

# EAI: A Business Perspective

BY RAVI ACHARYA

**A primary goal of EAI is to ensure that enterprise systems can communicate and share information in the most efficient way possible.**

**Rapidly changing business landscapes drive the demand for new or enhanced technical infrastructure. To meet immediate business requirements, developers frequently design applications as self-contained entities, giving limited consideration to integration with existing or future external systems. Ultimately, a variety of disparate systems is developed that may not collaborate efficiently.**

Gartner refers to this as application spaghetti. Figure 1 shows how a typical enterprise infrastructure can be better managed and deployed as an EAI solution.

Enterprise Application Integration (EAI) comprises the processes and technical tools that enable the successful collaboration of disparate, distributed systems. Successful EAI implementations typically involve more than just software development. They include several process definitions and even a certain amount of business process reengineering. An EAI implementation is a strategic initiative, which implies designing an enterprise-wide framework into which existing and future systems can plug in with minimal redundancy and associated costs.

In Figure 1, the EAI implementation centers on an EAI hub, which is used to perform and manage certain functions such as messaging, routing, business rule processing, data transformation, and external connectors.

A primary goal of EAI is to ensure that enterprise systems can communicate and share information in the most efficient way possible. EAI solutions

provide generic mechanisms and techniques that enable multiple systems to be plugged in, using well-defined interfaces. By providing connections to, or wrappers around, existing enterprise applications, EAI leverages existing systems to produce a consolidated view of information. EAI can also be extended to include business partners, enabling efficient information exchange and transactions.

### Business Value Proposition

Over the past several years, IT departments in large organizations have built or bought various enterprise systems to meet business demands. However, many such systems were designed to meet the requirements of a particular problem, without regard to integration.

A large organization could have software systems supporting its accounting, human resources, and other departments. As it seeks to share information across these systems, it builds customized interfaces for the required point-to-point integration. The application spaghetti scenario emerges when several interfaces are built between applications.

Organizations seek to generate the maximum possible return on all investments. To make sound business decisions, it's often imperative to have an accurate, consolidated view of information stored in multiple systems. So IT departments must provide the required information in the most efficient manner. EAI provides a scalable mechanism for consistently integrating existing and future systems to enable efficient information retrieval and analysis.

Companies also are trying to better integrate with their customers and suppliers to reduce costs and improve revenues. EDI has been widely used to exchange information. However, EDI technologies are usually proprietary and expensive. They also don't provide a consistent way to integrate with internal enterprise applications. EAI solutions that use XML as the data format and the Internet as the communication medium provide attractive alternatives to EDI. By relying on open standards, organizations can also select solutions from multiple vendors based on existing infrastructure and future requirements.

