



Leveraging the Power of the Web Using E-intelligence

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WHY E-INTELLIGENCE?

E-intelligence enables organizations to exploit the power of e-business and business intelligence to increase market share, profits, and customer satisfaction.

Organizations have been successfully employing business intelligence products, including data warehousing and OLAP tools, for the past several years, to improve the supply of business information to end users for cross industry applications like finance and customer relationship management, and in vertical markets such as retail, manufacturing, healthcare, banking, financial services, telecommunications, and utilities. Easy access to clean, consistent, and integrated business information has enabled executives and managers to optimize day-to-day business operations, and to leverage enterprise-wide corporate data for competitive advantage.

The Internet provides a new low-cost sales and marketing channel

The advent of the Internet has opened up a completely new and low-cost channel for selling and marketing products, and organizations are now rapidly moving toward the use of e-business applications to improve business efficiency, decrease costs, and increase revenues, and also to compete effectively against new *dot com* companies.

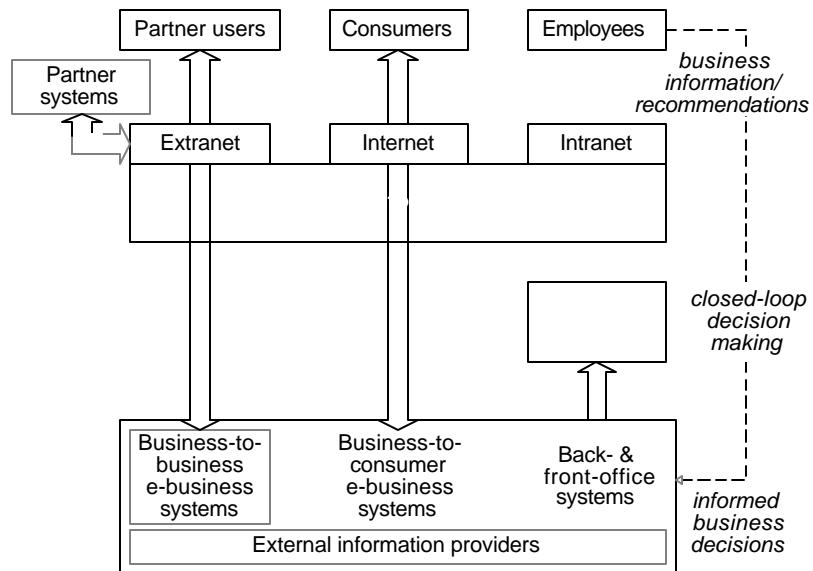


Figure 1. An e-intelligence system

E-business users
require business
intelligence

The issue facing end users as organizations deploy e-business systems is that they do not have the same business intelligence capabilities available to them in e-business systems as they do in the traditional corporate operating environment. This prevents businesses from exploiting the full power of the Internet as a sales and marketing channel. To solve this issue, vendors are rapidly enhancing business intelligence systems to capture and analyze the information flowing through e-business systems, and are developing Web-based information portals that provide an integrated and personalized view of enterprise-wide business information, applications, and services. Enhanced business intelligence systems, or so called *e-intelligence* systems (see Figure 1), are now appearing on the market, and they have the potential to provide significant business benefits to both traditional bricks-and-mortar companies and new dot com companies as they build their e-business environments.

In this paper, we examine in detail the architecture of the e-intelligence system shown in Figure 1, and discuss how such a system can be incorporated into the existing business intelligence environment. Before doing so, however, we will first examine why e-intelligence is critical to the success of e-business operations, and provide an overview of the key requirements of an e-intelligence system.

The Business Case for E-Intelligence

Many business benefits
to deploying an e-
intelligence system

E-intelligence systems provide internal business users, trading partners, and corporate clients with rapid and easy access to the e-business information, applications, and services they need to compete effectively and satisfy customer needs. They offer a significant number of business benefits to organizations in exploiting the power of the Internet.

