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Development and Deployment of Library Portal for Automating and Synchronizing Electronic Information Resources: An Adoptive Model

Ibrahim Wada

Jigawa State Institute of Information Technology,

Kano-Daura-Border Road, P. M. B. 5002, Kazaure, Jigawa State-Nigeria
Email: wadainfoscience@gmail.com

Abstract
The emergence of Free Open Source Software (FOSS) created a slightly deviated approach to portals and web applications development and deployment because of their pre-packaged nature. The effort of this article is to present a working Portal Development and Deployment Model (PDDM) that prescribes Out-of-the-Box strategy and steps for designing, developing and deploying Library Portal using FOSS. Attempt is being made to showcase various System Development Life Cycle (SDLC) models with their strengths and weaknesses. Librarians and Information Scientists are being encouraged to adopt PDDM to avoid the gap associated with SDLC weaknesses when using FOSS to automates and synchronizes electronic information resources in libraries to meet the needs of library clientele with ease.
Keywords: Automation, Synchronization, Electronic Information Resources, Model, Library Portal, Free Open Source Software

1. Introduction

Library portal is growing in its importance as the preferred way of organizing and using information in academic institutions. Web portals are seen as positive potential frameworks for achieving order out of chaos and are considered a type of information systems used to gather, manage, share, and utilize information that has been stored in disparate databases throughout the organization (Moraga, Calero and Piattini, 2006). It is believed that portals provide users with a single point of access to personalized information needed to make informed business and educational decisions. Due to the huge benefits portal can provide at both the individual and organizational levels (Tofan, 2010), different methods and models had been designed and proposed to guide the processes of their developments. However, since the emergence of Free Open Source Software (FOSS) for developing and deploying portals, the conventional models have started sustaining fall out in providing the proper guidelines for developers and designers thereby necessitating an adoptive model.

2. Conceptualization of Portal

Portal is being conceptualized in different ways because of its dynamic functions and features. Winkle (2014) observed that the term portal was used to refer to well-known Internet search and navigation sites that provided a starting point for web consumers to explore and access information on the World Wide Web. This implies that the original portals were much like search engines. The initial value proposition was to offer a full text index of document contents and a chance to take advantage of the hyper-linking capabilities built into the web protocols. However, the concept and application of portal to information customization and repackaging have been an issue of serious debates, spanning from what it is, how it could be created, for what it should be used and which technique or model should be applied to its development and deployment. Dempsey (2003:1) provided a distinctive definition of portal to refer to "An information hub; an entry point to information resources; a density of resources and services on the network; a 'portfolio' of resources, potentially customized to specific role or individual interests; an aggregation or collection of resources organized to assist particular categories of users." Similarly, Konnur and Kacherki (2006) asserts that the term "portal" describes a variety of web based interfaces, everything from a relatively static homepage with general product and contact information to a dynamic one-stop homepage where users can customize the content to meet their needs. The main element of portal, as identified by Konnur and Kacherki (2006) are: ease of use, search and navigation, resource linking, personalization, user authentication and interactive services.

3. Functions and Features of Portal

The functional features of portal can be categorized into concepts (Sägesser and Joseph, 2012; Benbya, Passiante and Belbaly, 2004). The most notable and powerful functional feature of portals is Content Management and Tailorability, which provides users with the ability to adjust and tailor accessed data based on users' specific requirements and preferences (Tofan, (2010), and this function encapsulates customization/ personalization/ profiling/ content management/ taxonomy/ presentation; related to the previous functional features of portals are

Integration, which aims at bringing together different or similar formats of information resources and applications, harmonization and synchronization of data existing in different formats irrespective of compatibility issues surrounding their presentation, and dissemination through a unified interface (i.e. the portal).

4. Conventional System and Web Development Models

There is numerous system and application development life cycle models, being developed, refined, reformed, changed and improved over the years now. Each SDLC is complete in itself, and could be applied to development and designing of systems and software mostly in engineering environment (Nehal, 2009). According to Bender-RBT (2003) "A systems development lifecycle (SDLC) has three primary objectives: to ensure that high quality systems are delivered, provide strong management controls over the projects, and maximize the productivity of the systems staff". Some of the notable SDCL are waterfall Model, Software Prototyping, V-Model and Iterative Model.

