

# ENTERPRISE APPLICATIONS BEYOND ERP

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What's next for enterprise applications? Will the enterprise resource planning (ERP) giants be the next Microsofts? What happens after 2000? In this issue of *The Software Investor*, we attempt to forecast the enterprise applications arena beyond ERP. Our vision for the future of enterprise applications is formed by the confluence of three macro trends we believe will conspire to change the software industry. The ramifications of these changes may be as profound as those resulting from the proliferation of the personal computer in the 1980s, and the initial introduction of business computing with mainframes in the 1960s. In other words, we believe we are on the verge of the next 20-year phase — we have experienced the introduction and infancy of business computing, we have struggled through the adolescence of commercialization and commoditization of computing power and tried to harness and control it, and we are nearly ready to build effective solutions upon the (hopefully) robust infrastructures in which we have invested so heavily.

How will this new era unfold? Who are the companies that will capitalize successfully on these trends? Investors who can identify the trends as they appear in software companies' strategies should take advantage of their insight — these will be the leaders in the next generation of enterprise applications.

## BACKGROUND

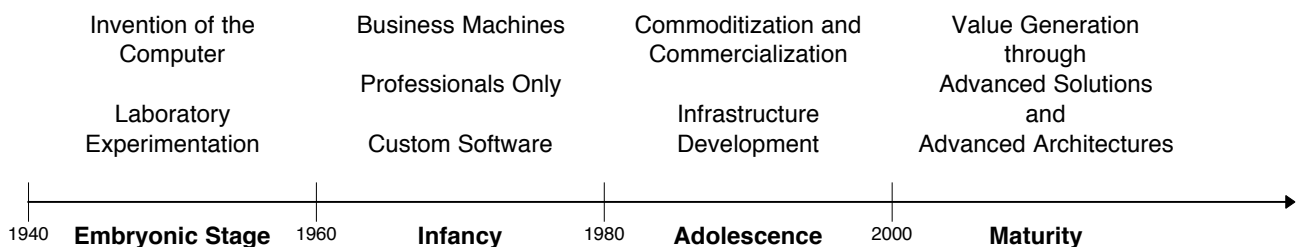
The 1940s and 1950s represented the embryonic stage of computers and information technology — it was then that the science was invented and under experimentation. The 1960s and 1970s were the industry's infancy in which business applications of computers and information technology were first born. The technology was handled gingerly by professionals only to carefully deliver simple solutions.

We are currently in the industry's adolescence, but are racing toward its maturity (see Figure 1). In the 1980s, successful software companies typically sold technologies and tools. Businesses were in their adolescence in their adoption of information technology and were beginning to explore developing applications to automate many business processes. They purchased technologies and tools from emerging software providers to help implement their custom systems. By the early 1990s, however, software companies began selling horizontally applicable solutions on the assumption that differences among businesses were

addressable through relatively minor customizations to general-purpose applications. Such applications included financial accounting, human resource management, manufacturing resource planning and others. When enterprise applications companies such as SAP, Oracle, Baan, PeopleSoft, J.D. Edwards, MAPICS, Marcam, SSA, QAD, and others combined the financial and manufacturing applications, thus was born enterprise resource planning application suites and backbones, known more familiarly as ERP software.

As ERP vendors continued to successfully penetrate large enterprises worldwide, and operational systems reached maturity levels among early adopters, the ERP space received another momentum boost — the millenium scare. Awareness spread like a virus, making those enterprises that had stuck by their legacy systems suddenly quite nervous about the integrity and reliability of their systems facing the impending, inevitable deadline of January 1, 2000. Consultants and systems integrators fueled the fire of panic, driving growth in the ERP sector even further in 1996 and 1997. After all, many executives

