EIMetrixs

Intelligent Data Platform

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1. Executive Summary

Rapid developments in information technology are shifting the basis of competition in nearly every industry worldwide from an emphasis on ownership of hard, enduring assets to the efficient acquisition, integration, and management of information. Success increasingly goes to those who can perform rapid, insightful analyses of scattered volumes of data, transforming it into strategic insights and operational priorities. Real-time decision making is becoming the norm, yet the cost of making poorly informed decisions is constantly increasing.

At the same time, businesses are operating in an increasingly complex environment, part of a wide array of interdependent partners, suppliers, and customers. Many are feeling the need to integrate and leverage databases and other information assets both within and outside organizational boundaries better. Although an expanding body of standards for multi-lateral electronic business is making it less cumbersome to establish and maintain basic business links, real-time, multi-source data integration remains a significant challenge.

This challenge only increases as more and more businesses open their internal databases to direct use by customers, partners, and other divisions to improve the efficiency of responding to inquiries and exchanging basic data and information. Consumers and businesses are coming to trust the security and value of electronic interaction, and their growing expectations for rich, integrated, and instantaneous access to data are in many cases becoming a key factor in selecting suppliers and partners.

Businesses that hope to compete effectively in this environment are faced with a raft of challenges and opportunities, including:

- Integrating data and information across multiple, disparate platforms
- Improving data accuracy while reducing the costs of data maintenance
- Managing end-to-end logistics along an entire value chain (from suppliers all the way to delivery and post-sales service)
- Making accurate, real-time decisions in a fast-moving, complex environment
- Leveraging the value of scarce skills and expensive human resources

EIMetrixs, LLC (EIM) provides a suite of technologies through its Intelligent Data Platform that address this broad set of issues directly and compellingly. Drawing on industry-standard computing and communications components combined with its own breakthrough algorithms and methodologies, EIM provides its customers with highly adaptive, integrated solutions that enable them to:

- Integrate data in real-time from a wide range of heterogeneous (and often geographically dispersed) sources

- Simultaneously conduct sophisticated high-speed queries of live data from multiple sources

- Automate decisions about a range of complex operational and transactional parameters, using explicit and derived business rules

- Dynamically evolve business rules in response to changing conditions

- Extract valuable latent insights into business operations and resource-allocation decisions

These capabilities are particularly applicable to large, complex enterprises or groups of companies that must work closely together. In particular, the EIM technology has been used to support a massive container-shipping and international trade consortium, as well as a pharmaceutical distributor complex operation. EIM is also working on applications in the distribution, healthcare, financial services, and manufacturing industries to help companies with end-to-end value-chain management, order fulfillment, and other complex, information-intensive business challenges. EIM technology has been applied to help customers:

- Optimize the deployment of business-critical capital and assets in a real-time, complex, multi-party environment (e.g., trading/shipping)

- Easily translate data between and among heterogeneous platforms

- Dynamically and intelligently reconfigure data to reflect changing relationships and transactional terms

- Reduce the costs and increase the effectiveness of human resources in functions such as sales, order fulfillment, service, and support

EIM's technology has been proven and evolved over 25 years in a highly demanding, global application dependent, robust, bug-free, secure, and fault-tolerant platform. EIM's technology is based on a modular architecture that can passively harness data in existing platforms, requiring no change to either a customer's existing business practices or existing IT architecture(s). *EIM can perform all the data analytics functions without using the customer's resources and doing the work the customer may not have time to do*. EIM's principals and teams bring extensive experience in customizing this unique suite of technologies to the scope and requirements of each customer situation.

2. Background

2.1. Information Overload and Management

Rapid evolution of information technology most notably microprocessors and the Internet is driving fundamental change in the cost structures and bases of competition in virtually every type of organization. Businesses are experiencing a dramatic increase in the pace of change, the need for interdependent partnerships, and the precision required in making critical operating decisions.

One outcome of these changes has been a dramatic increase in complexity. Increasingly, management teams are less able to access and process in real-time the large volumes of detailed data becoming available from diverse, but often incompatible sources (e.g., suppliers, partners, distributors, customers, and internal business units). Making intelligent use of this wealth of information quickly and efficiently is becoming a key challenge to success in nearly every industry.

2.1.1. Speed

Real-time access to, and analysis of, business-critical data is becoming *the* fundamental cornerstone of sustainable competitive advantage across information and service industries (e.g., banking, publishing, consulting) as well as those involved in the manufacture and delivery of tangible goods. Spectacular (and continuing) improvements in the power of microprocessors, combined with similar gains in network bandwidth, are driving businesses to create leaner cost structures and to seek dramatic increases in productivity by streamlining and speeding up both internal and inter-organizational processes. Businesses must do more, faster, with less.

2.1.2. Interdependence

Advances in networking technology have made it both easier and more important for companies to focus on what they do well, and to partner with others for services outside their core areas of expertise. Specialization and outsourcing have created a new level of interdependence among firms, blurring the boundaries of organizations (and their data). Business partners find it essential to be able to share information smoothly, seamlessly, and securely, and to interact at least as efficiently as if they were all parts of a single organization.

As a set of common standards for information exchange and transactions the Internet has helped to accelerate a general trend towards interdependence among businesses and towards the availability of outsourced data services. The so-called virtual corporation that this enables relies on electronic linkages with third parties to serve its customers, and on the ability to effectively integrate data among these partners and service providers.

