There is growing recognition that an improved flow of information and the ability to interact, seamlessly and in real-time, internally and with trading partners will provide significant benefits from both the operational and planning perspectives. CEOs, CFOs, and line managers, across a variety of disciplines, can all benefit from information that is up-to-date. Maintaining revenues and profits at an acceptable level are the core objectives of most executives. Without access to real-time information, many decisions are made too late or inaccurately. Marketing, logistics, sales, and every other organization must perform more effectively, and do with less, by making smarter decisions quicker. This can be accomplished only by obtaining the right information sooner to minimize costly mistakes.

A real-time enterprise requires new applications and application services designed to immediately process information and highlight the changes reflected in that information. These services are termed “business events” and require a data, transaction, and messaging infrastructure that supports the movement and processing of data much

**PAYOFF IDEA**
The idea of a real-time enterprise is gaining momentum very quickly. Although implementing a real-time solution is a complex and significant undertaking, the ROI is intuitively obvious and quantitatively verifiable. Managers must be provided an environment that allows them to make quicker, more informed business decisions to achieve their objectives. Managing companies with a mix of real-time and historical information is the best of both worlds. This can be accomplished through an evolutionary process of integration and accommodation. Existing system investments can be leveraged, ultimately allowing applications to provide the ROI they promised.
more quickly than is common practice. Newer technologies and capabilities are needed to provide asynchronous, near-real-time communication of business events to all interested resources: enterprise applications, business managers, and trusted trading partners.

Web services, both a strategy and a technology, are being developed and deployed to support real-time decision support and associated business automation. While Web services is an important component, the real value occurs once enterprise and legacy systems are adapted to support the data and messaging needs of the real-time enterprise. This is, of course, far from trivial because of the expense and time required to make the significant processing and integration changes. A new or upgraded communications infrastructure is required to move decision data through intranets, enterprise networks, and the Internet.

Because businesses and supply chains operate in real-time, it only makes sense to utilize technology that does the same. In fact, it can be argued that the current state of enterprise systems dominated by enterprise, resource planning (ERP), customer relationship management (CRM), and supply-chain solutions are fundamentally limited by their lack of real-time capabilities. Accessing, aggregating, analyzing, and acting upon intra-enterprise data is challenged by several realities. These include the fact that this data is processed by different database management systems, different application packages, across different operating systems, and at different locations. In addition, this data is captured using a variety of methodologies — from real-time to batch, from fax to Web.

Technology advances are changing all this by making real-time computing a reality. The need for high-end messaging middleware has become less proprietary and more commonly available to support the needs of the real-time supply chain. The Internet has also helped to aggregate information more quickly and at more reasonable costs.

Retailers, manufacturers, and distributors can all benefit from real-time computing. This is true within an organization or across a supply chain, making information accessible much more quickly between trading partners. A simple example is a national retailer that can utilize morning sales information from East Coast stores to plan for sales/promotions in their West Coast counterparts. A manufacturer with a distributed supply chain can work more closely with its logistics providers to move inventory more efficiently; due to weather or other scenarios.

As the complexity and costs of using real-time solutions diminish, enterprises will use the technology to better combine business processes and workflows. The basic ingredients for successful real-time initiatives — data movement, data access, data analysis, and data execution — are available, so it is a matter of understanding how to better integrate systems with processes and applying technology to solve problems.
Informed decision making is based on:

- Aggregating and analyzing key data
- Evaluating the data against industry, standard, or historical information
- Reviewing the information with appropriate managers
- Charting a course and developing a plan of action

This approach works best when the data available for analysis is fresh and up-to-date. In many cases, managers base decisions on partial information because a complete view is only available after the fact. The wealth of data, appropriately scrubbed and formatted, needed to make an informed decision often becomes available after the decision timeframe.

The promise of the real-time enterprise is to make information available when it is needed in an easily assessable and viewable format based on defined business rules that proactively, on an event basis, alert managers to business opportunities or problems. Once available, management is in a position and has the decision-making framework to manage the company more efficiently and effectively. The following are key architectural components of this strategy:

1. **Implement a data warehouse to provide easy access to aggregated information.** This involves setting up an infrastructure to extract, transform, control, and load data from enterprise systems using an ETL (extract, transform, and load) tool. Because data warehouses allow information to be viewed in many ways, it is important to consider a data warehouse “of the day.” This contains new, updated, or deleted pieces of information from across the business application landscape.

2. **Integrate key business applications so that data can be shared between applications quickly.** The enterprise application framework must provide for the retrieval of data from another application’s database.

3. **Model business processes from a business rather than an application perspective.** Businesses are interdisciplinary and processes cross the boundaries of many domains. A business process modeling engine operates at a higher level than individual applications, allowing seemingly random bits of information to be viewed holistically.

