Impact of Service Oriented Architecture on ERP Implementations in Technical Education

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Abstract

These days technical education is spreading all over the world (rural as well as urban areas) very rapidly and gradually application of ERP system in technical institutes is becoming common. But with very fast changing technology there is a continued need to enhance the efficiency of operations in ERP system as problems regarding decision making process are very complex and needs a lot of efforts. The ERP platforms are evolving to address these emerging needs of global technical areas. To take the correct decision inside a technical institute an ERP system integrates all databases of different departments/units into one central database but the major limitation of ERP system is that it can’t work in heterogeneous environment due to which it became very difficult to communicate between the different units of technical institute as well as to some other organizations. In the present paper it has been shown that the application of Service-Oriented Architecture (SOA) in ERP system i.e., extended form of ERP can resolve this problem.

Keywords: ERP System, Service-Oriented Architecture, Technical Education, Heterogeneous Environment.

1. Introduction

ERP software is a set of functional modules that perform organizational transactions such as admission, accounting, purchasing, fee submission etc and ERP System made by combination of ERP software, hardware & human resources attempt to integrate all organizational information in one central database. This central database allows information to be retrieved from many different organizational positions and makes organizational information visible and hence helps in effective planning of all organizational resources so that organization achieves its destination. Beside these advantages ERP system has also some limitations because of the fact that ERP system can’t work with heterogeneous environment which are:

(i) - Vendor Dependencies: Different modules of ERP s/w can be purchased from different vendors. Each vendor implements their module in different programming language. Integration of these modules will be a difficult issue as well as these modules cannot communicate with each other; this communication gap creates a big problem inside an organization to take a correct decision.

(ii) - Extending ERP: ERP system is hard to integrate with new technology (such as SCM, CRM etc) with ERP system.

(iii) - Integration with Legacy system: ERP system is hard to integrate with organizational existing environment.

In ERP system due to heterogeneity, integration with some other ERP module, new technology and legacy system becomes very difficult. These problems can be resolved by using the Service-Oriented Architecture (SOA) with ERP systems. Thus the aim of the present paper is to discuss the applicability of SOA in ERP systems by which technical institutes can increase their performance.

2. Overview of SOA

SOA is a tool for designing a software system to provide services to either end-user applications or to other services distributed in a network. In other words, a SOA is a collection of services which communicates with each other through message passing where service is well-defined & independent functions that perform a specific task. In considering the term service-oriented architecture, it is useful to review the key terms:

• An architecture is a formal description of a system, defining its purpose, functions, externally visible properties and interfaces. It also includes the description of the system’s internal components and their relationships.
A service is a software module that can be accessed via a network to provide functionality to a service requester. Services generally have the following characteristics:

(i) **Useful**: Services is individually useful to provide a specific type of service.

(ii) **Integrated**: Services are integrated to provide higher-level service.

(iii) **Re-use of existing functionality**: By creating a module once, we can use it many times.

(iv) **Message Passing**: Services communicate with their clients by exchanging messages.

(v) **Service choreography**: Services can participate in a workflow, where the order in which messages are sent and received affects the outcome of the operations performed by a service.

(vi) **Self-contained, or dependent**: Service can be independent or dependent on another service.

Services advertise details such as their capabilities, interfaces, policies, and supported communications protocols. Implementation details such as programming language and hosting platform are of no concern to clients, and are not revealed.

The term service-oriented architecture refers to a style of building reliable distributed systems that deliver functionality as services, with the additional emphasis on loose coupling between interacting services [1]. Here loose coupling means the interacting software components minimize their in-built knowledge of each other and its benefits include:

- **Flexibility**: A service can be located on any server, and relocated as necessary. As long as it maintains its registry entry, prospective clients will be able to find it as shown in Fig. 1.

- **Scalability**: Services can be added and removed as demand varies.

- **Replaceability**: Provided that the original interfaces are preserved, a new or updated implementation of a service can be introduced, and outdated implementations can be retired, without disruption to users.

- **Fault tolerance**: If a server, a software component, or a network segment fails, or the service becomes unavailable for any other reason, clients can query the registry for alternate services that offer the required functionality, and continue to operate without interruption.

The key principle of SOA is to write program code as few times as possible. Specific tasks that are performed in multiple programs are set up as “Service” objects. A program that handles a large function can “Call” that individual task by sending input and receiving output. The construction of ERP’s using SOA will resolve many problems such as:

(i) There will be no restrictions about the programming language while implementing ERP modules. For example, if we implement financial module in C language, attendance module can be implemented in Java.

(ii) It will provide some services to outside the organization. For example, provide tax services to all tax-payers.

SOA is based on the web services and by implementing web services, any application can communicate with service as well as use a service. Web services allow an organization to provide services that can interact with one another by exposing some of their capabilities and organizational processes to others on the web without constant human intervention. Since all communication is in XML, web services are independent of operating system or programming language limitations.