2.1.3. Precision

Customers' ability to search easily for (and often switch to) the best provider and the best price has permanently reduced operating margins in many industries. This has forced businesses to

focus more than ever on precise execution, including just-in-time inventory, build-to-order capabilities, and anticipation of customer demand. Survival in this environment requires operating at high speed but, at the same time, making fewer errors. This in turn demands that organizations be able to access, analyze, and act upon live data from partners, suppliers, and diverse internal operations together in real-time.

A new set of approaches to this kind of massive data integration and analysis are beginning to emerge. These approaches go well beyond the ability to make retrospective, linear cuts of data for limited purposes such as marketing. This new class of analytical tool, exemplified by EIM's approach, is already beginning to help organizations to identify emergent trends more precisely in evolving business data. Such insights make it possible to precisely adjust (and even *automate* the adjustment of) huge numbers of operational variables along the entire value chain from supply and manufacturing through to marketing, sales, delivery, and service long before traditional approaches would make them obvious.

2.1.4. Complexity

In many industries (e.g., retail, distribution, manufacturing, health care, financial services, etc.) the sheer complexity of business operations has moved beyond what any one person could possibly be capable of knowing, much less understand or manage in real-time. Increases in geographic scope, product diversity, configuration options, distribution channels, shipping, delivery, and service options, discounts, contractual terms, promotions, and other price dependencies, and a shifting mix of customers and customer demands, have exponentially and irreversibly raised the complexity of managing a business today.

It is no longer sufficient to rely on gut-feel for making day-to-day operational decisions. Similarly, it is insufficient to make decisions based on just a few high-level slices of business data. Often the most important patterns in business data are latent (not anticipated) and thus not something that managers are likely (or able) to look for and act upon. Making sense of this massive and highly interdependent jungle of business data and terms across widely dispersed business operations is critical to maintaining a competitive edge.

2.1.5. Uncertainty

As the speed of information, the efficiency of business processes, and the availability of outsourced service providers all increase, the rate of business change and the level of uncertainty about the future increase as well. In such an environment, organizations must maintain a high degree of flexibility, making sure not to lock themselves in to structural change that may be rendered irrelevant or counterproductive before delivering a return.

As information management and analytical insight become critical bases of competition, the level of certainty about the future is diminishing in both fast-moving and more stable industries. In the current climate, those who can identify complex, often hidden, patterns within constantly evolving business data, and who from this can distill more effective responses to anticipated future situations will be more successful than those who are only prepared to respond to critical events after they become apparent.

Enhanced intelligent neural networks like the EIM IDP are an important tool in enabling this type of short-term tactical prediction and in increasing the sophistication and accuracy of that prediction over time. Airlines use neural networks to improve yield management (revenue for a given plane on a given route), as do institutional investors to uncover hidden trends, risks, and pockets of opportunity within rapidly shifting financial markets.

2.2. Electronic Business Integration and Interaction

2.2.1. More than just electronic commerce

The number of businesses and individuals using the public Internet for commercial activities has increased to the point of no return. However, these highly visible changes are only part of the picture. They have whetted the collective appetite for increasingly sophisticated and efficient forms of behind the scenes electronic business integration and interaction with the need for intelligent data analytics and metrics.

Rich electronic interconnections between the databases of suppliers, internal operations, customers, and partners are overlooked, but critical, parts of the same electronic business phenomenon. These types of intimate electronic relationships require an adaptable, non-invasive means of ensuring that data is integrated, synchronized, shared, managed, and protected.

The increasing sophistication of data and network security mechanisms, combined with trust in the legal frameworks supporting electronic business, has only helped to accelerate this trend. Firms that may have been reluctant to embrace these new imperatives are realizing that they must pursue electronic integration and interaction more aggressively if they are to compete effectively in the future.

2.2.2. Opening of Internal Databases

A key factor drawing both businesses and consumers into the electronic business environment is the quality, scope, and timeliness of information available from comparison shopping through configuration, to order fulfillment, delivery, and service. Some of the earliest companies to open internal databases were shipping companies (such as FedEx), which allowed customers to track the progress of packages. Other less public examples include Boeing′s parts division, which allows customers to research and order airline parts directly over a private network.

Organizations that engage in electronic business typically provide such information to customers not by creating new platforms, but by developing web interfaces for existing internal platforms. Often, the goal is to provide one-stop-shopping (i.e., a single integrated interface to all the brands, products and services a company has to offer). However, the integration of this data into a single usable interface is often a major challenge when multiple overlapping, complex, or incompatible platforms are involved.

2.2.3. Virtual Comprehensive Inventory

Electronic business presents sellers with the opportunity to behave more like distributors. Increasingly, manufacturers and retailers can offer customers a vast array of goods made by others,

not yet made at all or stored in inventory much farther up the distribution chain. At the same time, interfaces that encompass a broad range of goods and upstream suppliers allow companies to avoid tying up cash flow in excess inventory and to cement the attention and loyalty of existing customers. In this sense, a seller can leverage an established customer relationship to participate in a much broader range of transactions with that customer.