EAI solutions should be strategic ini-

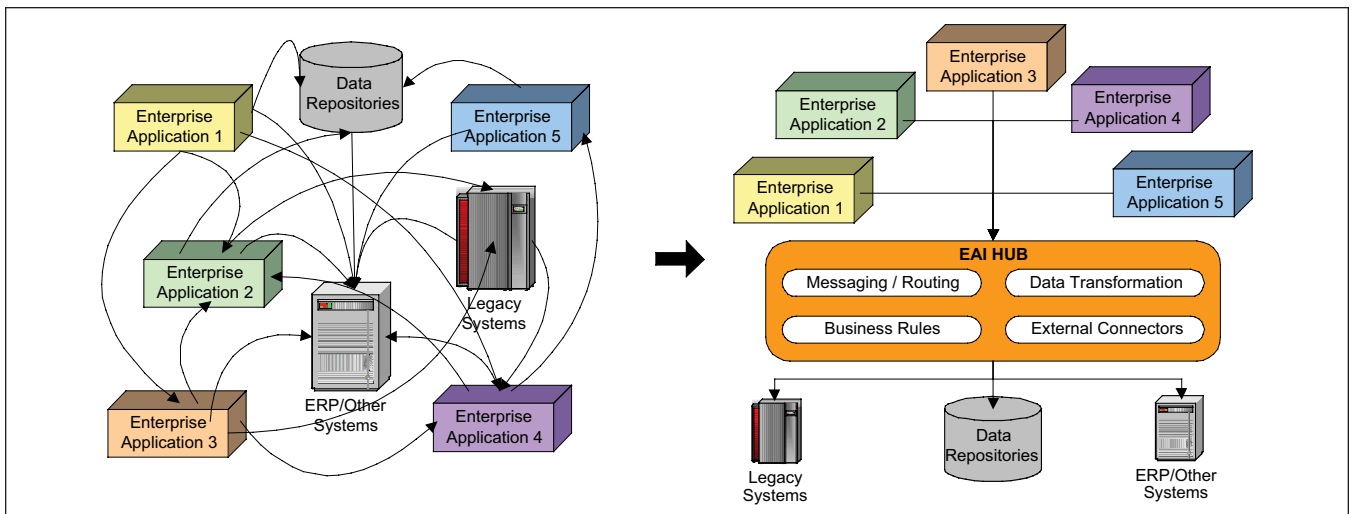


Figure 1 — Application Spaghetti vs. EAI Implementation

tatives, deployed in a phased manner, satisfying the most important business needs first. The following sections further discuss the business value of strategic EAI solutions.

### Sample Cost-Benefit Analysis

EAI promises more long-term savings than may be initially apparent. According to Gartner, approximately 30 percent of the budgets for all future enterprise IT projects will be spent on external application integration. As the number of applications increases, the number of interfaces increases exponentially. As the number of applications rises from 1 to n, there could be need for up to n-1 new interfaces.

Figure 2 shows a numerical analysis of required interfaces and associated costs. It uses Gartner's estimated cost of integrating each application. It's assumed that the cost of one enterprise application is \$100,000 and that all applications have the same cost and complexity.

Clearly, there are significant long-term cost savings to achieve by implementing a successful EAI solution.

### Strategic Enterprise Development

The ultimate beneficiary of a successful EAI solution is the entire organization. Users in both technical and business units will benefit from having access to an accurate, consolidated view of the enterprise. Key characteristics of an EAI project that make it strategic include:

- Executive sponsorship — Upper management must approve and support the entire implementation, requiring several groups in both the business

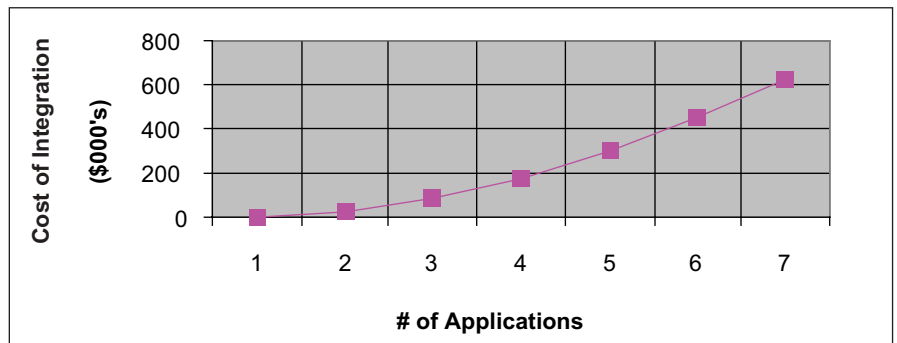


Figure 2 — Integration Cost vs. Number of Applications

- and technical units to collaborate.
- Cost-benefit analysis — An immediate financial benefit may not be explicitly apparent. It's therefore necessary for project leaders to ensure that they can justify the long-term benefits, which will typically more than recover initial investments.
- Process management — Business processes need to be defined, enhanced, implemented, and managed to produce a successful EAI solution.
- Structured approach — A formal, proven methodology must be used to ensure that all the relevant steps are being followed for a successful implementation.
- Architecture and process standards — It's essential to ensure that well-documented standards and techniques are adhered to while creating the solution, to prevent creation of further disparate systems.
- Leverage existing investments — EAI is also attractive because it supports reuse of existing systems. Unlike an ERP or billing system, EAI connects existing systems to generate better business and technical value.

Figure 3 shows an over-simplified EAI solution that describes data communications and integration between a legacy billing system, externally located ERP system, and an executive decision support system. The diagram shows how data from the ERP system can be securely transported via the Internet to the corporate legacy billing system, using XML. Here, a high-level logical view of the connector framework is shown to illustrate how the information from the various systems could actually be processed and inserted into other systems. Subsequently, the information from these and other applications is aggregated and made available to the decision support system to facilitate decision-making.

