Spatial world chants the EAI mantra

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Abstract

In today's scenario of rapid and continuous Business Process changes and requirements there is a demand for upgradation to the best of state-of-art Technology. As the scope of industry is extending and developing into cosmopolitan by nature, business policies are becoming more global. Information should flow from desk-to-desk, department-to-department, organization-to-organization, organization-to-partners and organization-to-customers. The Industry direction is maneuvering towards Enterprise Application Integration. It is indispensable for GIS corporate to adopt these growing challenges and move forward with this technology surge, lest they may loose to their competitors. In this paper we will focus on the GIS developments in align with the EAI advances. We start off with quick EAI perceptions and then look into the evolution of Enterprise Application Integration and the framework that builds it, discuss different strategies, standards and key points in EAI. We cover the spatial orbit and other Technical factors involved in enterprise level integration along the stream.

Introduction

The globalization of Business segments and rising battalion of e-commerce is driving a change in the Business Process logic. The major propellers for this revolution are business rationalization through ROI, Mergers and Acquisitions, limitations of Legacy systems and short-term business goals with shorter life cycles. Consequently, there are continuous amendments to the business requirements. To meet this change we need to streamline the Business Processes by integrating diverse systems within the enterprise and beyond. The cost-effective configuration for this process is realized by loose-coupled Integrations using Enterprise Application Integration.

There are various EAI definitions, which developed from time to time based on theories and hypotheses.

A congruent definition for EAI:

"EAI institutes a basic framework of Technology to coherently hook up disparate systems into single entity that renders Information sharing between organization, partners, customers and other stakeholders."

Evolution of EAI

Primitively Enterprise Resource Planning (ERP) systems were promoted for providing tools to perform business analysis. Then came the requirement to leverage existing applications in the ERP tier. The answer came out as Enterprise Application Integration. Thus, EAI is more a User-Driven market. Companies are moving their framework from intra-business to inter-business model focusing on large-scale integration of data and business process. However there is

missing link called 'Geography'. In order to establish a true Integrated Business environment it is imperative to add the 'Geography' dimension also.

Integration Framework

Enterprise Integration solution is classified into five levels of Integration.

- Business Process Integration
- Application Integration
- Component Integration
- Data Integration
- Platform Integration

Business Process Integration

Business Process Integration is the highest level of abstraction and manageability. This integration enables business directors to define, change and manage information flow across various applications. Several Vendors are providing process models developed through graphical modeling interface. This solution can be a part of the whole EAI or an add-on.

GIS also represents a Business component like other business units that enable the provision of Business Services. There is a big move away from traditional GIS applications to specific spatial tied applications. Integrating GIS with day-to-day operational applications such as Outage Management Systems (OMS), Work Management Systems (WMS), and Mobile dispatch is an example, when it comes to Telecom industry.

Application Integration

Application Integration draws closer to real-time integration. The structure of Application Integration involves basic platform integration, data translation, transformation and rules based routing, Application interface integration and applications themselves. This is applied when there is sharing of data among applications.

For example, to upgrade an Address Management System for the analysis of, say, crime patterns or voters registration, the problem is extra efforts are required in integrating a wide variety of old and new custom and COTS(Commercial off-the shelf) applications and also support the future Web-Enabling. A single, flexible platform ensuring connectivity and data integrity across the constantly changing hardware and applications is required to maintain the real-time network. In fact most of the people are moving to several more loosely coupled databases managed by different major applications like ERP or work management or GIS. Then Application Integration of these systems handles data flow between the heterogeneous systems meeting the above constraint.

Component Integration

Component Integration provides easy coupling of new services to the existing ERP packages and legacy systems. This is effectively managed through Application Servers.

Component Integration helps in adding GIS capabilities to other enterprise information systems such as Outage Management, Customer Information, and Enterprise Resource Planning.

Data Integration

Data Integration provides tools to obtain and commit data directly, eschewing application logic. This is realized through Database Gateways, Extraction/Transformation tools, and Reporting Generation tools. These tools are sought when fairly large data transfers are carried out.

Many tools are developed to provide enterprise database integration for Geospatial data, aiding live access to corporate data within the privileges granted to each user.

For example, using GIS technology and Water Company billing information, it is possible to simulate the discharge of materials in the septic systems in a neighborhood upstream from a wetland. The bills show how much water is used at each address. The amount of water a customer uses will roughly predict the amount of material that will be discharged into the septic systems, so that areas of heavy septic discharge can be located using a GIS.

Platform Integration

Platform Integration ties up various Legacy systems, hardware, Operating Systems and other application platforms. Object Request Brokers (ORBs), Remote Procedure Calls (RPCs), Remote Method Invocation (RMI) and Extended Java Beans (EJB) are today's technologies in Platform Integration.

