A Practical Guide for Application Integration

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Abstract

Most organizations use an increasing number of applications and services to solve specific business problems. In many cases, these applications and services exist on different platforms and were created at different times. The challenge that most organizations now face is to provide a method by which these applications can work together to address business goals that constantly evolve. This paper presents a practical guide for application integration. It discusses the major challenges involved and shows how organizations can adapt application integration environment to meet those challenges. The guide is not designed to show exactly which technologies to use in integration solution. Instead, it focuses on five major aspects of the application integration requirements: business process, interaction requirement, user exposure, cost and infrastructure. By considering these aspects, organizations can design an effective application integration solution and improve capabilities needed to enable application integration. So a complete picture of important aspects of application integration can be achieved.

1. Introduction

Today organizations probably use many applications and services that were built over many months or years, as new business needs were identified. As a result, these applications probably are of different ages, were written by different people using different languages and technologies, reside on different hardware platforms, use different operating systems, and provide very different functionality. For every organization, these conditions can result in redundant activities, higher costs, and inefficient response to customers. (Microsoft, 2003). So, organization probably identifies a business requirement for applications to work together to meet business goals. Application integration Application integration is the secure and orchestrated sharing of processes and/or data between applications within the enterprise. Application is a strategic approach for binding information systems together, at boat the service and information levels for exchange information and processes in real time (Linthicum,2003).

An effective application integration solution provides functionality that will rapidly become invaluable to organization, so it is vital that we carefully design an application integration solution. Effective application integration can provide the following important business benefits:

- Allowing applications to be introduced into the organization more efficiently and at a lower cost
- Allowing to modify business processes as required by the organization
- Providing more delivery channels for organization
- Allowing to add automated steps into business processes that previously required manual intervention

Application integration can have many forms, including internal application integration (enterprise application integration or EAI) or application integration integration (Business to Business application integration or B2B) (Linthicum,2003). A full documentation of application integration types can be found in (Linthicum,2000). To build an effective application integration environment, we need to understand the business problems to solve, and what we need from our application integration environment to solve them and What areas/aspects of integration should be looked at? This paper presents an integrated approach to enable the application integration integrated with organization tools, processes and infrastructure. We provide a generic guidance of important aspects of application integration that should be considered before planning and creating an integration solution.

This paper is organized as follows: First, in section 2, we introduce the important application integration concepts and some of the important challenges of application integration environment. Section 3 discusses the proposed framework and its 5 major aspects of application integration that organization need to determine an effective integration solution. We demonstrate our framework in section 4 by applying the framework in an IT department as a case study, which is the first part of the evaluation. Finally in section 5, the conclusion and further work are presented.

2. Integration challenges

The big question faced by an organization is how to develop computer systems to successfully automate previously manual operations such as billing, accounting, payroll, and order management. Solving any one of these individual problems is challenging enough, without considering the possibility of basing all of a company's systems on a common, reusable architecture.

Integration is required to resolve multiple types of business and technical application requirements among systems that, more often than not, were developed by different programming teams using different technologies and that were intended to solve different business problems (Newcomer,2005) . The more quickly integration solutions can be deployed, and at reasonable cost, the better. Some of the common reasons for investing in integration solutions have been presented in (Newcomer,2005).the existing problems of application integration illustrate that an integration solution is often not as simple as making two disparate systems work together. A few years ago, enterprise application integration (EAI) products became popular, based on the hub-and-spoke architecture, for addressing integration requirements. However, EAI products have proven expensive to purchase, consume considerable time and effort to deploy, and are subject to high project failure rates. Also, since most of these special integration products relied on proprietary transports and protocol, integration projects faced additional difficulty and complexity whenever a company invested in more than one EAI solution. Instead of being able to easily meet new challenges and business requirements, they found themselves face with multiple, isolated islands of software, representing additional integration problems.