1. **They integrate e-business operations into the traditional business environment**, enabling end users to obtain a complete view of all corporate business operations and business information.
2. **They help business users make informed decisions based on accurate and consistent e-business information** that is collected and integrated from the organization's e-business applications. This business information helps business users to optimize Web-based offerings (products offered, pricing and promotions, service and support, etc.) to match marketplace requirements, and to analyze business performance with respect to competitors and the organization's business performance objectives.
3. **They assist e-business applications in profiling and segmenting e-business customers** to personalize the actual Web pages displayed, and the products and services offered to the customer, through the Web interface.
4. **They extend the business intelligence environment outside of the corporate firewall to trading partners**. This enables organizations to share internal

business information with trading partners with the objective of optimizing the product supply chain to match the demand for products sold through the Internet, while at the same time keeping the costs of maintaining inventory to a minimum.

5. **They extend the business intelligence environment outside of the corporate firewall to key corporate clients.** This allows an organization to provide clients with business information about their accounts. This enables clients to analyze and tune their business relationships with the organization, and thus improves both client service and satisfaction.
6. **They link together e-business applications with business intelligence and collaborative processing applications,** allowing both internal and external users to seamlessly move between different systems.

E-Intelligence Requirements

E-intelligence adds business intelligence to e-business systems

An e-intelligence system builds on and extends existing business intelligence tools and applications, and enterprise information portals. Figure 2 shows examples of the types of business intelligence capabilities organizations are looking for in such a system.

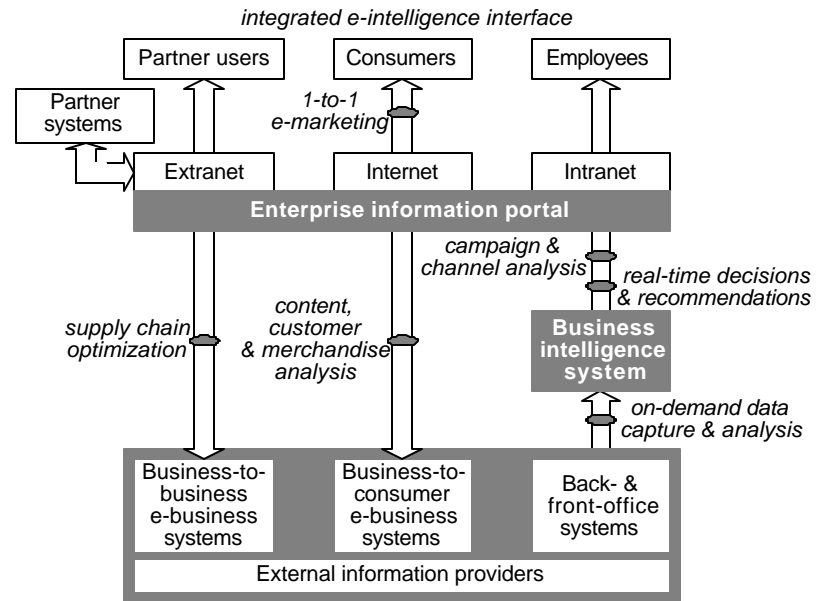


Figure 2. Examples of e-intelligence requirements

- **1-to-1 e-marketing analysis applications** that customize and personalize the information, applications, services, and products offered to consumers and clients via the Internet.

- **Content, customer, merchandise analysis applications** that track and analyze how users navigate and use the organization's e-business sites and applications to purchase products.
- **Channel and cross-channel analysis and campaign applications** that measure and analyze the success of the Internet as a sales, marketing and services channel.
- **Supply chain analysis applications** that enable the organization to work with trading partners to optimize the product supply chain to match the demand for products sold through the Internet.
- **A simple and integrated e-intelligence Web interface** that provides secure and managed access by internal and external Web users and applications to the organization's business information, applications, and services.
- **Demand-driven business intelligence gathering and analysis, and real-time decisions and recommendations** as consumers and clients interact with e-business systems via the Internet.