Most of today's GIS systems have open architecture design and support the state-of-the-art-technology like CORBA, XML and EJB that makes GIS-Enterprise Integration Process neutral to heterogeneous platforms.

Characteristics of EAI Solution

The entire framework provides adequate input for building EAI solution that supports the following qualities:

- Capable of integrating applications within the enterprise as well as across the enterprise.
- Imbibe the ongoing changes in IT business infrastructure.
- Support open standards on varied topologies.
- Eliminate redundant data repositories
- Reduce overall cost of IT infrastructure
- Facilitate business process management
- Easy and speedy transaction processing
- Automation and generalization

EAI Architecture

Traditionally integration was point-to-point having direct interface between the systems to be integrated. This approach requires unusual efforts as the number of applications increase and moreover causes loss of data integrity.

A better attempt is using an Integration Bus methodology. EAI applies this 'middleware' architecture to improve messaging, set up a common connectivity and provide security.

There are 3 major types of Middleware

- Message-Oriented Middleware (MOM)
- Remote Procedure Call (RPC) Middleware
- Object Request Broker (ORB) Middleware

Message-Oriented Middleware (MOM)

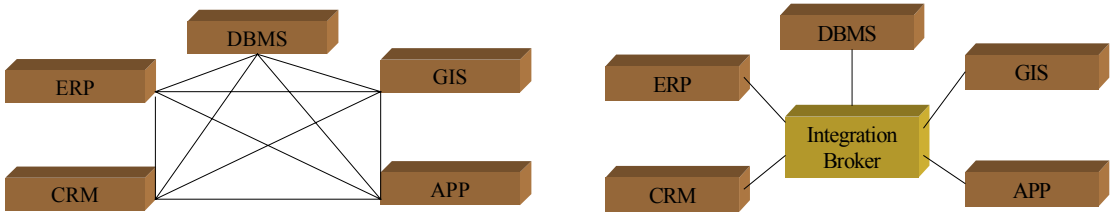
MOM enables movement of data packaged as messages between independent applications on multiple platforms and across disparate networks with a guarantee of delivery. MOM is used in distributed networks to manage the message distribution, receipt confirmation, and error handling processes

Remote Procedure Call (RPC) Middleware

RPC is synchronized with basic data-type translation and connection-oriented communication services and can also refer to products that use Interface Definition Language (IDL) to describe the argument lists for outgoing and incoming parameters. Normally DBMSs and Database Gateways incorporate RPCs into their applications.

Object Request Broker (ORB) Middleware

ORB Middleware connect at the business logic level by using defined standards and connecting objects, such as customers, accounts and transactions. This is most suitable to organizations obtaining new applications or developing applications internally.



Using Point-to-Point

Using Middleware

Middleware Message Services

Most of the EAI models apply message broker that is built on Message-Oriented Middleware (MOM) to enable integration at either application level or database level, as it is very flexible, reliable and secure.

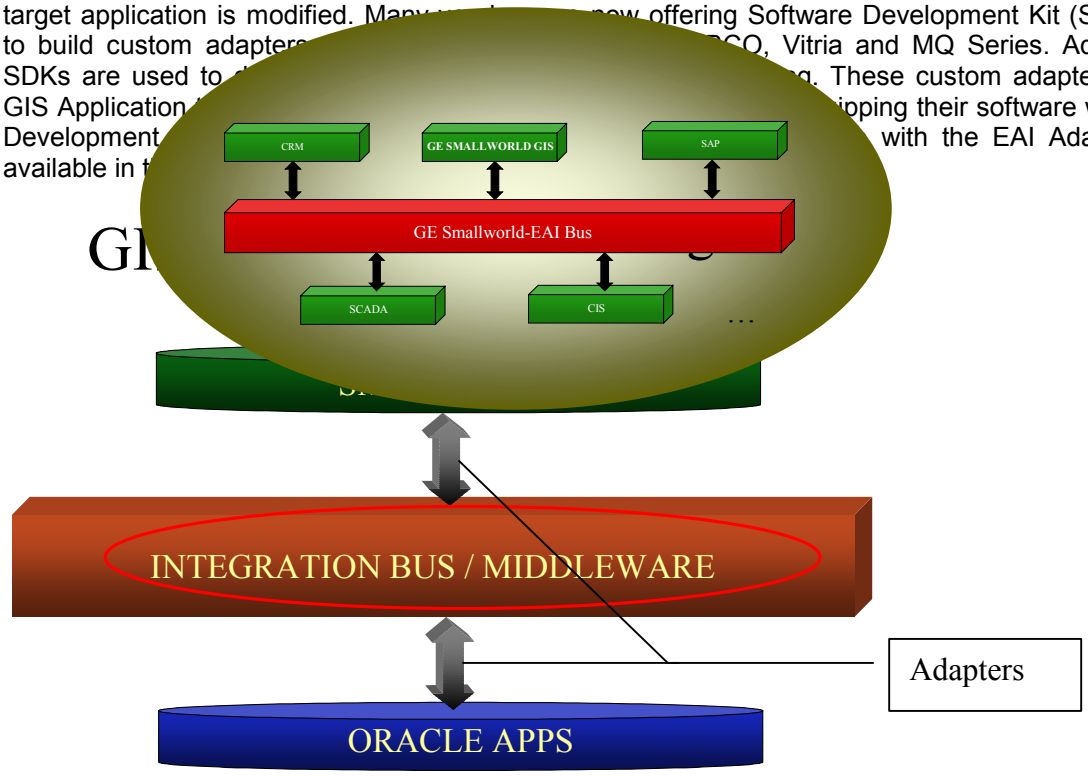
To address message tracking on a distributed network, MOM supports different message services like Store and Forward Middleware, Publish and Subscribe Middleware, Event Registry and Intelligent Routing Services.