**Figure 1. The information technology industry's timeline — a 20-year phenomenon**



Source: Lazard Frères & Co. LLC

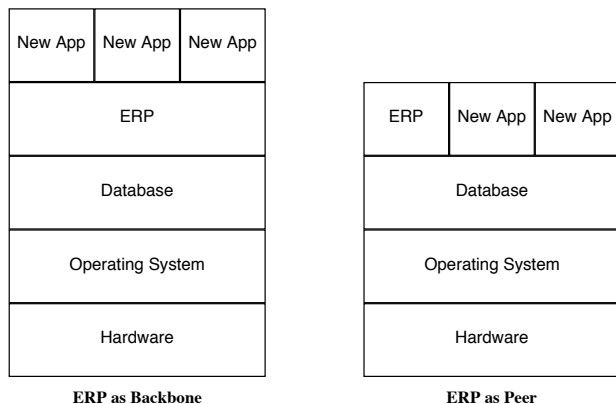
concluded, the safest way to avoid the millenium disaster would certainly be to replace old systems with new technology backed by the reputations and assurances of third-party enterprise applications providers.

As we approach the turn of the millenium, it is time to start considering what happens next. Both the early adopters and second wave of enterprises are about to reach a state in which ERP systems or legacy systems are considered robust and in working condition. One scenario — the one that ERP companies are hoping for — is that the ERP layer becomes the “business operating system”. That is, ERP becomes the layer upon which all other functions are built. Thus, as Microsoft’s dominance in desktop operating systems has led to its success in both ongoing improvements to operating system function and applications on top of it, ERP vendors hope to become the backbone of all enterprise systems, offering both basic transaction processing functions as well as additional functions layered on top.

However, we believe that an alternative scenario may very well arise instead. Here, ERP application modules become one set of functions making use of underlying operational databases. But, these databases become the common ground, from which many other functional applications can draw information, communicate results, and in combination provide a continuously expanding set of capabilities to enterprises. As shown in Figure 2, these new applications are peers of the ERP systems, as opposed to layered on top of them. Moreover, since ERP provides generic, cross-industry, basic transaction processing functions, the next generation of enterprise applications are free to focus on high-value-added, more specifically targeted functions.

We identify three macro trends that should drive the

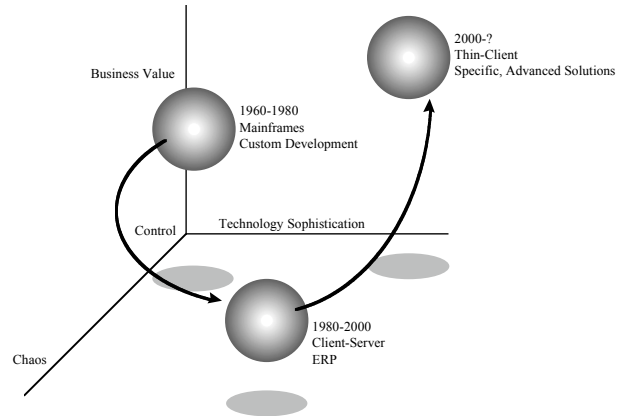
**Figure 2. Two scenarios for the future of enterprise applications**



Source: Lazard Frères & Co. LLC

successful, next-generation enterprise application company — industry-specificity, advanced best-of-breed solutions, and thin-client architectures leading to application outsourcing. The result of these trends should be higher business value perceived and measured by the enterprises, derived from greater levels of technological sophistication, and built upon manageable, economical architectures (see Figure 3).

**Figure 3. Evolution toward high business value, technological sophistication, and control**



Source: Lazard Frères & Co. LLC

### INDUSTRY-SPECIFIC APPLICATIONS

While ERP has enjoyed substantial growth and market penetration for its generic, cross-industry solutions, until recently, industries with specific needs (meaning almost all industries) have had to fend for themselves in custom-developing solutions. However, two factors are currently providing momentum for the growth of industry-specific software applications vendors — the increasing maturity of the underlying operating systems and databases within many enterprises, and the increasing maturity of specific industry knowledge among groups of software professionals. Due to these factors and the latent market demand, industry-specific applications are becoming one of the fastest growing segments of the software industry.