In the sections that follow we look at these requirements in more detail, and discuss the key features of an e-intelligence system that must be supported in order for users to be able to fully exploit the power of e-business.

A FRAMEWORK FOR E-INTELLIGENCE

An e-intelligence framework integrates e-business into the business intelligence environment

Having discussed the requirements and business benefits of e-intelligence, we now move on to introduce a business and technology framework that enables an organization to build an integrated e-intelligence operating environment. Such a framework is illustrated in Figure 3¹. This framework integrates e-business processing with the traditional business intelligence systems that supply business information to corporate decision makers. We will first briefly review current approaches to business intelligence, and then look at the changes that have to be made to incorporate, support, and exploit e-business operations.

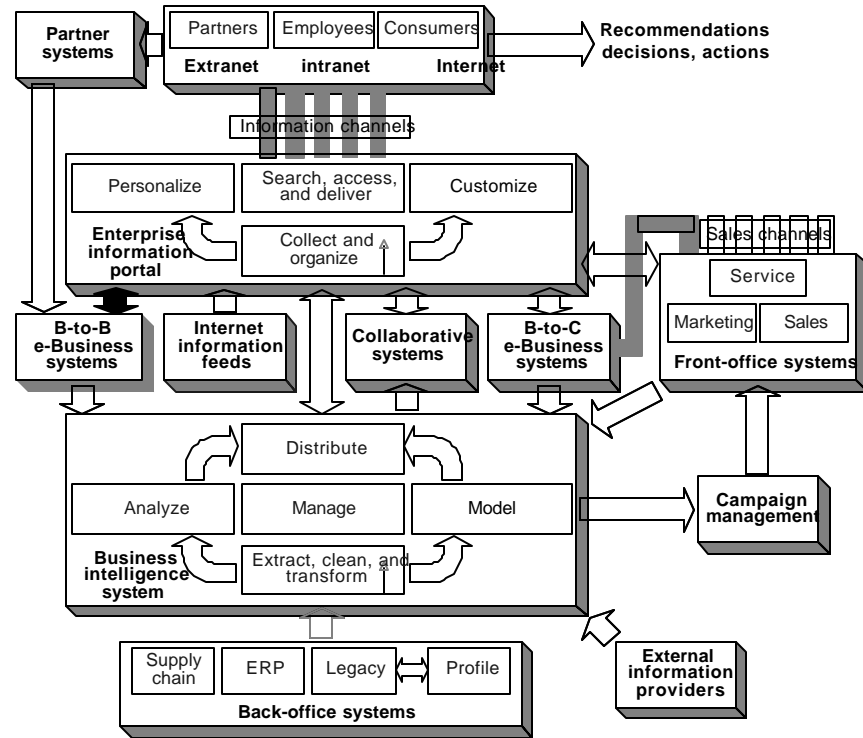


Figure 3: E-intelligence framework

Business Intelligence Today

¹ The business intelligence system and enterprise information portal components of the framework are shown in more detail in Figures 4 and 5 respectively.

Business intelligence processing (see Figure 4) involves extracting data from source back-office operational systems (ERP, supply chain management, legacy applications, for example) using ETL tools, or in-house developed applications, and transforming and integrating the extracted data into useful business information for corporate decision making. Where significant legacy data is involved, data profiling tools may be used to determine the quality of the source data, and data reengineering tools employed to cleanse the source data as appropriate. Cleansed and transformed business information is normally stored and managed in a data warehouse.

Data warehouse templates used to extract data from ERP systems

To reduce the time and resources required to build a data warehouse – especially when extracting data from ERP systems – organizations have begun using vendor-supplied data warehouse templates containing predefined and customizable data extract routines and data warehouse models that support a specific application area such as sales or cost analysis.

