Web Based Technologies to Support High Level Process Maturity

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Abstract - This paper discusses the uses of Web based Technologies to support High Level Process Maturity in an organization. It also provides an overview of CMMI, focusing on the importance of centralized data storage and data access for sustaining high maturity levels of CMMI. Further, elaboration is made on the web based technology, stressing that change over to Web Based Application is extremely helpful to maintain the centralized data repository, to collect data for process capability baseline, and to track process performance management, with reduced maintenance effort and ease of data access. A case study analysis of advantages of adopting Web Based Technology is also narrated. Finally the paper concludes that the sustenance of High level Process maturity can be achieved by adopting web application technology.

*Index Terms - **CMMI, management of organizational process improvement, centralized repository, web technology, effort booking and automated web based tools.***

1. INTRODUCTION
The Intranet and Internet-based technologies are impacting businesses in many ways. New technologies are promising to save costs, to improve customer and supplier relationships, business processes, and performance, and to open new business opportunities. They allow firms to respond better to existing challenges and improve the anticipation of future developments. While traditional use of information technology (IT) has been mostly at the back-end, and for applications supporting production-oriented procurement and supply-chains of large companies (the traditional area of EDI-systems), a recent trend is focusing on user-friendly front-end applications supporting non-production-oriented procurement by non-purchasing experts. The numbers of operational customer implementations are growing fast. Individual attempts to connect inter-organizational business processes and to interchange information are often undertaken independently from each other, and, due to a lack of commonly accepted standards, leading to incompatible results [1].

This paper addresses the use of web based technologies to support non production oriented processes. We discuss the implications of web based systems on High Level Process maturity and some of the critical success factors and key decision points that firms have to consider in order to utilize the technologies in an optimal way.

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An example from the BEL Software Technology Center is showcased to clarify the concepts. By presenting results from case and field study research, we address researchers as well as business managers who want to understand how emerging technologies are supporting High Level Process Maturity.

2. BACKGROUND FOR THE NEED
The BEL Software Technology Centre (BSTC), a leading Defence Public Sector Unit (DPSU), has followed the staged representation of CMMI. The organization was successfully appraised against SW CMM Level 4 in September 2004, Maturity Level 5 of the CMMI Version 1.2 in June 2009 and recently appraised for sustenance of SEI-CMMI L5Version 1.3 in May 2012.

The CMMI model, developed by a group of industry, government, and SEI representatives, is made up of best-of-the-best processes gleaned from multiple disciplines. It provides guidance in specific process areas through a set of goals and expected practices needed to meet those goals. The BEL Software Technology Centre has successfully adopted the CMMI best practices and follows statistically measured and controlled software process improvements [2].

For the Effective Management of Organizational Process Improvements the following data are required from Engineers: Engineer's Skill Set, Project & Task Allotment, Effort Hour accounted against project tasks, Suggestions for improvements, Root Cause analysis for Problems Faced, Trainings required and Attended. The organization has more than a couple of hundreds of engineers, working in various buildings, and connected through the organization's Intranet. This Situation pushed us to think about a centralized repository to capture and access the data from a Single place, with ease of access and maintenance. The Web Based application has a Client-Server Architecture, providing the single server-multiple clients concept. Thus it was decided to develop an Automated Web Based in House Tool to Support High Level Process maturity.

3. WEB BASED TECHNOLOGY
3.1 Overview
One of the early applications of the Internet was its most popular application, the World Wide Web or www. The www is one of the software tools that, through the use of hypertext, allow computers to link information in new ways different from a sequential reading approach, to make it easy to retrieve and add information from different computer sources through the use of communication links [3].

In a short time since its inception, the Internet has indeed revolutionized business, in that it redefines the methods used in traditional business practices and offers another important

channel for mass communication[4].Initially, the Internet was primarily utilized as a medium for communication (E.g. e-mail) purposes. Soon after many organizations from both public and private sectors began to discover that they could utilize this technology in support of marketing and information dissemination purposes. This resulted in organizations realizing that the greatest payback in investing in the technologies of www would be sharing information about the organization's products and services with the organization's stakeholders [5]. As a result, successful organizations of all sizes and types have been adopting different applications/technologies of www and discovering emerging ways of doing business that even a decade ago could not be imagined [6].