Presenting a comprehensive virtual inventory; however, requires the ability to link disparate, often geographically dispersed, and frequently incompatible product databases together into a seamless, current, and easily searchable interface. This is no small challenge, as advancing web technology-focused heavily on interfaces-does little to solve the problem of tightly integrating legacy data behind the scenes.

2.2.4. Value-chain Integration

The build-to-order model can help reduce inventory levels substantially; however, it requires a comprehensive and constant flow of information between parties to be effective. Such so-called value-chain integration is necessary if vendors are to coordinate between upstream suppliers, internal operations (e.g., manufacturing processes), and downstream shippers and customers effectively. Successfully implemented, value-chain integration can help improve the efficiency of the entire industry, speeding goods to customers faster and reducing the risk to suppliers and vendors. Today, the focus of many vendors is either upstream or downstream; few vendors have integrated the two. As with other aspects of multilateral electronic commerce, the challenge to accomplishing this is effective and seamless real-time integration of databases across multiple organizations.

2.2.5. Price Transparency

Increasingly easy on-line access to pricing information is altering the way both consumer and business buyers interact with vendors. Intelligent agents, buying clubs, and virtual distributors are some ways in which consumers can shop across many vendors at the same time. When the best price is only a click away, buyers are more likely to be aware of, and sensitive to, appropriate prices for a given product or service. This new pressure makes it increasingly attractive for sellers to be able to examine, anticipate, and respond to shifting market dynamics in real-time. The ability to use sophisticated real-time comprehensive price analyses to adjust (and even customize) prices automatically and intelligently can help sellers combat the new power buyers hold in EC markets.

3. About EIM, its Technology and Services

3.1. Who is EIM?

EIMetrixs, LLC or Enhanced Intelligence Metrixs (EIM) is a privately held provider of proven breakthrough technologies, platforms, and services that support high-speed, real-time data management and analysis in complex business-critical environments. Though EIM itself was only incorporated in 2018, the key principals and teams have been deeply involved in developing and deploying the specific enabling technology on a global scale for nearly 25+ years.

3.2. EIM IDP Technology

EIM's suite of proprietary technologies are collectively called the Intelligent Data Platform (IDP). The IDP technology was initially derived, developed and deployed to serve the international trading community, facilitating the process of contracting for and managing the complex logistics of container shipping among the world's leading international trade companies and their *tens of thousands* of customers around the world, in real-time. The IDP technology makes up the core of a platform that has been successfully supporting this massive application for many years. This platform is more extensive and complex-in several dimensions than the platforms behind either the NASDAQ stock exchange or airline reservations platform.

Platforms using IDP are based on an integrated combination of standard and modified off-the-shelf hardware components, along with proprietary software and algorithms. IDP platforms can work with, and across, the wide range of existing heterogeneous platforms, software, and network architectures typically found in large, global corporations.

3.3. EIM Capabilities and Benefits

3.3.1. Proven Technology

EIM's IDP technology has evolved over more than 25 years in the context of a single large-scale application for international trade. This is not new, risky technology in need of a shakedown cruise. Rather, the underlying components of IDP (including neural networks, artificial intelligence, virtual data warehousing, distributed objects, and wide-area search) are each well established in point applications elsewhere and proven together in this mission-critical platform. The technology is neither new nor old but discovered in that it is being extended to new customers with similarly complex and demanding requirements.

3.3.2. Robust Operations

The platforms and network infrastructure on which EIM technology is deployed for customers provides continuous fault-tolerant service that meets or exceeds that of the most demanding in the world. Triple-redundant capable hosts, divergent duplicate network routing, and hot-swap capabilities are just some of the essential features that EIM infrastructure provides and that large complex businesses require to assure the integrity of their operations.

3.3.3. Global Scale

The original application of EIM technology has been in operation on a global scale since it was initially deployed. The infrastructure supporting EIM includes thirteen (13) data centers and with seventeen (17), worldwide, data communication hubs or points of presence that help global businesses provide identical data access and analysis capabilities to their offices around the world.

3.3.4. Integration Experience

The primary power of EIM's technology lies in customizing its multiple capabilities to business purposes and existing IT environments. EIM has in-depth experience in working with large, complex organizations to implement its methodologies and technologies efficiently.

3.3.5. Non-invasive Architecture

The IDP exists logically and physically independent of EIM customers platforms and databases. Beyond taking an initial snapshot of data structures and elements, implementation of the IDP and supporting EIM technology requires no intrusion into underlying platforms. The IDP can receive data passively through the delivery of batch updates created by legacy platforms or, during ordinary operations, by periodically polling platforms for new data, or through any input stream available. The results can be presented in any number of flexible formats.

3.3.6. Adaptive and Flexible

IDP platforms can be easily configured and re-configured on the fly to the evolving practices, processes, and requirements of EIM customers. The modular, flexible nature of the IDP technology, presented through PaaS, makes this configuration process straightforward and fast; particularly when compared with the other point approaches (e.g., data warehousing, intranets, neural networks, and process re-engineering) that are often used in complex, multi-divisional, geographically dispersed corporations.

3.3.7. Modular Implementation

The power of EIM technology is most apparent in overly complex, distributed, multi-dimensional environments with disparate data. It can also provide compelling benefits however, on a smaller scale in limited business unit or functional applications. Extension of a EIM application from a contained pilot to a corporate-wide application, or even one that encompasses external partners does not require a significant re-work of the initial application environment.

