An Overview of Application Integration Concepts

IRIMIA ROXANA-ADINA
IT Department
The Bucharest Academy of economic Studies
6, Romana Square, district 1, Bucharest
ROMANIA

Abstract: - In the context of the explosive growth of the IT dispersion, the importance of enterprise integration has developed significantly. Enterprise integration takes a strategic and coordinated view of an organization's integration needs. Enterprise integration is suited where an organization's business requirements dictate the need for the real-time processing of complex business processes across different IT applications and parts of the enterprise. Enterprise integration solutions typically involve some form of integration broker that coordinates the flow of information from one IT application to another. Importantly, however, organizations should not underestimate the many technical and management challenges that need to be overcome in order to achieve enterprise integration success.

Information technology has known a continuous expansion in terms of the sphere of applicability and use of the informational products, but also in the development of new business opportunities created by the transition to the digital economy. The enterprise integration can be defined as the strategic consideration of the process, methods, tools and technologies associated with achieving interoperability between IT applications both within and external to the enterprise to enable collaborative business processes.

Importantly, enterprise integration is not purely about technology integration. Enterprise integration also includes a consideration of business processes that cut across various IT applications, and so provides the overarching basis for technology integration, taking into consideration the managerial and technical challenges that must be overcomes in order to achieve a full applications and processes integration.

Key-Words: - Application Integration, IT development, Technical Challenges, Organization Integration, Managerial Challenges

1 Introduction

Most organisations today are highly dependent upon information technology. In some organisations, IT provides a competitive edge, although it is generally accepted that most large organisations require a basic level of IT simply to function. Over the years, organisations have invested heavily in IT and, as a consequence, accumulated large portfolios of IT systems comprising of hundreds, possibly even thousands, of separate IT applications. Historically, individual IT applications were designed as stand-alone systems addressing specific functional domains such as marketing, sales, personnel, billing, and manufacturing. As business needs evolved, however, it became necessary for individual IT applications to be integrated in order to support new business requirements. As organizations expand, become more distributed, and rely more on technology, there is a need to ensure both business processes and technology systems, which must be co-coordinated in a strategic manner, focusing the business component of the organization's processes. Many strategic initiatives of an enterprise, such as e-business, customer relationship management and supply chain management depend upon enterprise integration.

There are four basic integration architectures, namely, batch integration, point-to-point integration, broker-based integration and business process integration. Each integration architecture represents different levels of enterprise integration maturity. Enterprise integration is a significant undertaking, and carries with it significant technical and managerial challenges. Managing enterprise integration projects requires, among other things, a strategic framework, senior management support and risk management. Understandably, there are several major elements within the strategic framework to consider: the organisation's business strategy, business directions, and consequently, the overall business case for enterprise integration; the way in which the organisation engages and interacts with business partners; business processes within the organisation and how they span across units within the enterprise; the enterprise IT architecture and portfolio of existing IT systems; the management of change associated; the integration requirements for individual projects; risk management.

An enterprise integration initiative therefore needs to be seen as a program that provides a coordinated and controlled platform for integration that is capable of

suffing the integration requirements of specific projects within the organisation.

2 Integration challenges

Enterprise integration is an activity that is business driven rather than technology driven, coordinates business processes with and across different parts of the enterprise, involves multiple stakeholders, adopts a strategic rather than tactical or localized view.

Enterprise integration is not some new technology that will come and go, but an essential feature of how IT solutions need to be designed in order to address today's business requirements.

Some of the generic kinds of business problems that enterprise integration can help solve include the following:

-Information aggregation: aggregating, organizing, and presenting information from multiple IT sources in one single view

-Single point of data entry: replacing the need for manual and duplicate data entry into multiple IT applications with data entry into a single IT application

-Process inefficiency: reducing the effort and time required to complete business processes and eliminating manual inefficiencies

-Web channel integration: enabling Web-based customers and partners direct access to the services provided by existing business systems

-Supplier integration and supply chain optimization: enabling a supplier to integrate with a larger company's business process or an electronic marketplace.

The main two challenges in organisation's integration are the technical and management challenges.