### Industry Trends and Market Analysis

The following market indicators were identified in reports from major industry research groups:

- Buy vs. build — Organizations are thoroughly examining available options for EAI implementations. An important

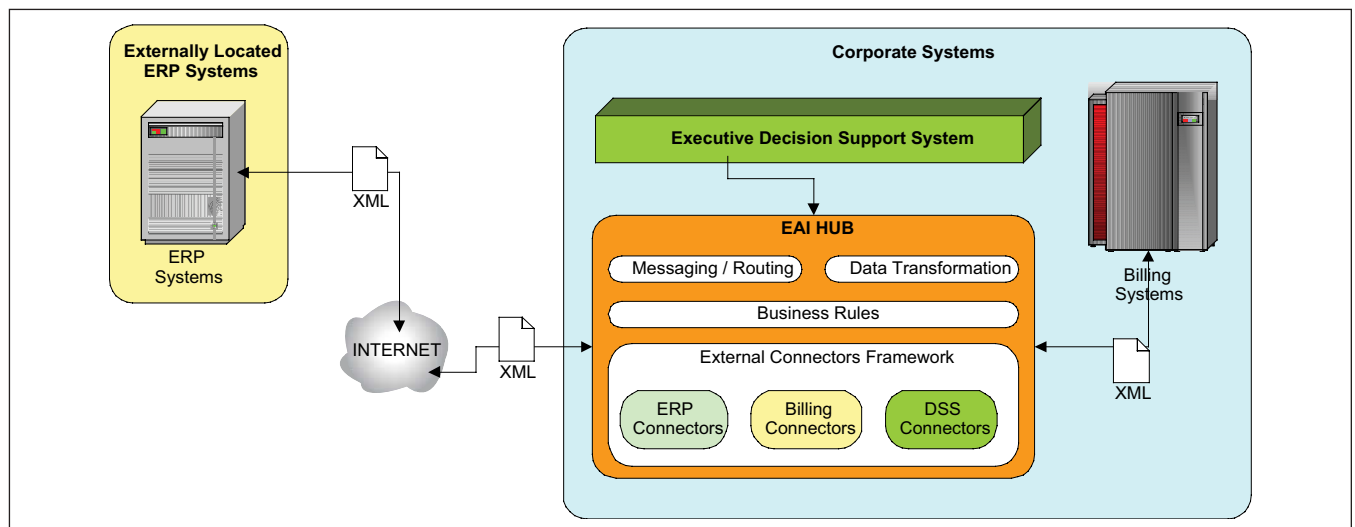


Figure 3 — EAI Example



## Well-managed EAI implementations result in strategic, scalable solutions that yield an attractive ROI.

decision is whether to buy a packaged solution or build a customized one. Although major EAI software vendors (e.g., SeeBeyond, TIBCO, Microsoft and webMethods) report stable or improving sales, enterprises are seriously considering building their own custom EAI solutions. They also can be designed to address only the required needs of an organization rather than implementing an entire suite, of which only a small percentage of functionality may be needed.

- Short-term, focused projects — Organizations are beginning to work on smaller, focused EAI solutions. There have been many cases of large, multi-year EAI projects going bad for various reasons. Systems integrators constantly find that implementations of EAI solutions have been poorly executed due to incorrect or incomplete processes and techniques. So organizations seek to solve their most important issues while integrating up to five enterprise applications. They're focusing on more data integration initiatives that will accelerate solution deployment.
- **Leverage existing application server infrastructure** — In recent years, several organizations have invested heavily in application server infrastructure (e.g., IBM WebSphere, BEA WebLogic). Current trends indicate that companies are more likely to extend the functionality provided by the application servers, rather than investing in entirely new architectures. Companies such as IBM and BEA are rapidly trying to capitalize on this trend by providing other EAI-specific features such as Business Process Management (BPM) tools in their newer versions.

### Types of EAI

Enterprise systems architecture typically consists of several logical tiers:

- Presentation tier interacts with users via PCs, Personal Digital Assistants (PDAs), and other media

- Business logic tier houses the applications that perform business functions, typically hosted on Web servers and application servers. This tier can be further divided into multiple tiers for more complex systems.
- Data tier provides permanent storage of business information in databases, files, Lightweight Directory Access Protocol (LDAP), and other persistent media.

It's therefore possible to integrate applications at any of the three major tiers.

### Data Tier Integration

Ensuring that all corporate databases are accurately synchronized is a primary requirement of IT managers. Using EAI mechanisms to perform the data integration is logical. It reduces the use of point-to-point integration, which could become unmanageable for large numbers of databases.

### Data Integration Benefits

- The EAI hub is used to connect multiple databases, resulting in a consolidated view of information.
- EAI connectors perform the data manipulation. This provides a layer of abstraction to ease ongoing enhancements and maintenance issues.
- Components of the EAI hub, including messaging and data transformation, are used in data integration.
- The databases can be of various types, located in disparate locations.
- The EAI hub is responsible for securely, reliably transporting the data (asynchronously) from one database to another in a consistent, repeatable manner.
- The connectors can be event-driven, based on database triggers and other mechanisms.