3.4. How EIM's Approach is Different

3.4.1. More than an intranet

The PC revolution was deeply empowering to individuals and small work groups. Unfortunately, PC's have tended to widen the gaps *between* those individuals and work groups, especially in larger organizations. Intranets, the Internet, and the applications that make use of them (groupware, e-mail, web pages, etc.) are helping to close these gaps and stimulate information sharing, especially for informal, interpersonal communications. They do little however, to integrate or provide analytical leverage for business-critical data much of which has never resided on PC's. To be effective, Intranet applications that attempt these loftier objectives require

organizations to restructure their data and/or to design custom interfaces. EIM's approach, by contrast, makes use of existing data structures, and can support an existing Executive Information Platform (EIP) or supplement it with a common, integrated interface with powerful analytical capabilities.

3.4.2 More than an Executive Information Platform

EIM's IDP can either supplement or supplant traditional EIP's, while incurring substantially lower costs for data maintenance. Specifically, the IDP can provide decision-makers with console-like access to real-time business data as it evolves. Traditional EIP's, by contrast, typically draw upon data that has been pre-processed or warehoused to deliver reasonable response time for complex queries. The efficiency of the IDP allows it to accomplish both objectives (speed and access to live data) simultaneously in one platform. The IDP allows for one-pass data maintenance and remove many of the justifications for a separate data warehouse (see below). The IDP also provides higher levels of flexibility than EIP's for decision-makers wishing to take non-standard views of business data and develop new insights into business operations. This allows organizations to avoid the time, expense and rigidity often involved in custom programming projects.

3.4.3. More than a data warehouse

Corporate data warehouses are generally intended to integrate business-critical data into one or a few easily accessible repositories, and to provide analytical tools and interfaces to make use of them. The data-warehousing concept, however, does not easily accommodate time-dependent applications. By design, these repositories are separate from operational platforms, and filled with somewhat delayed, retrospective data.

Most data warehouses are also not architected or equipped with the tools to recognize latent patterns in data dynamically and deliver spontaneous, non-linear insights into business operations. Instead, data warehouses provide a more thorough and precise picture of the past, thus helping to incrementally improve existing operations. However, as the pace of change accelerates and complexity increases in many businesses, a delayed view and a linear approach are insufficient to make the quantum breakthroughs needed to compete.

3.4.4. More than a neural network

EIM technology, particularly Intelligent Decision Criteria (IDC's) and Event Algorithms (EA's) share similarities with, and make use of, key aspects of neural network and artificial intelligence, enhanced intelligence, and machine learning technology. However, EIM's implementation of these base technologies provides far more powerful and practical capabilities than most traditional applications. EIM combines neural network capabilities with the ability to integrate massive volumes of heterogeneous data from multiple sources in real-time. These capabilities help to enhance the range of insights which users of EIM platforms can hope to derive from this approach to adaptive data analysis.

4. Business Challenges and Opportunities

4.1. Integrating Information from Disparate Platforms

As computing and network technologies have advanced, the main challenge to the IT function in many organizations has shifted from management of technology and platforms to management of data and information. How does a diverse business ensure that data used in one part of the organization not only means the same thing as similar data elsewhere, but is readily usable by different platforms? There are three main approaches to this problem: standardization, translation, and reference integration.

4.1.1. Standardization

One of the first preferences of many businesses to improving internal data sharing is to make all data adhere to a common framework of definitions and structures. The goal behind such efforts is typically to create a single, comprehensive data architecture for the entire organization. This approach can work in homogeneous organizations with strong top-down management, a relatively static business environment, and the skills, resources, and time to devote to such a massive project. Businesses that meet these criteria, however, are becoming increasingly scarce, making a single, comprehensive data architecture completely impractical for most.

4.1.2. Translation

Translation of data between pairs of platforms that must regularly interact offers a more pragmatic, if less comprehensive solution to data sharing within an organization. Bilateral data translation often becomes the default approach in the absence of an overarching corporate solution. Links are built between data sets as particular needs arise. This approach has serious shortcomings (e.g., in cost, complexity, and reliability) as the number of bilateral interfaces increases. In interdependent larger organizations, as well as groups of business partners, the number of bilateral translation interfaces that need to be built and supported often becomes unmanageable long before the benefits of data sharing are fully realized. Organizations that reach this point are often forced to make severe compromises in data sharing and business integration. Alternatively, they simply may attempt to bear the high costs of managing an extremely complex environment or backtrack to another approach.

4.1.3. Reference Integration

A simpler (though far from simple!) approach to sharing data among diverse platforms is reference integration, using what is often referred to as an integration hub. In this approach, different platforms and data sources need translate only once *to* a common reference data set. Other platforms require that data need translate only once *from* the reference data set. While this approach requires the up-front corporate work of creating common data definitions (and an integration hub), it provides somewhat more flexibility than a comprehensive data architecture. At the same time, it eliminates the roadblock of sharply increased complexity inherent in bilateral, platform-to-platform translations. Nonetheless, integration hub projects built from scratch in a

complex business are often subject to the same implementation difficulties that plague comprehensive data architecture efforts.