4.1 Waterfall Model

The Waterfall Model was developed by Boehm (1976). It is one of the most well known models. It is the most common and classic of system development life cycle models, also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, there are five phases of development and each phase must be completed in its entirety before the next phase can begin (Boehm, 1976). At the end of each phase, a review takes place to determine if the project is on the right path and whether or not to continue or discard the project (Boehm, 1976 cited in Nodder and Nielsen, 2012).The model involves the following sequential steps: Requirement, System and Software Design, Implementation and Unit Testing, Integration and System Testing as well as Operations and Maintenance.

Some of the strengths of waterfall SDLC are that it is simple and easy to use; it is easy to manage due to the rigidity of the model – each phase has specific deliverables and a review process; it phases are processed and completed one at a time and it works well for smaller projects where requirements are very well understood. However, waterfall SDLC is not without weaknesses. Some of the identified are: it does not allow adjusting scope during the life cycle can kill a project; with the waterfall, no working software is produced until late during the life cycle; it encourages a high amounts of risk and uncertainty; it is a poor model for complex and object-oriented projects, long and ongoing projects.

4.2 Prototyping System Model

According to Piccoli (2012), the goal of prototyping-based development is to counter the first two limitations of the waterfall model discussed earlier. The basic idea here is that instead of freezing the requirements before a design or coding can proceed, a throwaway prototype is built to understand the requirements. This prototype is developed based on the currently known requirements (Aggarwal and Singh, 2012).

Prototyping is an attractive idea for complicated and large systems for which there is no manual process or existing system to help determining the requirements. In such situations letting the client "plan" with the prototype provides invaluable and intangible inputs which helps in determining the requirements for the system. It is also an effective method to demonstrate the feasibility of a certain approach. This might be needed for novel systems where it is not clear that constraint can be met or that algorithms can be developed to implement the requirements (Nehal, 2009; Piccoli, 2012). Prototyping accommodates waste of resources since it entertain a throwaway system; leads to implementing and then repairing way of building systems, which may cause discomfort to users of the system; increase the complexity of the system as scope of the system may expand beyond original plans and is too rigid and does not give room for trust.

4.3 V-Shaped Model

V-shaped model was developed by Brook (1986) and according to Berra (2014) and just like the waterfall model, the V-Shaped life cycle is a sequential path of execution of processes. Each phase must be completed before the next phase begins. Testing is emphasized in this model more so than the waterfall model though. The testing procedures are developed early in the life cycle before any coding is done, during each of the phases preceding implementation. Kulpreet and Walia (2014) stated that Requirements begin the life cycle of V-shaped model just like the waterfall model. Before development is started, a system test plan is created. The test plan focuses on meeting the functionality specified in the requirements gathering (Brook, 1986). Just like other software development life cycle model, V-shape Model is not free from its own strengths as being Simple and easy to follow (Gauri, 2009); each phase has specific deliverables; it has higher chance of success over the waterfall model due to the development of test plans early on during the life cycle and finally, it works well for small projects where requirements are easily understood.

4.4 Iterative Model

This model was developed by Shewhart (1930s) as cited in Nodder and Nielsen (2012). Iterative development is a rework scheduling strategy in which time is set aside to revise and improve parts of the system (Nodder and Nielsen, 2012). "During software development, more than one iterations of the software development cycle may be in progress at the same time," and this process may be described as an "evolutionary acquisition" or "incremental build" approach" (Aggarwal and Singh, 2012). Typically, this is the lifecycle model that allows modification of the product or system based on learning (Nodder and Nielsen, 2012; Bender, 2003). This model generates working software quickly and early during the software life cycle; Even though Iterative model look simple on the surface, it has the potential to make one believe that perfect software or web application could be developed with it. This model requires rigorous validation of requirements, and verification and testing of each version of the software against those requirements within each cycle of the model.