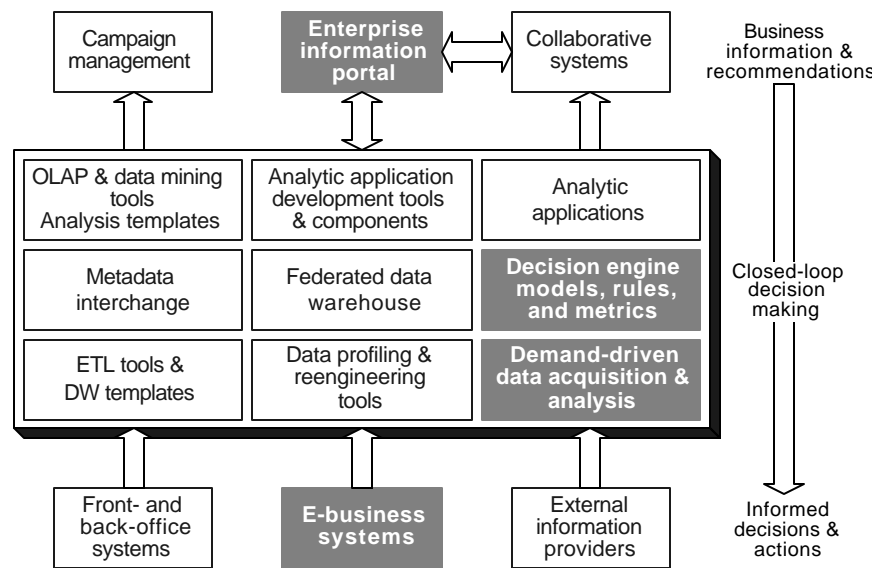


Figure 4. Business intelligence system components

OLAP tools are used to track, analyze and model business operations

Once a data warehouse for the application area of interest has been constructed, users then employ OLAP tools to analyze the information about current business operations to identify ways of reducing costs, and increasing profits and revenues. This analysis typically consists of the following steps:

- **Track** the key performance indicators (KPIs) of the business to monitor trends and to detect changes in business patterns. This may include, for example, monitoring sales and profits, or the tracking the current progress of a new sales campaign.
- **Analyze** in detail when and why a particular KPI changed.

- **Model** potential business improvements to determine their impact on the business. This could involve, for example, the running of a financial business modes, or the use of a data mining tool to profile and segment customers for a new sales campaign.
- **Modify** business operations to incorporate the decisions made as a result of business intelligence processing.

Analysis templates
reduce OLAP
development time

Deploying OLAP tools can be a complex and time-consuming process, and organizations are looking for ways of improving tool ease-of-use and reducing implementation time. One approach is to use predefined and customizable analysis templates that many vendors are now beginning to provide with OLAP tools. These analysis templates are often packaged with the data warehousing templates mentioned earlier.

Analytic applications
provide a complete
business intelligence
solution and reduce
implementation effort

Another approach to reducing development effort is to employ analytic application packages that provide a complete solution for both creating an application-specific data warehouse and analyzing its contents. Application areas being addressed by these analytic application packages include financial management (for financial consolidation, budgeting and planning, activity-based costing, etc.), customer relationship management (for customer cross- and up-selling, customer profitability analysis, promotion effectiveness, etc.), and supply chain performance management (supply optimization, distribution optimization, etc.).

The use of Web technology as an end-user interface also helps reduce the costs of providing business users with access to business intelligence. Most modern OLAP tools and analytic applications are Web-enabled, which not only reduces deployment costs, but also improves ease-of-use.

Closing the Loop

Closing the decision
making loop from
business intelligence
to e-business systems
has to be automated

A business intelligence system supplies users with the business information they need to make informed business decisions. These decisions often result in changes to back-office operations, for example, the introduction of new products, changes to product pricing, and so forth. These decisions (and associated actions) are typically made by users interacting with each other via collaborative processing documents such as e-mail, presentations, etc. We shall see later when we look at the impact of e-business, that this *ad hoc* and manual approach to *closing the loop* from business intelligence systems back to operational systems is too slow, and faster and more automated methods are required to support e-business operations.