### Data Integration Risks and Limitations

- As integration occurs at the database level, any business rules normally performed in the business logic tier are lost. This would imply that the rules would need to be either duplicated or omitted, which might not result in the best solution.
- The integrators would need to become familiar with the database types, internal schemas, and other attributes required for accurate integration.
- As the number of data sources

increases, there'll be numerous connectors and integration processes that need to be set up for each database.

- Data redundancies and inaccuracies in the primary data source might not be fixed, as business logic is absent.
- Data integrity will be more difficult to enforce across data stores.
- Volume of integration transactions and the size of each transactional data element need to be considered to ensure efficient processes.

### Business Logic Tier Integration

The business logic tier is where the organization's business process and rules are typically implemented. In today's environment, applications have been implemented using architectures ranging from legacy monolithic to n-tier Web systems. To develop an effective EAI solution at the business logic tier, consider these scenarios:

- Legacy integration — Older applications have been designed to function on the mainframe and other legacy environments. The code is usually not object-oriented, or even modular. Often, there's not much distinction between the business logic and application presentation functions. There are no obvious interfaces to the system from external applications. The existing code might need some reengineering to expose certain desirable interfaces.
- Application integration — Typically, these include newer applications that have been designed with the intent of interacting at various levels with external systems. Hence, interfaces will be fairly obvious to identify and use; however, process rules and sequences have to be carefully analyzed for successful results.
- Business process integration — The enterprise would like to integrate distinct business processes, regardless of the underlying technical infrastructure. Here, the end result could comprise several applications and data elements being integrated to produce the desired solution. Thorough analysis will be needed to identify the correct processes and underlying applications.

Figure 4 shows three types of business logic integration and a high-level view of enterprise sales, billing, and inventory systems. The sales-billing business pro-

cess is comprised of an orders system — a Web-based Java 2 Enterprise Edition (J2EE)-compliant system — and a billing system, a .NET-based Web system. The inventory business process is a CICS-based inventory management system. The EAI solution described above integrates a legacy application, two Web-based applications, and two business processes.

Here's a brief description of the connections labeled 1, 2, and 3 in Figure 4:

- Legacy integration (1) — The EAI hub uses an Application Program Interface (API) wrapper around the existing CICS applications to interact with other applications.
- Application integration (2) — The hub can connect to the two modern applications directly to exposed APIs and other interfaces.
- Business process integration (3) — The entire order, billing and inventory processes are now integrated via the EAI hub to the enterprise manager. It doesn't matter what the underlying applications are, as long as the required processes are correctly integrated.

## Business Logic Accessibility

Because enterprise systems consist of multiple architectures, platforms, technologies, and vendors, we must ensure that components from all applications that will participate in the EAI solution are easily accessible.

From an architectural perspective, it's recommended to abstract the external connectivity mechanisms, providing a consistent procedure for all components. In the J2EE environment, for example, the Java Connector Architecture (JCA) provides a standardized specification to interact with external applications.

In our earlier example, components from three major technical platforms are illustrated — J2EE, .NET, and legacy CICS. For a successful EAI implementation, it's imperative for the EAI hub to be able to communicate with each of the participating applications. There are various ways to do this, including:

- Direct API calls can be used for synchronous calls to local applications in the same technology and platforms.
- Remote Procedure Calls (RPCs) can be used for synchronous calls to distributed applications in the same technology and platforms.