There are many reasons that application integration is challenging. The first one is that it is rarely impossible for a company to have a single application that provides all its software needs."Companies want the best business capabilities in their systems: The best ERP, the best CRM, the best data warehouse. And they need those systems to work together and also work with investments they already have in place," (Bannan, 2011). Therefore they need to connect these various systems to deliver business value at a lower total cost. The second one is difficulty of integrating multiple data models and multiple instances of the application. This subject is more important especially for companies that provide their application form different service providers and vendors. The synchronization of data or the process increases in complexity in these applications. Finally, business considerations are the other problems that affect integration (Maréchaux, 2008). The business users usually are not involved with application integration decisions since both IT and business executives mistakenly think the process is all about technology. But it is not true. IT may not know exactly how a department is using an application or which functionality is most important for the continued growth and success of the business. So, IT may integrate the wrong set of applications or processes (Bannan, 2011).

In addition to these challenges, some technical and organizational challenges are exist. However, it is particularly important to resolve any organizational issues early on, so that organizations can focus on resolving the technical challenges of application integration. More documentation of integration challenges can be found in (Microsoft, 2003).

3. Content of The Framework

When organizations start designing a solution for the integration its legacy applications or defining a desire process between two or more departments and automation of them, they should have enough information and knowledge about some general features about business processes (process value chain, interaction between processes, external organizations and internal departments related to processes, …), stockholders and users, essential infrastructure such as hardware, software and so on. So, they use a mix of methods to collect the required information. There are numerous appraisal items related to the application integration that should be determined as integration requirements and could have been included in this practical guide. This guide is called as a framework and it has been built on certain premises surrounding the nature of processes automation and application integration enquiry, how it can be used for application integration purposes and how it can help. Based on the obtained results, the organization can determine where agile system integration and application development can correct process flaws, realize important integrations, and extract key information from systems to make a strategic solution for covering the integration needs across the entire organization. This guide highlights some of the management issues relating to integration projects including strategic planning for integration and understanding of business process flow across divisional silos.

In this guide a set of principles are considered around which to frame and structure questions that might be asked of a piece of work in order to determine interaction type, criticality of integration and integration requirements. In each case, a set of rating indicators are listed – features that will help to form a judgment about how well the question has been addressed. Further questions might also be added depending on the approach it uses. The selected appraisal items for this guide are recurrently cited as markers of integration in the literature, in pre-existing experiences and in the interviews conducted for this study. More details about the guidance features are presents in the following sections.

3.1. Guiding principles

The framework includes five major aspects of application integration enquiry. Among many distinctive features around the integration, it is characterized on five major aspects. All of these are based on themes that are highly recurrent in the literature and in the interviews conducted for the study. These aspects are as follows:

Business process: identifies business activities and procedures, user departments or organizations, etc.

User exposure: identifies user readily for automation and integration, number of users, user resistance and so on.

Integration requirement: assesses and collects information about vendors or service providers who has provided the applications/ systems that the process currently interacts with and the systems that the process needs to interact with.

Cost: identifies the amount of cost reduction after doing integration, integration cost, additional revenue that can be generate by exposing the application in multiple channels and so on.

Infrastructure: assesses the existing infrastructure and data center about network, hardware, operating systems and so on, to identify required changes or improvements for the integration

3.2. Appraisal questions

The guidance consists of five main sections to identify more than 40 appraisal questions to aid an assessment. The questions are listed in table1. They begin with the assessment and identification of the candidate process for automation. Then identify user exposure and resistance and continue with identification some general

features of integration requirements. It is suggested that the business process specification are given attention first, even though this is not a logical procedural order.

3.3. Appraisal indicators

Beside some questions, there is a series of appraisal indicators which help in answering the appraisal questions. They are not intended to be comprehensive and other indicators might well be added. For most appraisal questions, also, quality indicators could be added.

The assessment and identification of integration requirements, using this questioner, will require careful judgments on the part of the assessor. These, in turn, will require some knowledge of business domain and some expertise in using integration methods. In the following section, the questioner will be presented.