Business information
is used to drive
campaign management

The output from a business intelligence system can also be used to drive front-office operations. One component that plays a pivotal role here is a campaign management application, which uses business information to develop and manage new marketing campaigns. These campaigns may use a variety of different sales channels including direct sales, direct mail, outbound call centers,

e-mail, fax, and kiosks – e-business systems also offer an additional sales channel.

As a new sales campaign progresses, front-office data can be analyzed by the business intelligence system, and/or campaign management application to fine-tune the current campaign, and to provide valuable information for future campaigns. Information from external information providers may also be input into the business intelligence system to supplement existing corporate customer and marketing data in areas like competitive and marketplace analysis.

Front-office systems also provide valuable information for business intelligence processing

Front-office systems are a valuable source of data for analyzing, and thus improving, other aspects of company operations such as product quality, and the effectiveness of in-bound call centers that provide customer and product support and services. As with back-office operational systems, the closing of the loop from business intelligence systems back to the front-office systems at present is done manually using collaborative processing.

The Role of the Enterprise Information Portal

An EIP provides access to the complete information supply chain

The flow of information from back- and front-office operational applications to business intelligence and collaborative processing systems, and back to operational systems can be thought of as a closed-loop information supply chain. To obtain a complete and accurate picture of a company’s business operations, users need to be able to access the complete information supply chain. Although Web-enabled OLAP tools and analytic applications provide an effective approach to accessing information managed by a business intelligence system, they do not provide access to the complete information supply chain. To solve this problem vendors have introduced so-called enterprise information portals.

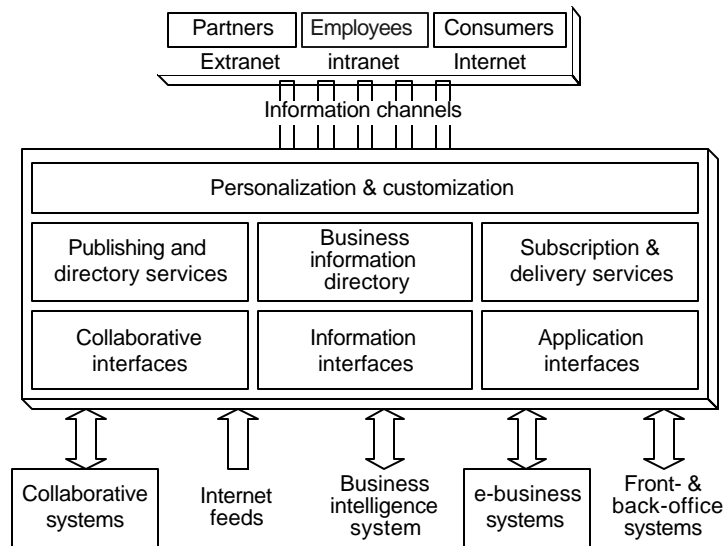


Figure 5. Enterprise information portal components

Information viewed through an EIP is customized and personalized to suit each user's needs

An enterprise information portal (see Figure 5) provides users with a single Web-based interface to business information and to the applications that produce business information no matter where they reside. The information and applications viewed through an enterprise information portal (EIP) can be personalized to match the requirements and authorization level of each business user, be they an executive, a business analyst, or a clerical assistant. An EIP also customizes information and application access to suit the role of the user in the organization. A business analyst in a marketing department, for example, could be given a view of the marketing information required to launch a new marketing campaign. This information could include analyses of customer profitability and past campaigns stored in a business intelligence system, marketing collateral managed by a collaborative processing system, and competitive marketing data provided by an external information provider.

The business information directory is a key component of an EIP

The cornerstone of an EIP is the business information directory, which points to and links together information and applications throughout the information supply chain. This directory can be maintained by a Web-based interactive publishing facility, or via interfaces that provide connectors to information and applications managed by collaborative processing, business intelligence, e-business, front-office and back-office systems, and also internal and external Web-servers. Later in this paper when we discuss the impact of e-business on the decision making process, we will see that an EIP may also be used to provide connectors to the information systems of trading partners and key clients.