Technical Challenges

The technical challenges of the organisations include the following aspects regarding the technologies employed in enterprise integration, which are both complex and diverse:

-Stand-alone design (legacy IT systems that were originally designed to stand alone, legacy IT systems that lack a published API or set of external interfaces)

-Internalized data models (packaged applications with internalized data models that are not meant to be shared with other IT systems, no data access or sharing of data from interfaces)

-Heterogeneous technologies (different IT systems use different platforms, applications, and programming languages, the presence of multiple distributed computing paradigms, for example, COM, EJB, and CORBA)

-Legacy engineering (IT systems that use very old and possibly unsupported technology; original designers are no longer available and system documentation is sparse,

compatibility issues between old legacy technologies and modern Web-based technology)

-Lack of interfaces (many IT systems that lack published interfaces or APIs that provide other applications access to functionality within the system, interfaces or APIs that are restricted in functionality, or mandate the use of a particular programming language such as C++)

-Semantic mismatch (semantic differences in the interpretation of data within individual IT systems that complicate the exchange of information, multiple business partners using proprietary business semantics and terminology)

-Unclear business processes (ill-defined and ad hoc business processes between organisational units)

-Standards (use of proprietary and organisation-specific standards for business data and documents, multiple business partners each with their own set of standards, a lack of universally adopted standards, and new emerging interoperability standards such as XML and Web services)

-Security (providing a consistent level of security across all integrated IT systems, providing users with single sign-on (SSO), and integrating authentication and authorization policies used by individual IT systems

Managerial Challenges

As well as the technical challenges, there are several management challenges.

-New collaborations (working across traditional organisational boundaries and silos, a more intimate working relationship with external partners, overcoming differences in organisational policies, working practices, culture, and internal politics)

-Project scoping (satisfying the enterprise integration needs of multiple stakeholders, agreeing on a project scope that can be realistically achieved given limited resources, estimating project resources and timelines for a complex project

-Continued stakeholder support (obtaining support from business stakeholders throughout the entire enterprise integration project life cycle, including detailed requirements analysis, business-process modeling, and user testing)

-Data ownership (resolving data ownership issues in situations where data are spread across different organisational entities, determining the policies regarding who has permission to change what data)

-Time constraints (the need to deliver enterprise integration solutions rapidly in order to meet time-sensitive business requirements)

-Cost constraints (the need to deliver effective, value-for-money enterprise integration solutions, operating within a set budget that offers little, if any, flexibility for cost overruns)

-Migration (the need to keep existing business-critical IT applications running while the enterprise integration

solution is being installed, executing migration plans that minimize downtime)
-Expertise (sourcing the necessary enterprise integration expertise, whether in house or externally).

3 Integration architectures and strategies

Integration strategies

Most enterprise integration projects generally fall into one of three project categories: enterprise application integration (EAI), business-to-business integration (B2Bi), and Web integration,

An EAI project is concerned with integrating the IT applications that reside within the organisation, for example, the integration of the customer-accounts IT system with the order-management IT system. A Web integration project is concerned with integrating an organisation's IT applications with Web applications to provide a Web channel. A B2B integration project, on the other hand, is concerned with integrating an organisation's IT system with those of its business partners or suppliers such as in an extended supply chain.

One of the main factors to consider when designing integration solutions is integration timeliness, or the manner in which IT systems communicate with one another. In real-time integration, IT systems communicate immediately with each other as and when required, and there is no time delay in the communication. Imagine, for example, a Web site that communicates with a back-end stock-price system to provide users with up-to-date information about stock prices. However, where there is a time delay in the communication, the integration is known as asynchronous.

Levels of integration

Organisations need to decide whether their integration needs are for real-time integration or asynchronous integration. Given the business climate of short processing and faster turnaround cycles, there has been a general move toward real-time integration and the adoption of an event-driven architecture. However, for some organisations, the cost and feasibility associated with adopting an event-driven architecture may be prohibitive.

Another way of looking at integration is in terms of the level at which integration occurs. Integration can occur at five levels. Each successive level of integration represents what might be considered a more advanced form of integration.

-Presentation integration: The aggregation of data from multiple IT systems within a single view. A Web portal that aggregates and displays a customer's stock portfolio

taken from one IT system and bank account balance from another IT system can be considered integration at the presentation level. However, there is no direct communication between the individual IT systems.