Business Process	
1	How many manual steps are involved in the candidate process?
	How many departments or different organizations are involved in this?
	How many different software's / applications are involved in this?
	How many users use this process?
	How many times does a single user use this process in a month?
	At an understanding level, how much of the process can be automated?> 70% is 5, > 50% is 4, > 40% is 3, > 30% is 2 and >10% is 1
User Exposure	
2	How many users are needed to administer this process? (one single execution of the process ie one loan processing)
	How many users can share the load at the most bottleneck points? (ie clerks for receiving the payments)
	How critical is this process (Impact of the process going down? Ie if organization completely halts it is of criticality 5, vs only a subset of functionality becomes unavailable to the users it is criticality 1)
	How secure is this process execution? (How critical is the process security from 1 to 5 , 5 making it extremely critical)
	How long does it take to execute one process execution? (one single execution of the process ie one loan processing for example)
	How much average time does it take to complete one process instance?
	How much minimum time does it take to complete one process instance?
	How much maximum time does it take to complete one process instance?
	What is the level of proficiency to use basic internet based application by external users? (5 being user regularly uses internet based applications at least once in a day, 1 being never used internet based forms)
	What is the level of proficiency to use basic internet based application for business users (Internal users)? (5 being user regularly uses internet based applications at least once in a day, 1 being never used internet based forms)
	How much resistance do you expect from the internal users if the process is deployed differently than the existing process? (rating with 5 being highly resistant)
	How much resistance do you expect from external users post implementation? (rating 5 being highly resistant)
Cost	
3	How many bottleneck areas do you see in the current process? For instance, if the bottlenecks are addressed, there is a certain possibility of improved service response time/tangible process improvement reflecting on Isfahan Municipality's performance
	What is the cost reduction you would get after automating this process and assuming it takes 30% to 50% less time to execute?
	How much additional revenue can you generate by exposing this application in multiple channels (ie mobile, internet, Kiosk etc…)
	Can this Process be a candidate process can be commonly deployed across all Municipalities across Iran? Or How much of this process can be deployed as a reusable process component? 5 - Highly reusable …. 1 - Negligible reusability

	Is there an overlap with any other processes? The more the overlap the rating increases from 1 to 5
Integration Requirement	
4	Number of different applications/ systems the process currently interacts with.
	Number of different applications/ systems the automated process would need to interact with
	Number of highly complex systems the process needs to interact with
	The level of ready support available from the 3rd party vendor who provided the system (if it an externally procured system)
	The nature and level of documentation available on the system
	How easy it is to access the API/ DB
	Is it a proprietary system
	Is the Source Code available for the system/process
	Number of medium complex systems the process needs to interact with (ie if it is easy to expose the database/ current APIs that are documented, so it can be exposed as web services)
	Number of easy to integrate with systems the process can integrate with (ie if it is easy to expose the application as web services or have already been exposed as web services)
	How much of existing functionality of existing systems can be reused in the process being defined? (if > 70% rating is 5 and less than 10% rating is 1)
	Is there any application that needs to be integrated via WAN?
	Percentage of the applications (that needs to be integrated with the process/system) that use a single authentication mechanism?
Infrastructure	
5	What are the different operating systems being used currently? Rating 5 for Windows Server 2003 and Above or Red hat linux 4.1 and above , Rating 1 for Mainframes/ AS400
	What is the available internet/ intranet speed for the users?
	Where is the data center hosted? Who maintains it? (Rating 5 - self maintained and owned and Rating 1 - private party)
	Do you have a qualified system administrator for majority of the applications/ systems used in this process?5 being completely trained admin,3 being a part time admin/ outsourced,1 being no official administrator
	How accessible are the servers for us to administer remotely?5 - highly accessible,1 - not really accessible

Table 1: The questioner of integration

4. Applying the Proposed Framework in a Case Study

To demonstrate the questioner and applicability of our idea, we have selected to do a case study at an IT department. This case study describes the application the questioner and also overviews proposed solution.

4.1. Introducing ICTIM

The application of computer technology in all facets of a modern municipality and the vital need for cultural and educational training, led the city of Isfahan to establish Information & Communication Technology Department of Isfahan Municipality (ICTIM) in 1981. Since the inception, this organization has provided a wide variety of automated and on line services to all departments of Isfahan municipality. In addition, it has furnished the central, local, satellite offices of municipality, personnel, employees and Isfahan citizens with software and hardware production, support and maintains services and is providing services to all fellow

Isfahan citizens on daily and continues bases. The services are typically IT applications and infrastructure that are packaged and offered as services by internal IT staff or external service providers. However most of the application services are provided by external service providers. Some of major systems provided at ICTIM for Isfahan municipality are as follows:

Computer system automation, mechanized uniform urban planning system, automatic vehicle location (AVL) management system, construction projects management system, procurement system, commercial tax system, car tax system,…