The industries that are supporting the most rapid growth in tailored software applications are financial services, healthcare, retail, and telecommunications. Other industries that are being serviced by this new breed of software company include bioengineering, construction, education, entertainment, gaming, and law enforcement.

*Financial Services.* Applications targeted at the financial services industry include a wide variety of specific solutions including investment tracking, account management, trading systems, risk management, credit evaluation, mortgage processing, and insurance account

and claims management. Many of these applications are characterized by high-volume transaction processing requirements. Others have recurring revenue features based on their reliance on underlying data sources and feeds that demand continuous subscription. And yet others require the use of advanced algorithms such as neural networks for pattern recognition and forecasting. All of these specific requirements are completely distinct from ERP offerings. While integration with underlying data used by ERP systems may be desirable, these systems are far more often either integrated with legacy systems, or not integrated at all.

Selected public companies specialized in software applications for the financial services industry are shown in Figure 4. Also shown are companies with specific offerings in this area, but who do not exclusively sell to this group.

**Figure 4. Selected software companies for the financial services industry (public)**

Advent Software	OTC-\$41 1/8-ADVS
Barra	OTC-\$23 3/4-BARZ
C.ATS Software	OTC-\$6 9/32-CATX
CFI Proservices	OTC-\$17 19/32-PROI
Credit Management Solutions	OTC-\$5 1/2-CMSS
Delphi Information Systems	OTC-\$5 1/16-DLPH
Factset Research Systems	NYSE-\$33-FDS
FDP	OTC-\$13 7/8-FDPC
HNC Software	OTC-\$36 3/8-HNCS
IA	OTC-\$2 9/16-IACP
Interinq Software	OTC-\$6 1/2-INLQ
NewsEgde	OTC-\$12 3/4-NEWZ
Omega Research	OTC-\$5 9/16-OMGA
Phoenix International	OTC-\$29 1/4-PHXX
SS&C Technologies	OTC-\$22 5/8-SSNC
Transaction Systems Architects	OTC-\$42 3/8-TSAI
Ultradata	OTC-\$6 7/8-ULTD

Source: Lazard Frères & Co. LLC

*Healthcare.* The healthcare industry is a paradox when it comes to its adoption of information technology. From a market requirements standpoint, the healthcare industry is in dire need of advanced, specifically tailored solutions. However, it has been one of the slowest industries in its adoption of information technology. Healthcare providers such as hospitals, managed-care organizations, and physician's practices need information systems for managing clinical, financial, and administrative information, and for inter-enterprise applications such as insurance processing. The underlying databases need to support large, high-resolution images such as X rays, CAT scans, and MRIs. The software processes can have real-time requirements and need to track long-range historical information.

In addition to the already-long list of requirements and specifications, emerging information technologies in the healthcare industry include protocol management for

specific diseases and syndromes, patient-care tracking systems, and other advanced applications.

While large companies like HBO & Company (OTC-\$61-HBOC) provide software and a complete set of information technology services for the healthcare industry, a group of software applications companies is emerging that provide pure software solutions to this industry (see Figure 5).

**Figure 5. Selected software companies for the healthcare industry (public)**

Dynamic Healthcare Technologies	OTC-\$1 13/16-DHTI
Health Management Systems	OTC-\$11 3/16-HMSY
Health System Design	OTC-\$8 7/8-HSDC
I.S.G. Technologies	OTC-\$2 9/16-ISGTF
Oacis Healthcare Holdings	OTC-\$4 1/16-OCIS
Quality Systems	OTC-\$7 7/16-QSII