-Data integration: The synchronization of data held in different databases. For example, if two different databases hold the same customer's address details, a change of address in one database should also by synchronized in the other database. If this synchronization takes place only after a period of time, a certain amount of data freshness will be lost.

-Application integration: Where applications make some of the functionality directly accessible to other applications. Popular packaged applications, for example, such as SAP and PeopleSoft, often expose their functionality through well-defined application programming interfaces (APIs).

-Service integration: A common set of reusable services that are made available to other applications. For example, a service to obtain a customer's status may be created that can be called by any other application within the organisation. Such services are usually built from a set of specific application functions.

-Process integration: The definition of business-process or workflow models from which reusable services are called. Process integration is particularly relevant in collaborative contexts, such as B2B, where there business processes drive interactions and transactions between business partners.

To date, the integration efforts of most organisations have largely been focused on the presentation, data, and application integration levels. However, more organisations are now realizing the benefits and potential for integration at the service and process levels. This is evidenced by the interest in service-oriented architectures (SOAs), which we will discuss in more detail later on.

Integration architectures

There are four basic kinds of integration architecture: batch integration, point-to-point integration, broker-based integration, and business-process integration. Each kind of integration architecture represents differing levels of sophistication, as illustrated in Figure 1.

It is not always the case that an organization should strive to achieve the most sophisticated integration architecture. The appropriateness of the integration architecture largely depends upon the business requirements for integration, and also on what can be achieved with the available technology.

Each kind of integration architecture has its own capabilities and limitations. With batch integration architecture, the simplest type of integration architecture, IT applications communicates asynchronously with each other and there is no business requirement for real-time processing. Batch integration architecture is often

suitable for organisations that perform high-volume back-end processing that is able to take place overnight, weekly, or on a scheduled basis.
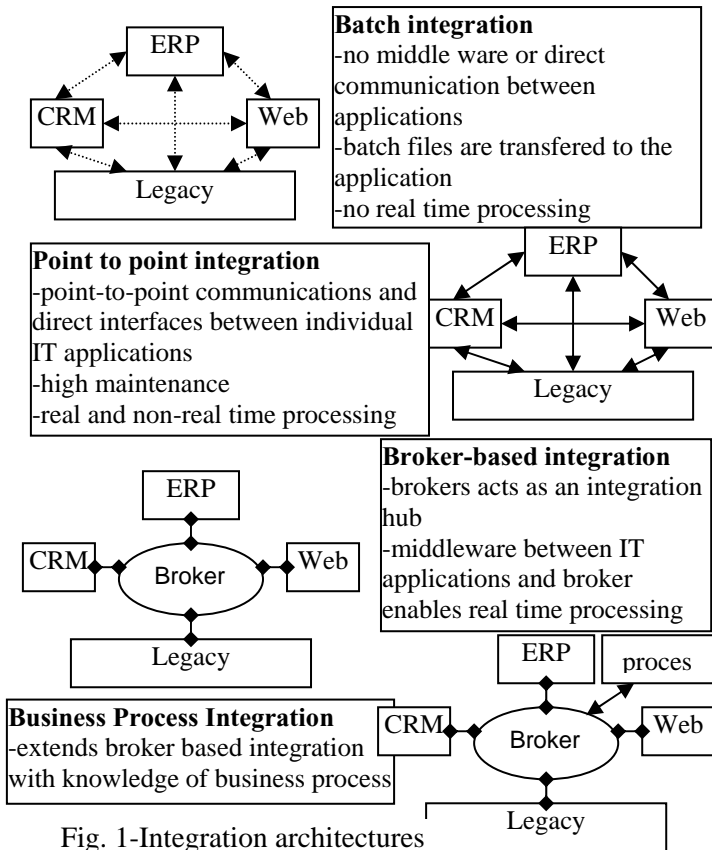

Fig. 1-Integration architectures

In a point-to-point integration architecture, IT applications communicate with other IT applications through interfaces, communication supported by these interfaces may be real time or asynchronous, the number of interfaces to be built rapidly grows as the number of IT applications increase. A point-to-point integration architecture is most suited when the number of IT applications to be integrated is small. However, as the number of IT applications grows, the number of interfaces to be maintained becomes problematic, and broker-based integration architecture becomes more appropriate. In a broker-based integration architecture, an integration broker acts as a hub for connecting IT systems. A good analogy is to view an integration broker as a major airport that serves as a hub for connecting flights to smaller cities.

