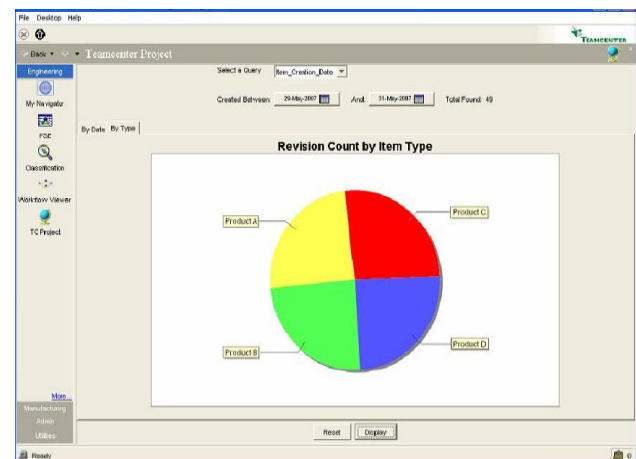


Figure 12: Pie Chart According TO Creation Date of Item

A. Excel sheet output

If organizations have to transfer these results to the reporting tools the application has to compatibility with the reporting formats. In this application the compatibility with excel sheet format. The various attributes of items are exported to the excel sheet according to the requirement along with creation date and Item number. The various attributes exported for this case study are listed as follow in Table 3

Table 3: Attributes of items

Column name in excel sheet	Attribute name of item
A	Item Creation Date
B	Item ID
C	Item Revision ID
D	Object Name
E	Owning user
F	Owning Group
G	Release Status
H	Object Type (Item Type)

The output in excel sheet according to attributes given in Table 4 are displayed in Figure

	A	B	C	D	E	F	G	H
7	29-May-2007	PB-0005	A	B3	info dba	dba		Product B
8	30-May-2007	PB-0010	A	B8	info dba	dba		Product B
9	29-May-2007	PB-0006	A	B4	info dba	dba		Product B
10	30-May-2007	PC-0005	A	C5	info dba	dba		Product C
11	30-May-2007	PA-0002	A	AA	devdas p	Analysis Head		Product A
12	30-May-2007	PA-0010	A	A4	info dba	dba		Product A
13	30-May-2007	PA-0011	A	A5	info dba	dba		Product A
14	30-May-2007	PA-0012	A	A6	info dba	dba		Product A
15	29-May-2007	PB-0003	A	B1	info dba	dba		Product B
16	30-May-2007	PB-0008	A	B6	info dba	dba		Product B
17	29-May-2007	PB-0004	A	B2	info dba	dba		Product B
18	30-May-2007	PB-0009	A	B7	info dba	dba		Product B
19	31-May-2007	PA-0014	A	A11	info dba	dba		Product A

Figure 13: Excel Sheet Report

5 CONCLUSIONS

In this paper, a novel method, Data Analysis, is proposed for capturing product information in development stage from the PLM software. The information is captured according to various attributes of fundamental objects in PLM software. This information is represented in graphical view i.e. Pie chart and XY chart to easily understand and analyze the data according to requirement of organization. Output of these results is generated in reporting file format for providing this information to various reporting tools. This output can be used to analyze the organization data, audits of objects, workflow status of products etc.

This application reduces time to access information from cross functional processes and teams of organization so that administrator saves the time of data collection and spends more time on data analysis.

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Author ¹ Sawan Sakharum Borul

M.Tech. (PLM)

Registration No. 2011 MMP 001

Department of Production Engineering

S.G.G.S. Institute of Engineering and Technology, Nanded

Email: sawanborul@gmail.com.

Co-author ² Jaykumar Yoga Mule

M.Tech. (PLM)

Department of Mechanical Engineering

Maharashtra Institute of Technology, Aurangabad

Email: mulejai@gmail.com.