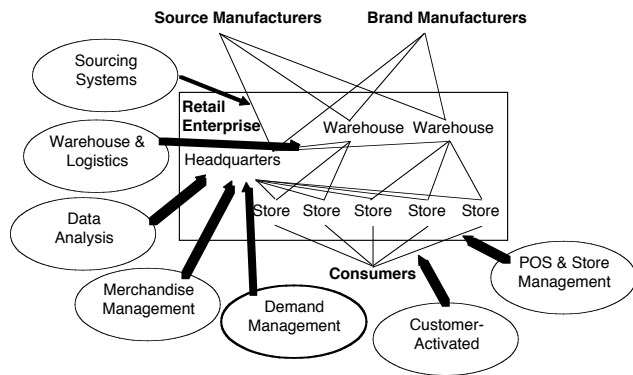
Source: Lazard Frères & Co. LLC

*Retail.* Retailers are another set of notoriously late adopters of technology. However, market pressures and millenium issues are forcing retailers to ramp up their decaying custom systems with modern applications. We estimate the global opportunity for retail applications, including software, services and maintenance fees is a \$9 billion potential market comprised of more than 3,400 retailers worldwide. Our study of the market leads us to believe that it is only 15% penetrated to date, or approximately \$1.3 billion in size (see *The Emergence of Retail Supply Chain Software*, A. Pasik, The Software Investor, Vol. 7, Lazard Frères & Co LLC, April 1998).

Modules comprising the full suite of retail applications include merchandise management, logistics and warehouse management, sourcing, data analysis, demand management and in-store systems, including point-of-sale, store management, and customer-activated systems (see Figure 6).

For the next several years, we believe increased and emerging competition from consolidators and direct marketers will force retailers to invest in their software systems to improve efficiencies. Furthermore, we believe those providers of comprehensive retail supply chain solutions, as opposed to point solution providers, will gain the largest share overtime. This will be increasingly important as the breadth and depth of the solutions extend into optimization and scheduling across all or most of the retail application functions. Public companies offering retail application solutions include HNC Software (OTC-\$36 3/8-HNCS), JDA Software (OTC-\$47 31/32-JDAS), and Radiant Systems (OTC-\$19 19/32-RADS).

**Figure 6. Components of retail application software**



Source: Lazard Frères & Co. LLC

**Telecommunications.** Through the mid 1980s telecommunications carriers provided wireline services in a highly regulated environment, characterized by monopoly dominance. In the US, deregulation began with the breakup of AT&T followed by the entrance of additional long distance carriers. Further industry deregulation occurred in 1994 when the government began auctioning substantial radio spectrum for digital cellular, PCS and other services attracting a large number of new entrants into the market.

We believe the Telecommunications Act of 1996 will further increase the number of wireline and wireless carriers in the US market by allowing local and long distance wireline, wireless, satellite and cable television companies to provide competing services. In non-US markets deregulation and privatization is also increasing the number of carriers in each market while the economies of implementation of cellular and other wireless systems, in comparison with wireline systems, are opening markets in less developed countries to enhanced telecommunications services and increased competition.

**Figure 7. Selected software companies for the telecommunications industry (public)**

Billing Concepts	OTC-\$23 7/8-BILL
CSG Systems International	OTC-\$43 5/8-CSGS
Evolving Systems	OTC-\$19 3/16-EVOL
International Telecom Data Systems	OTC-\$27-ITDS
LCC International	OTC-\$19 5/8-LCCI
LHS Group	OTC-\$121 15/16-LHSG
Lightbridge	OTC-\$11 3/4-LTBG
Precision Systems	OTC-\$1 31/32-PSYS
Saville Systems	OTC-\$46 3/4-SAVLY
USCS International	OTC-\$20 3/8-USCS
Wiztec Solutions	OTC-\$11 7/16-WIZTF

Source: Lazard Frères & Co. LLC

Advances in technology have also drawn new entrants into the market. In the wireless sector the move to digital from analog, due to lower infrastructure costs, greater privacy, and fraud protection is driving market growth. Additional growth verticals include Internet and direct-broadcast satellite providers. This rapidly changing market provides substantial opportunities for growth through increased competition and therefore continues to draw new entrants.