5. The basic ideas of System and Web development Models

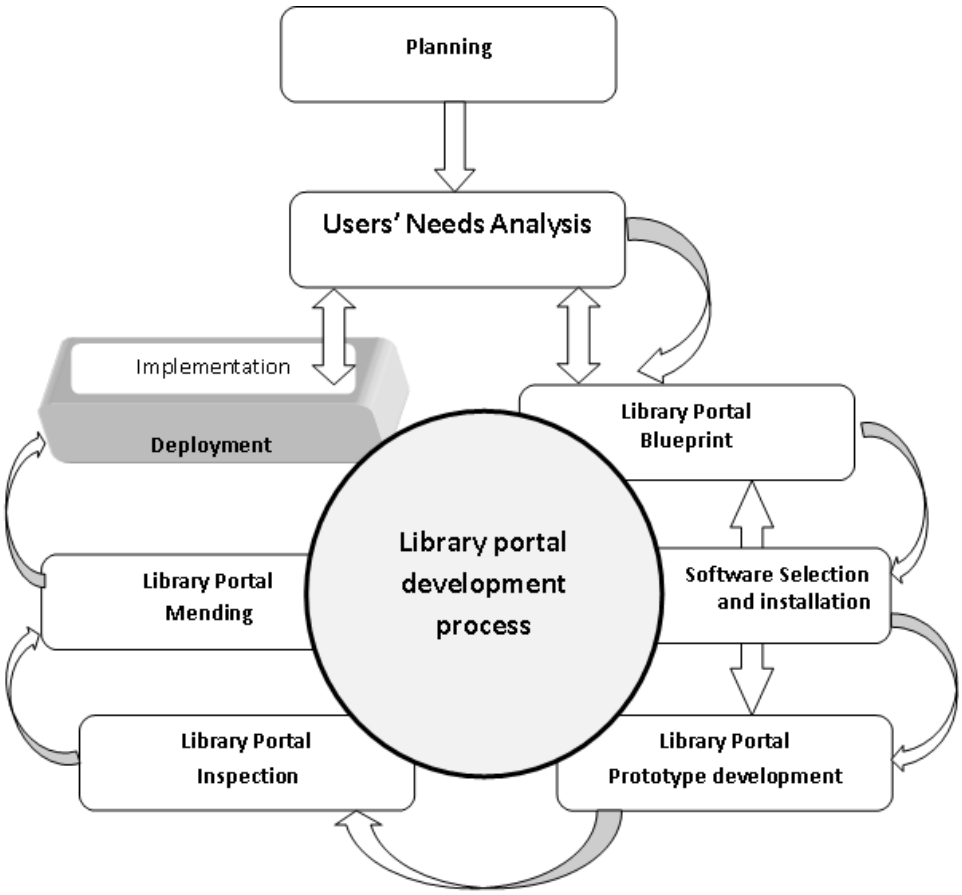
Waterfall and V-Shape models are traditionally based models and are of sequential type. Sequential means that the next phase can only start after the completion of first phase. The central problem peculiar to them are lack of easy adjustment and back-wheeling (Piccoli, 2012; Aggarwal and Singh, 2012). Comparatively, Prototyping and Iterative models are more accommodative in terms of change and are suitable for projects where the requirements are not so well defined, or the requirements change quite frequently. Yet, processes involved in these models are limited in scope and dimension.

Bergström and Reberg (2004) as well as Tofan (2010) believe that the use of Free Open Source Software came as an offshoot to make development of portal easy, simple, adjustable, robust and customizable. In the case of SDLC models, the developer or designer write codes, compiles the codes, simulates the codes and bit-by-bit organizes the codes into a full program using programming technicality (Ravitch and Riggan, 2012; Yang, Cai, Zhou, and Zhou (2005). The steps and strategy being prescribed by SDCL do not favour the use of FOSS to develop and deploy library portal in libraries. The System Development Life Cycle models are not able to accommodate the development and deployment of library portal using Free Open Source Software. This implies that librarians and information scientists need a model specifically developed and designed to be used while adopting FOSS for their web and portals development and deployment. The model should be able to guide any librarian or library institution using Content Management Systems, Course Management Systems, Library Management Systems as well as Users' Management Systems to develop a portal for their various educational requirement.