3.2 AVAILABLE TYPES
There are three main types of web applications:
- **Customer-facing applications** are known as ecommerce or B2C sites and use the internet. These typically present a customer with choices of products or services to buy using a shopping cart and payment method.
- **Employee-facing applications** use the intranet in a company. One example is a company's Accounting application. Another might be employee expense reporting. These applications previously operated on an internal client-server network. They are now web-enabled to make them easier to use and deploy.
- **Customer-Supplier facing applications** are known as B2B (Business to Business) sites and use the extranet, (an extension of an intranet that allows outside companies to work in a password-protected space). B2B sites provide a secure means for sharing selected information.

Not all web applications fit the above categories. For example Yahoo! email is not in any of the above. However, the above categories are representative of the main types of applications.

3.3 ARCHITECTURE
Web applications are built using a 3-tier architecture in which the client, server and database constitute the main elements [7]. The basic structure of a 3-tier architecture is indicated in the figure 1:
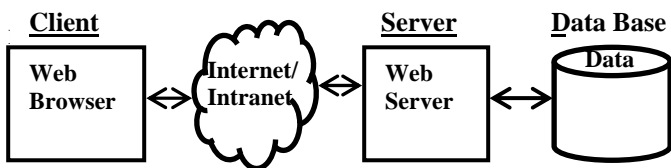

Figure 1: Basic structure of a 3-tier application architecture

3.4 TECHNOLOGIES USED TO BUILD WEB APPLICATION
There are 6 competing technology stacks that differ in the following attributes [8]:

- **Programming languages (Lang)** - can be used to create programs that control the behavior of a machine and/or to express algorithms precisely.
- **Operating system (OS)** is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is a vital component of the system software in a computer system. This can be Linux (L), Unix (U) or Windows (W).

Web server (Server) - can refer to either the hardware (the computer) or the software (the computer application) that helps to deliver Web content that can be accessed through the Internet/Intranet.

Database support (DB) – A Database Server is a computer program that provides database services to other computer programs or computers, as defined by the client–server model.

Sponsoring companies (Sponsors) - A **sponsor** is the individual or group that provides the support, similar to a benefactor.

The following table summarizes these technology stacks.

Stack	Sponsor	OS	Server	DB	Lang
CGI	Open source	L/U	Apache	Varies	Perl
Cold fusion	Macro media	W/L/U	Cold fusion	Varies	CFML
LAMP	Open source	L/W/U	Apache	MySQL	PHP
Java/ J2EE	Sun, IBM	L/U	J2EE	Varies	Java
.NET	**Microsoft**	**W**	**ASP.NET**	**SQL server**	**VBasic C#**
Java/ J2EE	**Open Source**	**L/U/W**	**Any Java Web Server**	**Varies**	**Java**

Table 1: Technology Stacks

Adopted Type and Stacks: Since our Engineers are connected through intranet, it is identified as the best suitable web application type is employee-facing application. The adopted stacks for the in house developed tools in BEL Software Technology Center are
For New Tools: SQL Server (DB), Apache Tomcat Server (Web Server), OS (L/U/W), Language (Java).
For Existing Tool (Developed in VB): SQL Server (DB), ASP .NET (Server), OS (W), Language (C#).

4. CASE STUDY
4.1 Establishment of Effort Capturing Web Based Tool in Bel Software Technology Centre
Need: It is required to track the effort hours accounted in the organization, with respect to projects and supporting tasks (such as quality assurance, testing, configuration management, network administration etc), performed by each of the engineers. This is needed to be accounted weekly, and collated on monthly basis as the total effort expended under each of the work orders executed in the organization.

4.2 Why Effort Booking is Important?

Effort data collected accurately helps to track projects and supporting tasks with respect to planned effort for the project or activity. The effort history available consistently over a period of time supports the estimation of effort hours required to perform future projects and supporting tasks.