The web-based interface of an EIP provides immediate access to the information and applications that are of interest to a business user. The interface also provides access to a subscription facility that enables business users to request that information be delivered to them, or an application run, when a certain event occurs. This event may be when a particular date and time is reached (an analysis could be run at the end of each month, for example), or when a certain business threshold is satisfied (when a customer account reaches a certain dollar value, for example).

The Impact of e-Business

Web technology has a major impact on the way we process and analyze business information

It is often said that the Web changes everything. This is particularly true when it comes to building systems that supply information to business users for corporate decision making. So far in this paper we have seen two uses of Web technology – the Web-enablement of OLAP tools and analytic applications, and the use of a Web-based enterprise information portal to provide access to enterprise-wide business information. In these two cases, Web technology is being used to provide a simple and cost-effective interface to business information, which enables an organization to make business information available to a much bigger and broader end-user audience.

Business intelligence systems need to be able to process and analyze Web data

The Web, however, is also a valuable source of business information. Information stored on Web servers on the public Internet may, for example, be a potential data source for a data warehouse, or at least be made accessible from an EIP. Also, as corporations begin using Internet commerce sites as a sales and marketing channel, the associated business-to-consumer e-business systems become an additional source of information for business intelligence processing. The source data here may be stored in conventional database and file systems, but may also come from Web server logs, or even the Web click-stream as users interact with e-business applications. This means that business intelligence systems not only need to be able to extract new types of data, but also need to be able to handle the huge data volumes that are potentially involved.

Once data has been extracted from business-to-consumer systems, it can be analyzed using OLAP tools and analytic applications. This analysis can be used to optimize e-business operations and to evaluate the use of the Internet as a sales channel.

Business decisions need to be made more rapidly when using the Internet as a sales channel

Using the Internet as a sales channel offers significant benefits – products can be brought to market much faster and at a much lower cost. Selling through the Internet, however, is very competitive, and organizations need to be able to react rapidly to consumer requirements and changing marketplace conditions, if they are to succeed in this new approach to marketing and selling products. There are four key success factors here:

- The product supply chain must be optimized to match consumer demand.
- Business decisions need to be made more rapidly, possibly in real-time.
- Service and support is a key differentiator.
- The e-intelligence system must have an open and scalable infrastructure.

Optimizing the Product Supply Chain

The challenge in any consumer environment is to satisfy consumer demand without incurring the costs of over-supply, i.e., excess inventory. Business intelligence systems and their associated data warehouses have been used for several years to analyze sales data and to optimize product supply and inventory. These techniques can be applied equally well when selling products through Internet commerce servers. One advantage of the Internet is that it consists of a single virtual storefront, which is easier to manage and supply than multiple physical stores.

Allowing business partners to access internal business information via an EIP helps them optimize the product supply chain

The low entry cost of employing the Internet as a sales and marketing channel, however, is creating a more competitive environment, and is adding pressure to retail prices, which in turn forces companies to fine tune their profit margins and their product supply chains. One way to rapidly and efficiently optimize product supply chains is to allow business users in external trading partners to tap into the internal closed-loop information supply chain discussed in this paper. This enables companies to share business information and to work cooperatively together to reduce costs and optimize profit margins. The simplest approach to supplying business information to end users in trading partners is via an enterprise information portal. An EIP can be used to customize, personalize, and control the information flowing between trading organizations across corporate extranets or even the Internet.

An EIP is also useful for controlling information flow between clients in non-retail situations. An insurance company could, for example, allow key clients to view and analyze claims history information via an EIP, and then, if appropriate, use the EIP to switch from the business intelligence environment to the e-business environment to modify insurance coverage.