6. Portal Development and Deployment Model (PDDM)

Portal Development and Deployment Model is expected to help librarians and information scientists handle the development and deployment of portal themselves. It contains all the necessary steps and guidelines that are well defined in line with the current information age demand and need. The model is characteristically clear in direction and exhaustive is employing the variables that would make successful deliverance of desired web-based applications. See below the Portal Development and Deployment Model.

Portal Development and Deployment Model (PDDM)



This model stipulates that development and deployment of library portal need not follow the course of code writing and engineering techniques. Because, Free Open Source Software such as Joomla, Drupal and others have been designed without hurdles and sit-tight programming problems associated with SDLC models. The guidelines are:

→Planning → User Needs Analysis → Library portal Blueprint →← Software Selection and Installation →← Library Portal Prototype Development → Library Portal Inspection → Library Portal Mending→Deployment/Implementation}

6.1 Planning

Planning is the process of thinking about and organizing the activities required to achieve a desired goal. Planning involves the creation and maintenance of a plan. At the planning stage Library Portal Development Model, a researcher identifies a problem and preliminary study on the problem. During this timeframe the nature of the problem, the resources needed to tackle the problem, the stakeholders involved and the technical know-how required to executive the plan are all determined. In planning to develop a library portal, the institution that need the system needs to be identified and tools necessary for the implementation of the system must be identified. The planning must cover all the length and breadth of the project, including the timeframe within which the project would be actualized.

6.2 Users' Needs Analysis

Users' needs refer to the various information needs as regards what the users want, how they want them, when they want them and where they want them. In academic environment, it spans through the various courses being taught and learned by lecturers, teachers and tutors as well as students at all levels. More so, the information needs of staff are also considered. Users of library portal are those who make use of the information resources that are placed in it. Needs analysis can be achieved through survey or interview or focus group discussions.

Whichever instrument chosen, such instrument must be designed to encompass and include demographic status and other important information relating to the purposes for which they need the information, their information searching and seeking skills, web-based usage experience as well as their opinion about a related system. Therefore, the data collected via any of the instrument must be organized, presented and analyzed to make meaning out of it. The results from the data analysis need to be simulated into a ***blueprint*** to give a clear guide on the form of the library portal to be developed. Furthermore, users' needs analysis is still necessary during the development process because library users, by default, change their needs frequently. Thus, there is need for constant review of library users' opinions, views and make decision regarding the functional features that need to be available in a library portal.

6.3 Blueprint

A blueprint is a reproduction of a technical drawing, documenting architecture or an engineering design. It is a manual representative of a system or project, which serves as a guide for proper execution of the project. At this stage of the library portal development, a blueprint must be clearly designed, because it is meant to be a paper representation of the library portal to be developed based on the results simulated from users' needs analysis. The blueprint defines the functional architecture of library portal. This guides the developer through to the end of the library portal production. With the blueprint, a developer would know the resources to be provided through the library portal, which include how information is computed or fed into the portal, how the information is processed and how it is presented for use by the public.

6.4 Software Selection and Installation

Software consists of clearly defined instructions that upon execution, instructs hardware or itself to perform the tasks for which it is designed. Software is usually written in high-level programming languages that are easier and more efficient for humans to use. It is pre-configured program designed to enable the user develop another form of web-based program that could be used to perform certain defined tasks in a seamless and flexible manner. Software selection is an important stage in portal development because it requires identification of various Free Open Source Software, study their characteristics and functionalities, and then select the most suitable one for a project. At this point, a developer must be careful so as to be able to employs his technical know-how to avoid making mistakes of selecting software he may not be able to use effectively and efficiently. Installation of the select of FOSS should follow to pave way for configuration and prototype development.

6.5 Prototype development

This is a collaborative activity between a developer and users of library portal in an effort to produce a user-based system. This is the production of functional sample of library portal with all the necessary features, look and feel. While the developer gathers the materials and tools that are to be used in the course of the development, there is an involvement of the potential and actual users via focus group discussions, which will allows the users and developer to harmonize their common interests, knowledge and skills so as to produce a working library portal. At this stage, the developed uses the installed software to develop a sample of library portal that reflects the blueprint based on the needs of the users. All the software are organized and fed into a working operating system and the information on the blueprint will be fed into the software to produce a prototype that has all functional features.