4.2. Automatic Intelligent Maintenance of Data

4.2.1. Hands-off database management

Businesses having more than a few customers can expend an inordinate amount of effort (and overhead) maintaining the consistency and accuracy of electronic customer records. In many organizations, seemingly simple changes to customer information (e.g., contact person, billing address, etc.) can often trigger a cascade of complex manual changes, many of which may not be immediately apparent. This can lead to costly delays in billing or shipping, or embarrassing gaps in other aspects of customer service. In multi-unit businesses where the same customer may exist on several platform the problem is acute. When the customer is a business with multiple locations (or a consumer changing locations), the problem can be severe. Merely having customer data is no guarantee that the costs of managing it will be reasonable.

4.2.2. Maintaining seamless customer relationships

The ability to reconfigure customer records dynamically and automatically within a complex web of business relationships is a major customer service opportunity. Complex, distributed businesses that can appear and behave as a single, integrated entity in their interactions with customers (e.g., by providing aggregated billing) have an inherent advantage over those that cannot. This is particularly important in businesses that have been assembled by acquisition. Similarly, businesses that can quickly and easily recognize complex, changing customer organizations as a single entity for some purposes (e.g., aggregating volume discounts), have inherent cost, speed, and service advantage over those that can do so only through exceptional or manual processes.

4.3. 360-degree Logistics Management

The complexities and challenges of sharing information internally across disparate platforms are magnified in interdependent, multi-party business relationships.

4.3.1. Removing bottlenecks

Among suppliers, customers, and partners along a complex value chain, the timeliness and accuracy of information *about* product delivery is often as critical as product delivery itself. In making and adjusting commitments to customers, hard-goods businesses require a holistic, integrated view of the *entire* supply chain that can help to identify bottlenecks before they become widely apparent.

4.3.2. Reducing costs in a rational way

The ability to take a complete end-to-end snapshot view of the value chain can also help in identifying and reducing the costs of bringing goods or services to market. Dynamic knowledge of the value chain both upstream (to one's suppliers) and downstream (to one's customers-and potentially to *their* customers) is an essential precursor to improving the value chain itself and reducing overall costs.

4.3.3. Automating the customer interface

With the advent of the World Wide Web, many businesses began opening their databases to customers, reducing the load on traditional, expensive customer service channels such as call centers. When customers can have direct access to accurate, timely information about products, pricing, and delivery scheduling, it becomes possible to improve customer service significantly while reducing the cost of providing it. Access to common information, however, stops far short of eliminating the need for expensive human involvement in special questions and customized requests. Customizing product, pricing, and delivery information (e.g., what is *my* discount?) creates an added level of sophistication, but at the cost of added complexity in IT platforms. In providing customers with more seamless access to complex transactional information across multiple internal platforms, businesses face the challenge not only of improving their electronic interfaces, but also of tightly integrating and speeding access to the data sources and business rules that support them.

4.4. Decision Making in a Dynamic, Complex Environment

4.4.1. Tactical modeling and what if scenarios

As the complexity and speed of change accelerates in many industries, it becomes increasingly difficult to anticipate the changing dimensions of customer demand and the impact of potential competitive moves. A personal feel for the business environment is no longer sufficient for managing in most industries global markets that are too vast, information is too abundant, and changes are too rapid. Streamlined distribution (and reduced inventories) can help reduce (but not eliminate) the impact of poor decisions. Businesses still need to make bets based on incomplete information on how to deploy their resources in the short term.

This kind of business environment rewards those able to process the most transactional data and dynamically mine it for insights into evolving market dynamics. The most complete and current map of the industry enables decision makers to make the most accurate decisions about how to deploy strategic and tactical resources. The ability to test potential actions against a current and accurate model of the industry helps management to identify better courses of action before real resources are committed.

4.4.2. Price optimization

One important application of data mining, industry modeling, and tactical scenarios is dynamic full value pricing. Business that can charge as close as possible to what the market will bear have an advantage over those who charge too much and forgo sales and market share or charge too little and forgo realizable margins. In a fixed-price environment, businesses will inevitably face both problems at once, even if they do not recognize that they are losing some sales to substitutes or competitors, and/or taking less profit than they might on others due to incomplete knowledge of a buyer's willingness to pay.

With more intelligently flexible pricing, businesses can capture incremental revenues while ensuring maximum market share. The airlines are the classic example of this: they charge business travelers more (because they are willing to pay more) and leisure travelers less, because they otherwise would not take the trip. Airlines also make constant specific, selective price changes based on analyses of a wide range of variables, including evolving patterns of demand. Rapid, intelligent analysis of a mass of current market data, and weaving of this analysis into the context of historical and analogous pricing patterns is essential to asking the optimum price of each customer in each transition.

4.5. Leveraging Scarce/Expensive Human Resources

As the information economy evolves, more and more companies are finding it difficult to find, train, and extend the productivity of knowledge workers, specialists, and customer service people. In this competitive environment, the most productive companies are those best able to apply scarce, expensive human resources to only those tasks that *require* human involvement reserving others for automation.

4.5.1. Just-in-time judgment

Tools and business processes that reduce the rote, manual component of knowledge work and that present useful information only when needed will become more and more essential to increasing managerial productivity. Executive Information Platforms (EIP's) were an early approach to this problem. News alert services and data warehouses are aimed at similar concerns. However, these approaches often do not go far enough in integrating themselves into data managers daily routines. Those that do are not necessarily able to deliver creative, intelligent insights into emerging or latent patterns in the business. These approaches have been unable to address the problem of appropriately focusing managerial attention in real-time to problems that require uniquely human judgment.