Store and Forward services holds messages in a central queue if the recipient is Offline. An email application illustrates this method. Event Registry Services enables the establishment of an event registry and event monitoring services as in Transaction Processing Monitor(TPM) Software. Intelligent Routing Middleware Services ensure the message gets delivered to the appropriate recipients in the correct sequence. Some software that are capable of letting the end-user to create “pre-routing” do it through Intelligent Routing. Publish and Subscribe Middleware may publish event messages to the subscribed applications. For example, an inventory is moved and the inventory manager wants to locate it geographically on the map. The Inventory system and the GIS system subscribe to the event. Inventory system publishes a locate event and the GIS system receives the event message and initiate processes to fetch the spatial coordinates and locate the inventory on a graphical map. Middleware can divide, reconfigure and string up messages based on predefined rules. The reconfigured messages are sent to appropriate target systems. It utilizes rule engines, transformation engines, and intelligent routing mechanisms to transform data from application-specific to a common unit and vice-versa.

GIS Enterprise Architecture

As said above connectivity of GIS to other Enterprise applications is better achieved by an "integration-bus". In this, all systems talk to a single integration bus, which is a system (i.e., middleware) that manages the passing of messages among applications. The Integration broker performs routing and transformation for each message based on a specification.

Message-brokers mostly provide interfaces that connect applications to the common integration-bus. These interfaces are called "adapters" or "connectors". Adapters in addition to read/write data between applications, also provide a means to apply data transformation, security and business rules attached to the application logic. It is also possible to extend or modify the adapter if the target application is modified. Many [illegible] now offering Software Development Kit (SDKs) to build custom adapters [illegible]CO, Vitria and MQ Series. Adapter SDKs are used to [illegible]g. These custom adapters let GIS Application [illegible]loping their software with a Development [illegible] with the EAI Adapters available in t[illegible]



Industry Standards

With so many EAI providers/vendors from different organizations and different nations, there is desideratum to adhere to some common Industry standards. Standards are emerging to be the most powerful entity in Integration orbit. Right now the standards are at an infant stage. Only when we arrive at a more matured standard framework then only we can eliminate the heterogeneity in the Enterprise Application Integration.

While considering spatial integration with enterprise the following standards are normally followed:

- Open GIS Consortium
- Spatial Data Transfer Standard (SDTS)
- Proprietary Formats (like Smallworld ds file and ESRI Shape file)

Composition of EAI Package

Normally EAI packages include the following components:

1. An Integration Broker
2. Tools to build Connectors /Adapters into Applications
3. Adapters
4. Monitoring, Administration and Security facilities

Also middleware should contain the following advanced features:

- Required Type of Messaging – Asynchronous and Synchronous
- Routing / Workflow Engine to support complex Business Processes
- Pre-built transformation functions
- Application Deployment and Monitoring environment
- Monitoring Tools for Transport services and message warehouse
- Integrated Development environment with metadata repository and support to Configuration Management.

Additionally they may extend the features to support E-commerce, Portal Services and Web-Services.

All the EAI components put together provide architecture to integrate disparate applications and enable real-time business processes. EAI addresses application-to-application integration, but it doesn't support the Process definition controlling those applications. Business Process management (BPM) comes into aspect in this territory. By adding BPM to EAI architecture we obtain Total Business Integration.

EAI Implementation Guide

While implementing EAI solution, a number of factors come into consideration.