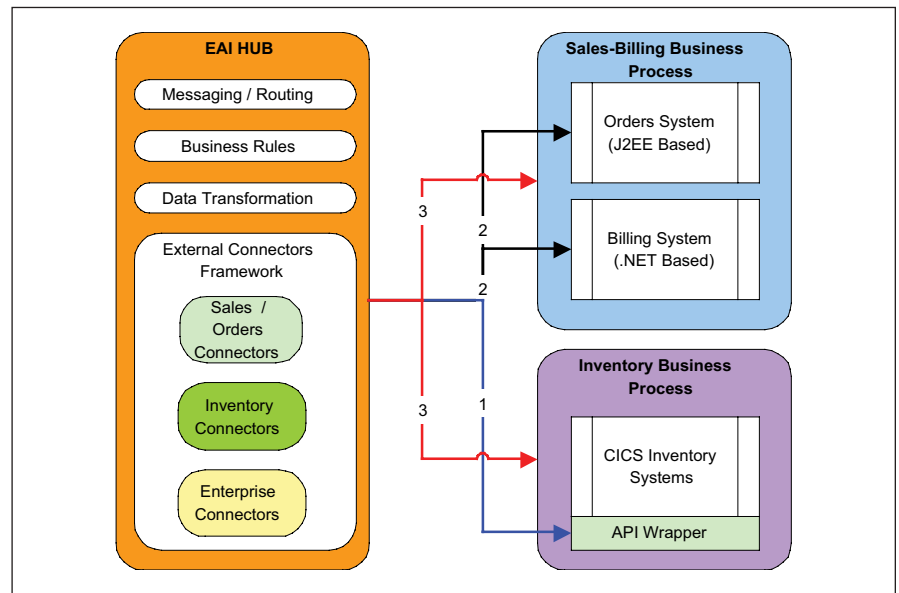


Figure 4 — Business Logic Integration Sample

- Messaging solutions can be used for asynchronous calls to a variety of platforms. For instance, using third-party or home-grown, Message-Oriented Middleware (MOM) solutions, connections can be established from Web to legacy systems.
- Web services represent a fairly new paradigm for integrating disparate, distributed applications using the Internet and XML.
- Simple Object Access Protocol (SOAP) and HyperText Transfer Protocol (HTTP) provide an Internet-based messaging mechanism to communicate across applications.
- Common Object Request Broker Architecture (CORBA) and Distributed Component Object Model (DCOM) are other mechanisms to communicate with legacy applications.

## Business Logic Integration Benefits

- By integrating at the business logic tier, it's possible to derive the maximum value from existing applications.
- Existing business rules will be used to securely process the data and only provide the required results.
- It's possible to start viewing applications as service providers — enterprise applications provide various services that can be packaged into a desired result.
- With the technologies available today (especially the Internet, XML, and Web services), distributed applications can be easily accessed. Disparate sys-

tems, applications written for various platforms, can be integrated using open standards, hence reducing the amount of dependencies.

- IT staff can focus on building business solutions using the most appropriate tools and technologies and not worry about constantly training staff in the next big thing.
- Even older, legacy systems can be rapidly integrated into an enterprise information system by creating wrappers around existing applications.
- Future integration of enterprise-to-enterprise business logic will further improve current B2B techniques.

## Business Logic Integration Risks and Limitations

- Newer technologies, such as Web services, are still evolving and have certain issues (including security) that need to be addressed.
- By exposing certain key business logic interfaces, enterprises run the risk of misuse, both intentional and unintentional. This means that, by not understanding a business process correctly, certain APIs could be invoked to provide misleading results. Technologies such as Web services could expose the APIs to the outside world, which could pose as a security threat.
- Interfaces need to be formalized and resistant to constant change. Although EAI systems can be loosely coupled, there's still a high amount of risk if the application interfaces change without proper analysis.

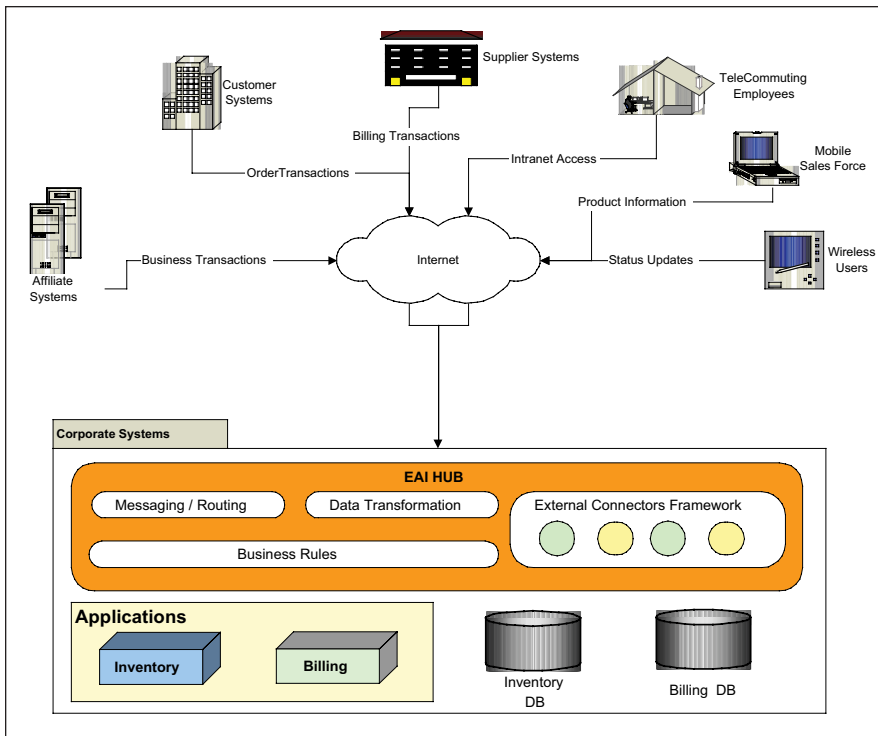


Figure 5 — Enterprise Integrated With Its Business Partners to Perform Collaborated Transactions