4.5.2. Virtual sales and service

Increasingly, the World Wide Web is providing the means for companies to directly sell and provide service to their customers with far less incremental human involvement than traditional approaches. The best current applications have allowed new players to emerge with far leaner staff and cost structures than existing competitors. (Most platforms for electronic sales and service, however, *still* have not yet reached a level of sophistication or ease-of-use that would make them compelling to customers when compared with other, human-intensive channel options such as phone, retail, in-person, etc.). Conversely, in most industries, insufficient numbers of customers have yet moved to electronic channels to allow suppliers to significantly reduce the resources they have committed to supporting traditional channels. Clearly there will be further leverage in sales and service automation in many industries, with some coming closer than others come to the low-cost ideal of lights out customer service operations.

5. Current Examples and Potential Applications

5.1. Current Case Studies

5.1.1. Container shipping and international trade

EIM's core technology has been used for over 25 years as part of a robust, integrated platform that supports contracting, pricing, logistics, and trade for most of the commercial shipping traffic around the world. The platform provides subscribing shippers, brokers, and transportation firms with a range of integrated capabilities including:

- Real-time logistics management
- Facilitation of contracting between parties
- Dynamic, intelligent pricing (including dynamic currency conversion)
- Forecasting and modeling (including freeze-frame holistic analysis)

This platform allows thousands of simultaneous sessions to conduct as many as two million transactions per hour at more than 200 distributed sites, 24 hours per day, 365 days per year.

5.1.2. Pharmaceutical distribution

A pharmaceutical distributor in North America employs approximately 22K people on revenues of just under $179.6 Billion and operates 26 distribution centers in 29 states.

Using EIM technology, began to sharply improve both internal and customer productivity and to provide a compelling set of services that differentiate it in an intensely competitive marketplace. The EIM platform implemented provided customers with remote electronic access to real-time EIM transformed information on the full breadth of the product line, including complete attributes for the more than 300,000 stock-keeping units (SKUs) that are spread across five operating divisions. Customers were able to place orders for any of these products, on-line, and securely approve and manage their outstanding purchase orders through the platform. Information on these products resides and is updated within several different platforms throughout the company and around the country. The EIM technology completely masked this complexity, providing a seamless and powerful one-brand interface for the customers to use. EIM provides the technology that transforms the data and generates dynamic data logic and enhanced intelligence.

The EIM technology also allowed customers to obtain rapid, accurate, and comprehensive reports on product purchases and, for the first time, to know the exact price they will pay for a product before it is shipped based on and generated through the IDP Insights. This seemingly straightforward capability is difficult to provide, in real-time, in the pharmaceutical distribution business, where the range of prices, terms, costs, and discounts that may be applied to a particular

order is extremely complex. Pharmaceutical pricing is also dependent on a range of outside variables such as volume, source, buying group membership, and the end customer to whom the product will ultimately be sold. Sorting through this complexity, for each item to be purchased, requires such significant CPU cycles that distributors have been unable to provide accurate product pricing information at the time of customer order. Typically, customers learn of a product's cost only after delivery. Ex-post-facto cross-checking for pricing errors consumes precious human cycles and requires costly corrections and re-billings.

The platform, implemented using the EIM IDP, solved his difficult set of problems and providing these important, differentiating services to customers with no disruption to existing architectures or platform operations. Approaches that use conventional technology were seen as far more costly and difficult when considered how to integrate multiple geographically dispersed legacy platforms and databases from around the company.

5.2. Key Vertical Market Applications

5.2.1. Distribution

Breadth of products and features, rapid changes in pricing, and the complexity of sales, order processing, delivery and customer service make the distribution of manufactured goods an immensely complex and fast-moving business. EIM technology is well suited to improving logistics management, providing better customer service at lower cost, and reducing the time and overhead involved in dealing with thousands of suppliers and customers in the distribution business.

In particular, EIM transformation technology can provide buyers with seamless, integrated access to live manufacturer and product data while presenting this data in an integrated, common form. Unlike standard web-based front-ends to legacy platforms, EIM technology operates logically and physically independent of each constituent platform, making it possible to integrate this data quickly across many distributed platforms. EIM technology goes a step beyond business applications running over the public Internet to make geography and heterogeneous data formats utterly transparent to the end customer and allows for real-time insights that increase ROI and generate value.

EIM technology can also help a distributor provide customized quotes that dynamically consider market conditions, the preferences and price sensitivities of customers, and the underlying costs of each product. This kind of intelligent, on-the-fly adaptation can allow a distributor to extract the maximum margin possible from each transaction, maximizing the overall profit yield for a given product or customer.

5.2.2. Financial services

EIM is well suited to a range of retail consumer and commercial financial service industry applications. Financial services are the ultimate virtual product, with a near-infinite range of possible permutations, terms, and pricing models that can be manufactured on the fly to meet the

special requirements of customers. At a wholesale level among financial institutions and large corporations this kind of vast variety and customization is commonplace.