ICTIM has documented around 140 processes of Isfahan municipality and they have decided to automate 2 processes in the first phase before we start looking at the rest of the processes. The overview of these processes is described in table2 and table3 as follows:

| Process I.D.	D1
Name of Process	Management and receipt of renewal revenues
Relevant roles	In charge of receiving renewal taxes, officer of computing municipality taxes, authority issuing the circular letter, municipality tax payer, in charge of following up of claims.
Objective	Management of renewal revenues
Result of procedure	Case or periodical report of renewal revenues, issued settlement certificates
Details of the Process	Through reception of the circular letter regarding ratified renewal taxes and also retrieval of renewal audit data, the file will be studies. In case needed, the renewal audit is done and up-dated. Taxes are computed based on file data and payment slip is issued. Following payment of taxes by the taxpayer and providing the receipt, in case needed account settlement letter for subsequent actions is issued. Also, debts of debtors will be followed up at the end of the determined periods, received revenues are specified and accompanied with documents are sent to the office of receiving taxes.
Date relevant to the process	
Credit, accounts sand financial documents, received sums and payments, renewal revenue, data on municipality commissions and meetings communication procedures, data on non-government organizations, data on state institutions, financial regulations & rules, correspondence, results of financial and economical studies, executive programs, bank, financial knowledge, systems and data security guidelines, data, licenses and urban development licenses, land, building, apartment, and city geographical data.	

Table 2: Process description of process1 (ICTIM, 2006)

| Process I.D.	D2
Name of Process	Investigation and registration of financial documents
Relevant roles	Executive / Operational Depts., Accountant
Objective	Controlling financial operations and checking it with documents
Result of procedure	Financial reports & statements to be provided with the prevent authorities
Details of the Process	Through reception of documents of expenses and received revenues, affirmative papers and documents will be collected, audited, and while issuing bill, it will be registered in accounts. Following registering financial bills, remainder of accounts and credits are computed and financial reports are drawn up.
Information regarding the process	
Credit, accounts and financial documents, expenses received and paid sums, wage and salary	

information, general and particular revenues, car revenue, renovation revenue, job and profession revenue, construction revenue, warehouse warrant and receipt, claims, financial rules and regulations, correspondence, systems and directions, security of information.

Table 3: Process description of process2 (ICTIM, 2006)