Real-Time Decision Making

Decision making in the Internet environment may have to be made in real time

We discussed earlier, how, in the traditional business intelligence environment, the closing of the loop between business intelligence and operational systems is done manually using collaborative processing documents. We also saw how an EIP provides a similar feedback loop to e-business systems. There are situations, however, in the e-business environment where this manual approach to decision making is inadequate, and a more dynamic and automated process is required. One example here is where we may want to dynamically control the Web pages displayed to potential e-business customers. The decisions in this situation could be based on parameters such as the buying power of each customer and the types of products they may be interested in. Another example is where the customer expects an immediate decision when using the e-business application. This situation could occur, for example, when a customer applies for a new credit card, or requests an upgrade to a gold or platinum credit card. The competitive nature of the Internet requires companies to react immediately to such requests, or risk losing the customer to another company.

There are several different requirements when processing information and making decisions in real time

The need to make rapid decisions in e-business operations leads to the notion that our business intelligence systems need to operate in real time. This real-time requirement, however, has several flavors. Returning to the credit card example, let's assume that a customer requests an upgrade to a platinum credit card, that he or she has been with the financial institution for one year, and that the decision to upgrade the customer is based on a three-year return on investment (ROI). To make this decision, the e-business application will need to determine the existing one year ROI of the customer, and predict, based on the customer's profile, what the remaining two-year ROI is likely to be. To do this, the e-business application will need to:

- Access data warehouse summarized data in real time to retrieve the one-year ROI for the customer, or calculate in real time the one-year ROI from detailed warehouse data, or extract in real time the required data from operational systems for the calculation.
- Profile the customer and run a business model that predicts a two-year ROI in real time for a customer with that profile. In some cases the business model itself and the business rules for the model may have to be built or modified in real time.

Additional facilities are required in a business intelligence system to process information in real time

This may be an extreme example, but it does demonstrate several aspects of real-time processing including the need to make decisions, access and analyze data warehouse information, extract data from operational and e-business systems, and build business models and rules in real time. Real-time processing can also involve getting data from external systems, for example, to obtain marketing or customer data from an external information provider. Figure 4 highlights the additional facilities required in a business intelligence system to support real-time decision making in e-business operations, including support for dynamic business models and rules, and a demand-driven data acquisition and analysis capability.

So far in this paper, we have discussed both the manual and real-time approaches to corporate decision making. The manual approach involves business users employing business intelligence systems to manually analyze business information, and then manually feeding business decisions back to the operational and e-business environments using a collaborative processing system, or an EIP. The real-time approach involves an event-driven e-business or analytic application that analyzes business information and makes automated business decisions in real time. There are, however, other options between these two extremes. A possible middle-of-the-road approach could be supported by an analytic application that detects a certain business event (a sudden change in stock values, for example) and then employs a business model and associated business rules to automatically analyze business information, and alert and make recommendations to business users about potential business actions that could be taken.

E-Business Service and Support

E-business systems can be linked to both business intelligence and collaborative processing systems to provide service to Web customers

Price is not the only factor that consumers consider when using the Internet to purchase products. Service and support are also likely to become key distinguishing factors between companies offering e-business storefronts. The consumer may, for example, require access to background information about products, and may also need to speak to a real person to get additional information, or obtain product support. These requirements could be satisfied by an enterprise information portal that provides consumer access to a product and support database, and that also has the ability to use Web- and video-based collaborative services to connect the consumer to an inbound call center.

E-Intelligence Infrastructure

We have discussed above how the e-intelligence framework shown in Figure 3 supports the business and technology requirements for supplying business intelligence about e-business operations to business users. Given the large number of users and amount of data involved in e-business processing, this infrastructure must provide good performance, have good reliability, and be highly scalable if an organization is to survive in this highly competitive approach to sales, marketing and support. Also, given the high rate of change of technology in this area, the framework must support industry standards where they exist, and must be open so that organizations can plug-in different vendor products as requirements change.

In summary, we can see that an e-intelligence system not only enables business intelligence techniques to be applied to the e-business environment, but also adds some additional capabilities that are not currently available in the traditional business intelligence environment, namely the ability to do real-time analysis and decision making.

About DataBase Associates

DataBase Associates is a consulting company specializing in leading-edge technologies in the fields of data warehousing, business intelligence, analytic applications, enterprise information portals, intelligent e-business, and database technology.



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