### 2.1. Service Delivery Life Cycle (SDLC)

SDLC in context of SOA starts with service oriented analysis followed by service oriented design, service development, service testing and finally service deployment. Throughout this process Service Administration is necessary to monitor the designed services (Fig. 2). The task performed at each phase is as follows [2]:

![Service interaction in a service-oriented environment](image)
Fig. 2: Service delivery life cycle.

Service-oriented analysis determines potential scope of SOA within the organization; service are identified and mapped out from traditional legacy system to model as smart services.

In Service-oriented design phase, standards and protocols are designed conforming service level agreement (SLA) along with business processes. Service development phase is actual construction phase where services identified in design phases are coded using suitable language.

Service Testing phase is required to undergo rigorous testing of services prior to deployment. Service Deployment needs to configure distributed components, service interfaces and any associated middleware products onto the production servers.

3. Implementations of ERP with SOA in the institutions providing technical education

Most of the technical institutes implement traditional ERP system in which different modules like admissions, attendance, grading, feedback system, accounting, training & placement, inventory, human resource management etc are implemented in an unplanned manner without having an overall objective of a comprehensive ERP. Many of the modules are generally developed at different times in different programming language and due to this these modules cannot talk to each other. This can be understood by using a simple example of an engineering college. Suppose in the institute admission module give admission to already enrolled student only if he paid all his fees. On the other hand, library module can issue the book to enrolled student, even if he did not pay his fee. Such problems are common in an institute using the traditional ERP system as in it generally all the ERP modules will be in different programming languages and hence can not talk to each other.

Application of ERP with SOA (extended ERP) can resolve such problems as it fulfills communication gap among different modules of an organization [3, 4].

SOA uses web services for sending information to service requestor so SOA allows different sections of the college to speed their decision cycles by providing accurate information in real time. ERP system creates central repository for information sharing, while SOA speed up the communication among several sections. ERP with SOA provides “central single source of information” so that all necessary decisions may take correctly. Besides this, SOA helps ERP to communicate outside the organization i.e., communication between different organization. It is not necessary that all organization have same platform (i.e.,
same architecture) so SOA helps the organization to communicate with other organization using different platform.

So with the help of ERP & SOA, communication inside the organization & outside the organization becomes very easy.

Some of the issues that ERP & SOA can solve:
- Use of central repository for all organizational information.
- Ability to manage relationships inside & outside the organization.
- Integration with Legacy system
- User friendly interface
- Fast & effective search capability [5].

4. Benefits of SOA in ERP implementations at technical education institutions

SOA is most widely used in the market as it links computational resources and promotes their reuse. SOA is helpful as it responds more quickly and makes cost effective changes according to the market situations. It also simplifies the usage of the existing IT (legacy) assets and interconnection among the assets. SOA isolates the user from the service implementation in order to run the services on various distributed platform and make it accessible across the network.

SOA architecture enables seamless Enterprise Information Integration. Here are some of the Benefits of the Service Oriented Architecture:
- Due to its platform independence, it allows organizations to use the software and hardware of their choice.
- Technical institutes can use the existing software (investments) and use SOA to build applications without replacing the existing applications.
- Application of SOA in ERP is secure as standard encryption & decryption techniques are used in this combination.

5. Challenges in implementing SOA with ERP in technical education

Applying SOA in ERP system has also some challenges which are:
(i)- Modifiability: if service provider modify its service then service consumer may have complain of this change.
(ii)- Performance: there are some issues in SOA that may degrade system performance:
(a)- Services are implemented by different languages and platforms.
(b)- XML can affect the processing time.
(iii)- Organizational barrier: There is still resistance within organizations to adopt ERP & SOA because of employee resistance for using these new technologies. The main reasons for the resistance towards change are fear of failure, fear of being redundant and fear about the uncertain future. Moreover true interoperability, like software reuse and complete communication among different modules using different programming language still largely remains an illusion [1].
(iv)- Standard barrier: Most SOA standards are either very limited or incomplete. Adoption of standard, open, general-purpose protocols and interfaces are still evolving [1].
(v)- Service Modeling: Often, developers develop web services without understanding or modeling the organization properly. If the services are not designed without understanding the organizational processes then it will be not beneficial for the organization [1].

6. Conclusions and future work

The present paper describes how the application of SOA in ERP systems may integrate all information of different units using different platforms into one central database and makes information visible everywhere, so that all individual can take correct decision before taking any important action. The benefits of this approach include cost savings, improved business agility by decreasing time to deliver results, and enhanced collaboration and sharing of resource. In a nutshell it may be concluded that although, the use of SOA can improve the performance of ERP system and thus may enhance the performance of the technical institutes it has also some limitations such as modifiability and performance problems. The effort should be done to resolve these problems and hence
these shortcomings may be regarded as the future research problems.

References