In the next step of the requirements gathering and integration process analysis, some information was prepared based on the defined questioner in the previous section. Due to lack of space, the completed questioners of the processes are not presented in this paper. But we extracted useful information from the given answers. Also, in order to understand the activities and their relationships, a process flow diagram was provided for each process. Figure1 and figure2 illustrate process flow diagrams of two processes.
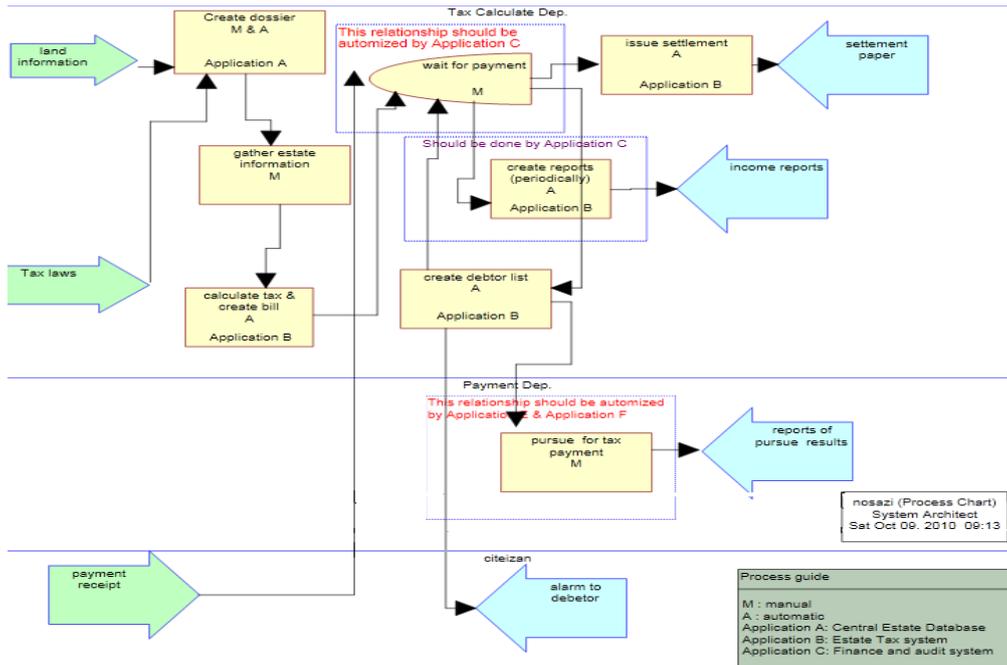
Figure1: Process flow diagram of process1
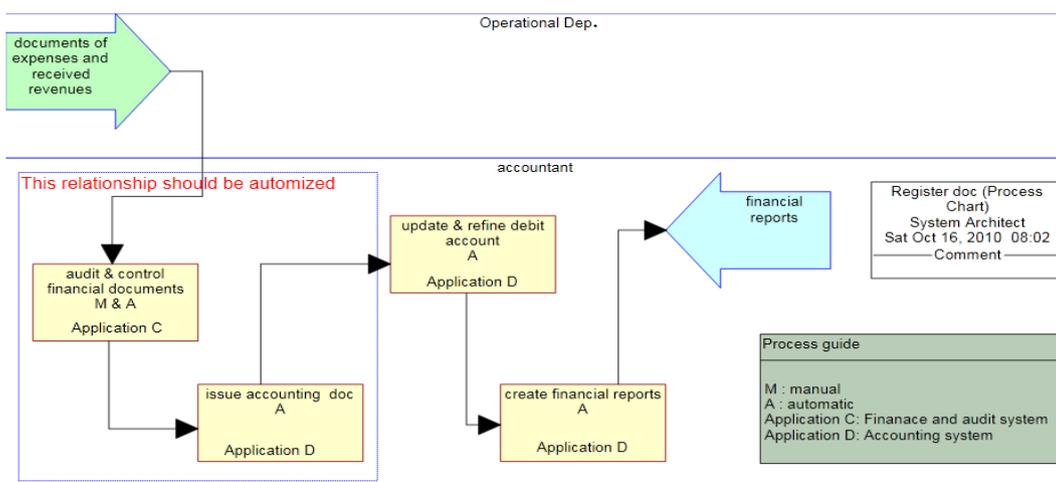
Figure2: Process flow diagram of process2

4.2. The Integration solution

In the last step, an integration solution was proposed for the requirement described above .The proposed solution includes four integrated layers. These layers are briefly explained below:

Application layer: includes prepackaged and custom build applications

Connectivity Layer: publishes the required functionality of existing applications as web services to the enterprise service bus (ESB). Also the existing applications are made accessible to this layer, by providing access of existing API's and database.

Business process Layer: The services of the external applications and the current system being built will be coherently modeled together as business processes. The modeled processes

- BPMs
- Rules for deciding which path to take based on various parameters
- Human Tasks – Screens for users to enter the input
- Transformations – to transform data/ message from incoming message format to the needed intermediate/ process and outgoing message formats
- Modeled Interaction with external systems

User Interface layer - includes screens, reports and dashboards

Due to lack of space, we will not discuss the implementation of the new proposed solution. However, such a discussion will be published in the future papers.

Summary

In this paper, a practical guide or framework was presented for collecting required information in the application integration enquiry. The framework examines the major aspects of application integration requirements: business process, user exposure, integration requirement, cost and infrastructure. These principles are based on themes that are highly repeated in the literature and in the interviews conducted for the study. It can be used for collecting needed information in the domain of automation and integration. It can also be utilized for identifying integration requirements and limitation and designing a desire solution for the integration. By means of the proposed framework, we demonstrated its application in an IT service department. However, further research is required to evaluate the suggested framework. It may be evaluated with respect to several criteria: usability, coverage, adaptability. usability refers to the ability of the framework to be understood, learned, used and attractive to the user; coverage refers to the extent to which the framework addresses the needs of application integration requirements; adaptability refers to the ability of the framework to be adapted for different specified environments without applying actions or modify and adjust the framework to use in domain of integration. Another research direction could be an improvement of the principles that have guided the design of the framework, and the suggested questions relevant to guiding theme.

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