4. **Set up an event-based business alert system that continuously monitors data feeds.** Real-time analytics allow data to be compared against predefined levels. This allows the information monitoring infrastructure to instantly alert management of business changes.
Newer technologies such as Web Services, middleware messaging, B2Bi (business-to-business integration), and business process modeling all serve as a platform for real-time application integration (within and between companies). Companies can harness live data streams to trigger alerts when inventory is not where it is expected or financial information (i.e., payment authorization) is not coordinated with delivery schedules.

This naturally entails close coordination with the requirements of trading partners from the document/data exchange and transaction facilitation points of view. Real-time trading partner solutions must encompass both technology and best business practice issues in order to automate the facilitation of inter-enterprise processes.

The gap between supply-chain planning and execution can be reduced, resulting in cuts in both time and expense. The opportunity to reduce or eliminate daily batch processing runs means information can be made available with “zero” latency. Multiple sets of data can be brought to bear to highlight problems and identify opportunities. This ubiquity of data is the “holy grail” for which organizations and trading communities have long searched.

The issue of batch processing is a critical one because the great majority of enterprises still utilize batch processing as the primary means of assimilating information across systems. Firms must understand where information is not flowing and where the gaps are. Making decisions based on yesterday’s data, in the best of cases, is the issue. Business professionals, across a variety of disciplines, are potentially faced with this dilemma whenever the phone rings: real-time information from a phone call versus the data being used for decision making that is available on a report.

Obviously, it is easier to talk about eliminating batch processing than it is to accomplish. Costs and complexities often temper the most enthusiastic real-time initiatives. This means that a phased approach is often the most realistic. The first step is to understand the relationship and data requirements of upstream and downstream applications. Next, a realistic appraisal of the resources (in people and dollars) needed to migrate batch processes is required. This appraisal can be matched against the value of upgrading or replacing each system. While all systems will eventually need revision, this can happen over time, based on ROI (return on investment). Finally, a messaging and data management infrastructure must be put in place, allowing information to be analyzed and processed as it is received.

Integrating batch-oriented legacy applications with real-time middleware is difficult. There are a variety of complexities to manage that include heterogeneous platforms, architectures, data structures, and organizations. It may make sense to first migrate big batch environments to a series of smaller batch processes. Although technology is improving
and vendors are trying to respond to the needs of their clients, there is no fixed path to the real-time enterprise.

Firms of all sizes have large investments in enterprise applications (e.g., ERP, SCM [supply-chain management], CRM). These applications and others are supposedly providing an ROI and business advantage. The fact that these applications are actually implemented as “near”-independent silos of information processing robs much of the intended ROI. To regain the benefits and potential of these systems, they must be tied together around common business events.

Event-driven business processing is a key advantage of the real-time enterprise. Many vendors are revising systems to allow their clients to make decisions based on a view of prioritized, constraint-oriented data. Analyzing information and presenting it when it falls outside user-defined, prescribed boundaries is the first step. Once systems are working closer together and sharing data via higher-level business process definitions, notification boundaries will fluctuate based on actual conditions. For example, additional inventory need not be ordered for safety stock purposes, at this moment, if orders or shipments are down. Similarly, if orders are up, an additional assembly line, and all that that involves from the inventory, scheduling, and HR perspectives, can be prepared for production.

There are existing technologies that support event-enabled business strategies. For example, database systems support triggers. Common Object Request Broker Architecture (CORBA) and Distributed Component Object Model (DCOM) are also technologies that support business events. Scalable and reliable multicast protocols, federated architectures, and advanced caching functions help balance the network load and data movement chores. Because enterprises move and process a huge amount of data, these facilities are critical. The benefit of existing technologies is that a firm can begin to test the waters today and many enterprise applications provide application programming interfaces (APIs) or support these technologies.

Multicast protocols have been around for a number of years and are an efficient method for distributing real-time information. Multicast protocols are efficient because they send a single message to all recipients. Compare this to TCP, which sends individual messages to all recipients. Because lost messages are not automatically retransmitted, data can be lost. Business-critical events require a more reliable communications mechanism to be effective.

Scalability is a critical issue because of the number and frequency of messages, transactions, and data being processed across the network. Multicasting only provides scalability in terms of the number of messages sent. Federated architectures provide scalability by supporting multiple, independent information processors. Units of work (communications,
application, or otherwise) can be partitioned across, or even within, servers, based on the infrastructure and configuration of CPUs.

Caching also optimizes message flows by allowing often-used data to reside in memory. That this can be done locally or across the network minimizes the latency and transaction sizes. Security and recovery are issues with caching but many vendors use this technique, balancing how much and what data is available. The goal, not yet realized, is unlimited scalability and zero latency with no architectural constraints.