1. Plan, delineate and map the IT requirement to Business Strategy
2. Evaluate Business process and data models
3. Measure the ROI for the EAI investment
4. Develop an EAI architecture based on integration characteristics.
5. Establish definite canons, regulation procedures, ownership and accountability.
6. Compare different EAI packages in the market based on their maturity, case studies and suitability to the designed model.
7. Evaluate technologies- scalability, adaptability, extensibility, standards, redundancy and infrastructure.
8. Check for the development Tools to build seamless custom interfaces.
9. Check for administration tools and processes to monitor the system
10. Buy the suitable EAI solution
11. Pilot the EAI solution in a real environment

Spatial integration needs largely to peep into other factors like:

1. Acquiring the appropriate GIS infrastructure required for Enterprise Integration
2. The conversion/migration strategy required for construction of the geospatial and attribute data.
3. Where data sets will reside? Build overall architecture placing GIS in an effective position.

Are you choosing the right EAI solution?

Before choosing the EAI solution, give a thought to the following:

1. If the integration includes enterprise resource planning (ERP) software packages or call-center packages, make sure you have the required expertise.
2. If the integration includes Custom-Applications, you may require bridging them to the message backbone.
3. The data has to be published across the business horizons.
4. If the infrastructure required by the EAI package is not provided, you may have to put up some infrastructure.
5. The last but most important factor is –Piloting and Testing. How much time will be required to test the package? Evaluate the efforts for this.

EAI network is a one-time implementation. The significant point to note is that it may be extended easily but replacement will cost fairly large.

Points to be noted for Spatial Integration

Integration of a spatial system poses special considerations and risks, due to:

- The complexity of spatial data structures
- Integrating a design environment (long transaction) with other systems
- Visual or graphic information content of maps

When integrating spatial systems since these systems will typically be involved in composite application integration – the most demanding form of integration requires the most advanced tools.

Some gunpoint measures:

- One important decision is in choosing Messaging Paradigm. If companies are looking at distributing information between applications over the Intranet or the Internet, then it is worth considering the middleware products for messaging based EAI. This solution should support multiple clients and address heterogeneous operating systems, databases and applications. IBM Message Queue, Java Message Service (JMS), SeeBeyond™, TIBCO™ and Vitria are moving headway in this approach. But the messaging systems fall short of some basic scalability requirements. In such case investing in more powerful hardware to gain performance will be a logical move.

- One more constituent of enterprise messaging architecture to be considered is the choice of network protocol. For applications across Internet/enterprises, TCP/IP messaging system and for inside Enterprise/LAN IP multicasting will be a proper choice.

- XML can be used to describe structured data and is often appropriate for the content of messages transmitted by a messaging system or for data passed between CORBA objects. Indeed, XML compliant EAI extends the integration capabilities to provide browser-based access for end-users and enable the integration of the e-commerce site.

- Another aspect is the Routing process. Each of the major EAI products offers a mechanism for flexibly routing messages. Most EAIs provide request / reply, publish / subscribe routing, as well as both content-based and logical address routing. Content-based routing introduces a conditional element, which can (in principle) be based on

anything that can be incorporated as part of the content of the message. Pre-defined routing can be extremely efficient wherever it is applicable.

- Transformation Engines are required when altering message content between source and destination. Conventions to be followed for transformation Engines:

    - Event-driven content merge and split
    - XML support
    - Support to multiple records from one source but separated in time
    - Support to multiple sources

Spatial technology and systems throw special challenges - demanding, complex applications - that make the choice of EAI solution even more difficult although emerging standards for the web and for application integration will make a difference.

Where are we heading?

So far what was discussed previously has focused on Enterprise Application Integration, the wing that will actually glide EAI is Internet. Internet allows the same basic approach to be used for e-business. In terms of "uniting the enterprise," Internet technologies combined with advances in portable devices and wireless communications will have an enormous effect during the next two to five years. It will be possible for mobile users to access sophisticated applications and corporate databases wherever they are via lightweight hand-held units and wireless communications. The convergence of all these technologies will revolutionize the way we use geospatial technology (and many other things) over the next few years.

Conclusion

Every year companies spend huge amounts to build and maintain individual integration solutions. EAI will definitely cut down the cost factor and enhances the information velocity. But at the same time careful evaluation and selection of the right EAI solution is equally significant. The flexibility to incorporate powerful best of breed application solutions enterprise wide is one of the most potent ways for an organization to get rapid ROI. Spatial technologies are an excellent example of this. The growth of EAI depends mostly on the Enterprise heads decisions, long-run investment, Architecture refinement and globalization of Standards.

Acknowledgements

I thank Mr. B.V.R. Mohan Reddy, CMD, InfoTech Enterprises Limited, and Mr. Rajeev Lal, Chief Operating Officer who have been a constant source of inspiration and dynamism to me. A special thanks goes to Srinivas Uppuluri and Ashish Gupta who meticulously provided substantial and valuable comments and ideas. I am also thankful to all my associates who are directly or indirectly involved.