6.6 Expert Inspection

Expert is someone recognized as a reliable source of technique or skill whose faculty for judging or deciding rightly, justly, or wisely is accorded authority and status by their peers or the public in a specific well-distinguished domain. Based on this view, a prototype of library portal must be given to an expert to evaluate so as to give judgment that would serve as identification of error (if any) and hitherto suggestions. This implies that, web development experts are to evaluate the prototype against the blueprint so as to find out errors and deviations. This would lead to generation of expert suggestions. After this stage, the developer would collect the proposed suggestions from the experts and move to the next stage of mending the system.

6.7 Library Portal Mending

Mending is the process of freeing a system from faults or defects and put it into good shape or working order as expected or desired based on the suggestions of experts. At this stage, the experts would make use of a usability guideline and check the library portal for its functionality, the features and the outlook so as to identify errors. The experts need to record their observations and present them to the developer for further actions. The developer would collect their observations, study them and go ahead to mend the system.

6.8 Deployment or Implementation

Deployment is a complete activity that user an application into operation and it involves series of steps that make a software available for use. Deployment is a process of preparing system by installing programs and activating such program for end-users utilization. Therefore, this model, at this stage, prescribes packaging and transferring the developed library portal from the developer's computer system onto the stakeholders' or customers' server As the finale stage, the users of the portal carried along during deployment and at completion of the deployment, the guidelines booklet At this stage, the system is deployed into small-scale use.

7. Conclusion

The Portal Development and Deployment Model (PDDM) should be adopted when using Free Open Source Software (FOSS). It portrays a holistic process and stages of designing and developing library portal system. Based on the model, there are eight (8) stages for library portal development, such as: Planning, Users needs assessment, library portal blueprint, software selection and installation, prototype development, inspection, mending, and deployment (implementation). These eight processes are evolutionary, iterative and inclusive. It is evolutionary because, it begins at a point of planning and progresses until it reaches its peak of portal deployment (planning—to—deployment). It is iterative, because every stage is a single instance of an integrating resource, requiring a complete scenario with the characteristics of linking back to the previous stage and to the upfront stage for integration. It is inclusive, because every single stage is part of the whole stages and necessary in itself for the portal to be developed.

8. Recommendations

Based on the above analysis, the following recommendations are provided to encourage librarians and information scientists utilise Portal Development and Deployment Model as guide for the creation of websites and portals.

1. In adopting FOSS to develop and deploy portal, librarians should use Development Deployment Model (PDDM) as a guide

2. There is need for library schools to implement Development Deployment Model (PDDM) as part of their teaching guide on suing for its simplicity.

3. When adopting this model—FDDM, all the eight steps should be judiciously used to the fullest to ensure optimum and successful outcome.

a. The planning stage should be taken seriously to include all the stakeholders and their interested and needs should be carefully analysed to ensure full representation;

b. The blueprint stage should contain low and high fidelity design that carry full information about the structure, interface items, navigational routes as well as the sequence of operations;

c. The software selection and installation stage should be done carefully with expert skills that will permit the demonstration with the demo of each of identified FOSS to avoid breakdown during full implementation;

d. The prototype development stage should be done collaborative way where representative of the stakeholders could take part to usher their contributions in all aspects.

e. The expert inspection stage must be done in such a way that know specialists outside the domain of the institution or organization should be contracted to critically study the usability of the system in terms of required functionalities, features and scalability. The experts should be vested with the need to use the blueprint as guides.

f. The mending stage should follow the experts recommendations and suggestions religiously to avoid repetition of any error encountered with the prototype system

g. Deployment stage should first be carried out on operating system running on Virtual system before the full implementation.

4. Individual or academic institutions that do not wish to implement FOSS for their information and library digitization can also adopt the model for any other Open source in order to benefit from the streamlined and collaborative technique showcased by the model

5. All the library schools should include this model it their educational curriculum for training administrators and managers of libraries in this information age.

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