A new generation of vendors, with newer technologies, is available and offers better functionality, performance, and scalability. The architecture required to support real-time, event-driven functionality and application (and cross-enterprise) inter-activity is based on messaging middleware, business process modeling engines, advanced data analytics, and enterprise application integration technologies. Publish and subscribe is one type of messaging scenario that allows servers to send or broadcast application data to other interested application or database servers. With data delivery occurring as information becomes available, information can be analyzed and processed much more effectively. Web services standards like SOAP (Simple Object Access Protocol) and WSDL (Web Services Description Language) are also intended to support inter- and intra-enterprise application exchanges, as are J2EE and JMS.

An evolutionary approach to building the real-time enterprise makes sense. One example of this was the discussion of a batch migration plan. Another example is to design a real-time architecture that can be implemented with minimal modification or coding to the existing application environment. This entails:

- The use of an ETL tool to populate the data warehouse. These tools, which are available today, should allow data and application servers to be accessible natively and without the use of proprietary facilities.
- Application integration tools that support business modeling across the functionality provided by individual systems.
- Building an infrastructure that is high performing. The real-time enterprise entails sifting through a wealth of data, and performance bottlenecks must be avoided.
- Defining a set of business rules and incorporating an event monitoring system that can alert management to predefined issues.
- Reporting tools that can present the information in an easy-to-visualize, actionable format, any time and any place.

As discussed, the real-time enterprise is not an island. Business activities extend beyond the boundaries of the enterprise, so a model that incorporates the information exchange beyond the firewall is a requirement. Communication mechanisms and business processes, in the form
of Web services, should be considered to incorporate these extra-enterprise activities.

The opportunity to improve operational coordination, increase execution efficiencies, reduce costs, and plan more effectively is very compelling. While the benefits of collaboration are often touted, the processes and procedures required for success are a little less clear. As a rule, enterprises have difficulties in managing and balancing internal supply-chain processes and associated communications. When one considers the added complexity of extending these processes and communications to trading partners, in real-time, it is not surprising that things get a bit murky.

Recognizing the depth of these challenges is important for several reasons. First, establishing an information flow with trading partners is inherently complex. A reliable infrastructure for doing business with partners must be established. Technology, integration, and messaging issues must be determined and this is where Web services standards can be beneficial. Security, messaging, transaction schemas, and related infrastructure issues are now being standardized and supported by vendor offerings.

Building a sustainable real-time transaction flow is the key to achieving a state in which the various collaborative participants can jointly be alerted and react to changes. Event-based business supply and demand decisions can only be identified based on the quality, quantity, and timeliness of the information being exchanged. The biggest barrier to this transaction liquidity is the difficulty in getting trading partners connected and ready to exchange information seamlessly and as it is available.

The management of inter-enterprise transactions that reflect the flow of inventory and information is daunting. While improving the management and flow of transactions between trading partners is not a new problem, it has become more of an issue. Economic considerations, the constant push toward operational efficiencies, and management’s need to make better decisions faster are all factors.

Companies of all sizes cannot only trade more efficiently but can utilize the underlying data to help find the best balance between demand opportunities and supply constraints while enabling effective, controlled operational execution. Real-time, Internet-based integration and automation is the key to gaining benefits in terms of both cost savings and partner satisfaction.

Vendors across a variety of domains understand the needs of real-time solutions and are delivering new products or revising existing offerings to help firms in the push toward real-time. This is true of database, application, network, analytics, business modeling, and a host of other solution providers. Similarly, standards groups and industry consortiums are working to deliver horizontal (e.g., security, communications) and vertical (e.g., CPG, chemicals) frameworks and templates. While there is
much work still to be done, it is clear that organizations of all sizes can get started and realize the benefits today.

**CONCLUSION**
Implementing a real-time solution is a complex and significant undertaking. This is true from the perspective of both business and technology professionals. Achieving the bottom-line benefits and efficiencies associated with event-driven strategies can be accomplished in a variety of ways. Regardless of the method selected, it is critical that the choice be based on a robust, extensible, and implementable strategy that supports the needs of the business and its trading-partner community. It is equally important that the technology solution be flexible enough to support the diverse enterprise application landscape and existing legacy environment.

Because more and more companies are communicating and collaborating with their trading partners, the solution must provide a framework for the buyer and supplier to participate. While adding complexity, the benefits include a more balanced view of the extended supply chain and better relationships.

The idea of a real-time enterprise is gaining momentum very quickly. The ROI is intuitively obvious and quantitatively verifiable. Managers must be provided with an environment that allows them to make quicker, more informed business decisions to achieve their objectives.

Managing companies with a mix of real-time and historical information is the best of both worlds. This can be accomplished through an evolutionary process of integration and accommodation. Existing system investments can be leveraged, ultimately allowing applications to provide the ROI they promised.

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