At a retail level, however, the costs of managing such variety and complexity even in virtual financial products have generally outweighed the benefits. Retail financial services (e.g., mortgages, demand deposit accounts, wealth management, insurance, brokerage, etc.) have thus generally adhered to the arbitrary notion of discrete products with relatively fixed terms and pricing models for all comers. Credit card providers are one counter-example where customization (at least at a crude, demographic level) is becoming more common as issuers make use of detailed data on customers financial histories.

EIM technology empowers retail financial service providers to customize their offerings to the needs of particular customers automatically and inexpensively, based on real-time mining of existing information on each customer, on competitive offerings, and on general market conditions. By delivering such deep customization at low cost, providers should be able to increase customer loyalty and the depth of their involvement with each customer, and to maximize their incremental profit on each offering.

Financial service providers, especially banks, have also been hamstrung by artificial organizational barriers, including multiple charters resulting from regulatory constraints and serpentine histories of acquisitions. It is imperative that existing players be able to consolidate and maintain their relationships seamlessly with customers as these constraints erode and industry consolidation continues. Customers who use multiple services from the same institution, for example, increasingly need the simplicity of a single, consolidated statement. Similarly, customers who relocate need the ability to have their accounts transitioned across internal institutional boundaries with a minimum of friction and hassle. While both capabilities are achievable (at some cost) with conventional database technology, EIM technology provides a new level of seamless, real-time integration that can deliver these capabilities easily across multiple platforms within a complex and/or highly distributed financial services organization.

5.3. Key Horizontal Applications

5.3.1. Dynamic data reconfiguration

EIM technology can provide organizations with the ability to automate and improve the efficiency of costly data maintenance, as well as administrative functions that span multiple organizational entities and data sets. The kind of automated, intelligent data reconfiguration that EIM provides through its transformation services can help to improve the timeliness and accuracy of links with and among customer, supplier, product, partner, and business unit data. In environments where data and the relationships between data sets are changing faster than manual processes can keep pace, EIM technology offers a more effective way to preserve and enhance the value of corporate data assets while enhancing customer service and reducing costs.

Benefits administration, including healthcare, retirement, workmen's compensation, and disability, is one area in which dynamic data transformation and reconfiguration can help to significantly.

reduce the overhead of a critical but non-revenue-producing function, turning it in to one, while increasing accuracy and providing far better service and response time to internal customers. Benefits administration in many companies today is a manual, paper-intensive, error-prone, and disjointed set of activities. Dynamic data transformation and reconfiguration makes it possible to integrate and reduce the cost of these activities, in part by automatically updating the links between employee records, benefits providers, claims, payments, bills and other relevant records across multiple databases inside and outside an organization with a high level of security. EIM's approach makes it possible for organizations to turn enrollment, eligibility, and billing verification into real-time processes improving both customer service and accuracy.

This is only one example of the type of data maintenance, data integration, and administrative overhead that routinely wastes time, effort, and money in larger organizations. Even where existing manual, paper, or multi-database processes eventually do the job, the hidden soft costs of erroneous data and slow customer response can have major negative impacts on performance. EIM technology helps to dramatically improve the efficiency of routine data maintenance, data management, and administrative functions through intelligent real-time business integration and dynamic data transformation and reconfiguration.

5.3.2. Virtual translator

EIM technology offers a non-invasive approach to integrating distributed, heterogeneous, and constantly evolving data in complex environments. Compared to other approaches to corporate data integration (ad hoc bilateral translation, common reference integration hub, or the imposition of a corporate data architecture), EIM's IDP provides a cost-effective solution that can be implemented quickly, and that leaves critical operational platforms free to continue their transaction processing undisturbed.

An example of a situation where virtual translator capabilities might be useful would be a manufacturing company with many different business units and product lines that wanted to present a more united front to its customers. Features such as consolidated invoicing and seamless access to integrated product catalogs would help the company to increase brand awareness and make it easier for customers to do business with it. By using EIM's IDP database management platform, such a manufacturer could, dynamically, integrate heterogeneous live information from platforms dispersed across its business units around the world, making them appear as one. More importantly, this could be accomplished without having to force business units to write off investments in existing platforms that work, or to incur the cost, risk, and time of migrating to a common corporate data architecture. Unlike corporate data warehouses, which assemble data from across a large, complex organization in one massive platform for retrospective analysis, EIM's IDP database harnesses real data in real-time, at high speed.

5.3.3. Strategic ERP

EIM's technology allows customers to make use of real-time transactional information for strategic, externally focused Enterprise Resource Planning (ERP). Unlike SAP and PeopleSoft, which provide ERP primarily for internally focused functions (e.g., manufacturing) and

administrative platforms (e.g., human resources), EIM IDP empowers its customers to manage all phases of time-dependent resources more effectively.

One example of how *strategic* ERP (SERP) capabilities can be useful is in international trade. In this application, multiple parties (to eke out profitability) require timely, accurate insights into hugely complex operations in a hyper-competitive environment. Producers need to get their goods to market as quickly as possible to serve their customers better, to minimize the amount of capital they have tied up in goods in transit, and to capitalize on fleeting or literally perishable market opportunities. Shippers wish to maximize the utilization of their own perishable resources (space on ships leaving the dock); buyers wish to ensure that goods they have ordered arrive precisely on time neither too late, nor too early.