Broker-based integration architecture supports real-time integration. Such tools provide the basic integration broker and messaging infrastructure, but adapters must be purchased to interface with the kind of IT systems that reside within the organisation. Business-process integration architecture builds upon the broker-based integration architecture by adding the concept of business processes that trigger the relevant messages to

be sent to individual IT systems. For example, when a banking customer opens up a new account, the business process may involve doing a background check, creating an account if the background check is positive, and then sending a notification to the customer. Each step in the business process involves communication with different IT systems.

Service-Oriented Architecture

A new development in the area of integration architectures is that of SOA. In SOA, IT systems expose business functionality as services that can be accessed by other IT systems, both internal and external to the organisation. A set of standards, known collectively as Web services, enables services to be implemented in a standardized and consistent way, which allows them to be accessed via an intranet or the Internet.

In an SOA, organizations can treat services (whether provided internally or externally by another organisation) as a kind of building block from which they can compose new applications. Creating a service in the first place requires some initial development cost, but the cost is amortized when the service gets reused across multiple applications. In an SOA, IT systems are loosely coupled and, with Web services, use a common standardized protocol to communicate with each other. This makes the job of integration much easier and therefore potentially much cheaper as no special tools or proprietary technologies are required.

Advantages of SOA

The potential advantages of SOA are as follows:

-Shorter development cycles: an organisation is able to rapidly create IT applications from the reuse and composition of existing services. The need to write new code from scratch is kept to a minimum.

-Lower development costs: the overall costs of IT are lowered due to the reuse of existing services.

-Simplified systems integration: IT systems that expose their functionality as a set of services are more easily integrated with other IT systems that are able to tap into those services.

-Increased business agility: an organisation can respond to changing business requirements more effectively because it is able to create new services and IT applications more quickly.

-Improved quality of service (QoS): customers and end users experience an improved level in the QoS because SOAs allow poorly performing services to be easily substituted with improved services without affecting other systems.

4 Conclusion

Enterprise integration solutions can be large, complex, and costly. It is therefore important that enterprise integration requirements are understood before the

organisation proceeds to design, develop, or procure an integration solution. A framework for gathering enterprise integration requirements contains five major categories: connectivity, process support, data exchange, security, quality of service.

The application and processes integration must take into consideration the following aspects:

-Strategy (understanding business needs, monitoring industry trends and movements)

-Business Processes (re-engineering the existing processes, enabling new processes, locating points of flexibility for business agility)

-Enterprise Architecture (establishing an architectural vision, identifying new technologies and strategies for integration, creation a technical framework)

-Change Management (transitional and development plans, new organisational role and responsibilities)

-Projects (defining project scope and requirements, analysis, design, testing, evaluation)

-Business Partners (identifying new ways of trading with existing and new partners, exploring new alliances and outsourcing opportunities)

The organization's integration is a complex, multifaceted task, with a great risk regarding the implementation, that must take into consideration various and heterogeneous aspects (of technical, managerial or human resources nature), but it represent a reality that must be overcome in order to ensure a proper functionality of the enterprises.

References:

[1] Mehdi Khosrow-Pour, *Encyclopedia of Information Science and Technology*, Idea Group Publishing, 2005

[2] Omar Khalil and Syed Mahbubur Rahman, Knowledge and Information Technology Management: Human and Social Perspectives, Idea Group Publishing, 2003

[3] Harold Kerzner, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Eighth Edition*, John Wiley & Sons, 2005

[4] Wing Lam and Venky Shankararaman, *Enterprise Architecture and Integration: Methods, Implementation and Technologies*, IGI Publishing, 2005

[5] Margaret K. Kulpa and Kent A. Johnson, *Interpreting the CMMI: A Process Improvement Approach,* Auerbach Publications, 2003

[6] Boris Mutafelija and Harvey Stromberg, *Systematic Process Improvement Using ISO 9001: 2000 and CMMI*, Artech House, 2003