4.3 Challenge

The organization has various groups of engineers, spread out over different facilities / buildings of the organization. They all expend effort, contributing to a set of projects and supporting tasks of the organization. Engineers working on the same project or same supporting function are not strictly co-located at the same facility. From all the facilities, the project managers are needed to allot tasks to the engineers and the engineers are required to book their expended effort. From the common repository, the effort needs to be collated and status / tracking reports as well as history data have to be generated. The situation is depicted pictorially in figure 2.

Solution: A Web Based Tool is developed in BEL Software Technology Center to log the project details, engineer details, and effort hours spent towards software development and support activities. The tool maintains the data in a common repository.
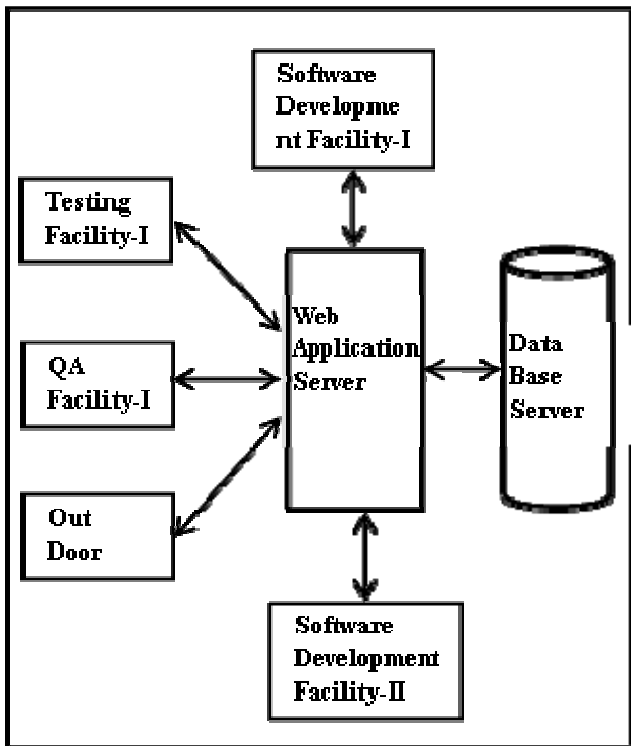

Figure 2: Multiple groups accessing the common data from different facilities

4.3.1 Approach

Task List: Detailed Task List was identified for different activities performed during the software development and support tasks.

Installation and Configuration: SQL server was installed on the development machine and Server machine. IIS was installed and configured to deploy the packages.

Package1- **Engineer WRS:** Consists of activity task list and enables the week wise effort hour booking for the engineers.

Package2- **Manager WRS:** Provides options to enter project details, engineer details and task assignment. Provides report generation on booked engineer's effort hours.

Deployment: The package is deployed from the server and the same is accessed through the web browser for all machines connected to the organization's Intranet. Browsers supported are IE6 or above and Firefox 3 or above.

Benefits:

1. Centralized Repository is maintained, leading to ease of data collection and improved process performance management.
2. Tool is installed centrally on a single server, avoiding the effort, time and space required to install in individual engineer's PCs.
3. New releases of the Software are installed at central server, eliminating the need to update each work station. This significantly reduces the on-going maintenance costs.
4. Network traffic is minimized because users of the system receive only the information they need.
5. Training Cost is reduced because end users are already familiar with the functionality of their browsers and web application in general. So it is easier for them to adapt to web based systems.

5. CONCLUSION

The Web Based Technology is offering new emerging capabilities for sharing and disseminating information. In this paper, we provided an overview of how web based technologies can support High Level Process maturity. A case study on Effort Booking Server as showcases to illustrate the issues. A Cost Effective Process Performance Management can be achieved by adopting Web based Technology. This in turn boosts the organization's ability to sustain the operations at the high level process maturity with ease.

FUTURE SCOPE

In BEL Software Technology Center, currently the in-house developed tools are used for various process automation aspects such as suggestion management, training management, effort and task management, decision and causal analysis records and knowledge management. These tools are based on common standardized web technologies and are being maintained by in-house development teams. The future work would involve activities for integrating these tools and maintaining a common catalogued centralized repository, further easing the maintainability.

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