EIM's technology allows each of these parties to manage their critical resources in real-time in the context of what others are doing. Companies using EIM technology can be more precise in how they deploy resources and how they select and frame service contracts with customers, suppliers, and third parties. Companies can also reduce their risk of making poor resource allocation decisions by playing tactical what if scenarios into the near future based on current information about market conditions, resource utilization, and resource deployment.

5.3.4. Zero-call effectiveness

Sales and service organizations often speak of first-call effectiveness when describing how well they can meet the needs of customers on first contact (e.g., when a customer with a problem calls a technical support hotline). While this single measure is valuable in highlighting and making incremental improvements to the efficiency of call center operations, it completely ignores the costs and limitations of running a call center in the first place. Measures of first-call effectiveness say nothing about the total number of calls an organization must handle from its customers, and extraordinarily little about how making a call, compared with getting the information in a more efficient way, impacts a customer's productivity.

One of the current ideals for any customer service organization is to achieve one-call effectiveness - serving all a customer's needs in a single interaction. Achievement of this ideal state helps to reduce costs and increase customer satisfaction. The spreading presence of the web makes it possible to raise this standard further - to one of zero-contact effectiveness. Customer service organizations can reduce costs by one to two *orders of magnitude* by serving a full range of customer needs on-line, precluding the need for more costly (and often less useful) human-mediated data delivery.

Increasingly, organizations are opening portions of key internal databases (e.g., for product and technical information) directly to customers. This is being done both in the business-to-consumer environment as well as in the business-to-business realm, where limited private extranets involving one or a few trusted partners are one manifestation of this trend. Access to these databases through an easy-to-use interface empowers customers to serve themselves to rich, accurate, timely, and often personalized information. Implementing this from scratch however is far easier than

integrating and providing rapid access to live information stored in a variety of legacy platforms across a complex, global business.

EIM technology offers a cost-effective solution to sales and service organizations that seek to provide their customers with seamless, rapid electronic access to distributed product and technical information residing on different platforms in different forms and structures. EIM technology can allow a company to reduce its sales and service costs while at the same time improve the value and effectiveness of these interactions for customers and used predictive analytics in real-time in addition to the insights generated.

6. Enabling Technologies and Capabilities

6.1. Real-time Integration of Distributed Data

Integrating data from multiple heterogeneous sources is the perennial problem in distributed computing. Doing so in real-time while transforming with constantly changing live business data over complex distributed networks, represents another level of challenge altogether. EIM's database management platform (known as IDP see section 3.2) provides advanced capabilities that directly address these challenges.

The EIM IDP is a single, multi-dimensional network data model that integrates existing databases without altering their structure or affecting their ongoing operation by transformation, application of date methodologies and technologies. It does this by applying descriptive, classification and functional algorithms or formulae to each unique database element within its multi-dimensional network model. The combination of labels forms a comprehensive class and object oriented algorithmic model of data across multiple sources. Such models can be as effective at integrating dispersed, heterogeneous data within a single organization (e.g., across several geographically distributed offices), as they are at integrating data among many business partners (e.g., within a consortium, along a value chain of suppliers and customers, or within a trading community).

6.2. Ultra-high Speed Database Queries

The interlocking descriptive, classification and functional algorithms allows the EIM IDP to establish what is effectively an infinite number of access pathways to each piece of the data, creating dynamic data logic that contains enhanced intelligence that will trigger value generating events contained in the data and made actionable through insights. This enables subsequent queries of the data to make use of the fastest path available, based on current platform conditions the path of least resistance. This approach obviates the need for indices, queuing, replication, meta-data layers, or cycle-consuming direct searches of storage media.

6.3. Dynamically Variable Business Rules

Intelligent Decision Criteria (IDC) are a special Dynamic Data Logic business rules, process descriptions, and formulas that guide the processing, interpretation, and delivery of data within an IDP environment. They can be set, for example, to vary (optimize) the price and terms a customer sees based upon a complex and constantly evolving set of variables within the networked IDP. These might include the price of similar recent transactions, the transaction history and credit-worthiness of a particular customer, the season, the time of day, or inventory levels in a warehouse.

IDC′s can be used to support and make explicit existing business models and rules, while enabling the flexible adaptation of models and rules as well as the creation of entirely new ones. IDC′s can be created and modified either manually or automatically in response to evolving parameters.

6.4. Automated Adaptation

IDC′s can provide a powerful extra level of automated intuition when allowed to evolve and modify *themselves* in response to key events, emergent patterns in data, or higher-level algorithmic classes. EIM technology uses a component called Event Algorithms (EA′s) to perform this dynamic modification of IDC′s, key data, and meta-data elements. Event algorithms make use of changes to key data to drive changes in Intelligent Decision Criteria. In this sense the IDC and EA components work together as a kind of intelligent, learning-enabled autopilot for a range of operational and transactional decisions. This can help companies to free-up scarce management attention, and better leverage human judgment for those decisions that truly require it. However, IDC′s and EA′s can be used to push well beyond maintenance and incremental improvement of the status quo by providing timely insights into patterns in business data thus allowing for the enhanced intelligence driven insights.

6.5. Knowledge Extraction

New business rules and decision criteria evolved by the IDP itself can be made explicit, informing management with new insights and rules for optimizing business operations. In this sense, IDC′s provide a mechanism for managers to extract knowledge and insights from complex operations without having to know in advance what patterns or metrics they ought to be looking for.