## Presentation Tier Integration

The presentation tier represents the user interaction layer. Current user interaction mechanisms include legacy dumb terminals, Windows fat clients, Web-based thin clients, PDAs, cellular telephones, and others. It's important to ensure that the correct content is being aggregated and presented to the user in the most desirable format. EAI at the presentation tier implies using the information obtained by various business logic components and displaying them in the correct manner.

## B2B Integration

Using EAI-based solutions, it's possible to regard customers' and suppliers' systems as part of an extended enterprise. Consequently, external systems that provide business value can be seamlessly integrated into an EAI solution.

Figure 5 shows how an enterprise can be integrated with its business partners to perform collaborated transactions.

## Web Services

Web services technology is a fairly new, rapidly growing paradigm in systems integration. Essentially, Web services provide the ability for organizations to expose certain functionality as services to other authorized users and systems. By using open, platform-independent standards, Web service-based solutions can assist in integrating disparate, distributed systems (e.g., J2EE, .NET, and legacy).

Web services solutions are typically based on the following technologies:

- SOAP is the standard protocol used to transmit XML-based messages over the Web.


- Universal Description, Discovery, and Integration (UDDI) is a common registry used to advertise or publish available Web services. Compare it to an online Yellow Pages, where you can look for pizza restaurants and menus, and order the item of your choice.
- Web Services Description Language (WSDL) is a common language that can be used to describe a Web service.

Figure 6 shows a sample Web service solution that lets a user view his consolidated financial statements. The Web portal uses Web service proxies to securely communicate (integrate) with the various financial institutions to get the account information for the user. The information is then aggregated and displayed to the Website user as required. The user need not know how the information is being collected from various sources, just that it shows an accurate, consolidated view.

As the technology matures and gains widespread acceptance, it will serve as a solid component of an overall EAI strategy.

## Conclusion

An EAI solution can be a competitive advantage to an organization that needs to improve collaboration between internal and external systems and processes. Market research and cost-benefit analyses indicate that well-managed EAI implementations result in strategic, scalable solutions that yield an attractive ROI.

As new technologies and standards continue to improve, the feasibility and relevance of EAI solutions increase proportionately. There are various types of EAI and organizations must assess their specific requirements while deciding on an appropriate EAI strategy. EAI can be a powerful enterprise solution to help organizations reduce technology costs and improve efficiency by leveraging existing investments. 

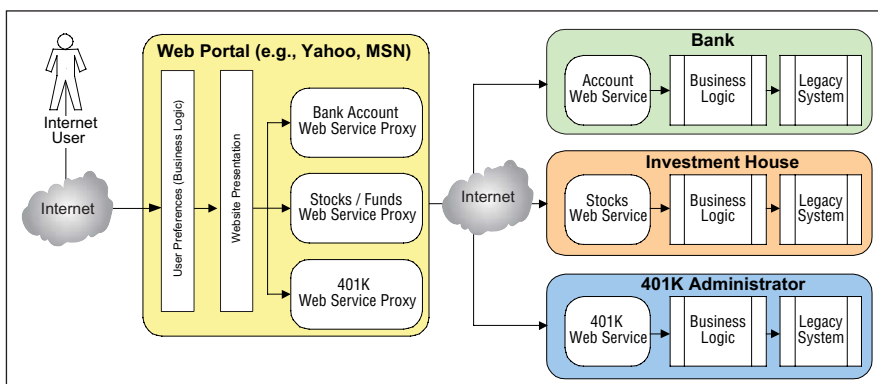


Figure 6 — Sample Web Service Solution

## About the Author



Ravi Acharya is the director of Solutions Architecture for Encore Consulting, a Chicago-based professional services firm. He's involved with devising and marketing customized enterprise integration solutions for Encore's Fortune 500 clients. e-Mail: racharya@encore-c.com; Website: www.encore-c.com.