Rapid carrier growth along with advancements in technology have driven greater competition in the telecommunications services market. Service offerings have emerged as a differentiating factor among telecommunications carriers, which has increased demand for advanced, flexible software solutions targeted specifically for the telecommunications industry. These solutions include customer care and billing, operational support, network management, planning and design, and best-of-breed point solutions for addressing issues such as local number portability and pre-paid billing (see *Initiating Coverage on Telecom Billing*, A. Pasik and P. Reddington, *The Software Investor*, Vol. 5, Lazard Frères & Co LLC, February 1998). Figure 7 shows a selected list of public companies providing software solutions for the telecommunications industry.

#### ADVANCED BEST-OF-BREED SOLUTIONS

Our second trend is the emergence and proliferation of advanced, best-of-breed solutions. These enterprise applications make use of advanced technologies such as constraint-based reasoning, genetic algorithms, neural networks, rule-based systems, and visualization to create software that can dramatically add value to businesses by enabling processes previously beyond their reach. In contrast to ERP applications that automate existing business processes, advanced solutions enable businesses to increase profitability by both increasing revenue and decreasing both operating expenses and working capital requirements. Software companies providing these advanced solutions have high barriers to competition as the underlying technology is difficult to implement and productize. They also are in the enviable position of providing measurable returns on their customers' investments.

The first great success story in advanced solutions is the supply chain planning space. Market leaders i2 Technologies (OTC-\$72 1/2-ITWO) and Manugistics Group (OTC-\$59 15/16-MANU) have been growing at exponential rates. Since January 2, 1997 their stock prices have soared 87% and 210% respectively. Supply chain planning software providers give their customers the ability to optimize their interactions with suppliers, forecast demand, reduce inventory requirements, and predict availability of products accurately. The software can use a combination of constraint-based reasoning algorithms,

linear programming models, rule-based systems, and genetic algorithms.

Other public enterprise application companies using advanced technologies to provide high-value-added solutions include Logility (OTC-\$10-LGTY) also in supply chain planning, Aspen Technology (OTC-\$48-AZPN) with its process manufacturing optimization solutions, Concentra (OTC-\$4 1/8-CTRA) with its product configuration software, HNC Software (OTC-\$36 3/8-HNCS) with its neural-network-based predictive software for the financial and healthcare industries, and SPSS (OTC-\$25-SPSS), MathSoft (OTC-\$4-MATH), Cognos (OTC-\$27 7/16-COGNF) and Business Objects (OTC-\$19 9/32-BOBJY) with their data mining product offerings.

But it is not always the use of specific advanced algorithms that make a successful best-of-breed solution. Emerging sectors of the software industry that are focusing on these types of enterprise applications include warehouse management, order fulfillment, capital asset management and scheduling, and product configuration. While many companies in areas such as warehouse management and product configuration are private, some public companies in these spaces are shown in Figure 8a along with the other optimization and decision support suppliers.

**Figure 8. Selected enterprise applications companies providing advanced, best-of-breed solutions across industries (public)**

Aspen Technology	OTC-\$48-AZPN
Catalyst International	OTC-\$13-CLYS
Concentra	OTC-\$4 1/8-CTRA
DataStream Systems	OTC-\$22 1/2-DSTM
HNC Software	OTC-\$36 3/8-HNCS
i2 Technologies	OTC-\$72 1/2-ITWO
Indus International	OTC-\$8 1/2-IINT
Industri-Matematik	OTC-\$15 1/4-IMIC
Logility	OTC-\$10-LGTY
Manugistics Group	OTC-\$59 15/16-MANU
Project Software and Development	OTC-\$25 3/16-PSDI
Robocom Systems	OTC-\$5 3/8-RIMS

**Figure 8b. Selected data analysis companies (public)**

Applix	OTC-\$5 3/8-APLX
Arbor Software	OTC-\$44 5/16-ARSW
Brio Technology	OTC-\$15 3/4-BRYO
Business Objects	OTC-\$19 9/32-BOBJY
Cognos	OTC-\$27 7/16-COGNF
Computer Concepts	OTC-\$6 1/2-CCEE
Comshare	OTC-\$8 3/16-CSRE
Gentia Software	OTC-\$6 15/32-GNTIY
Group 1 Software	OTC-\$12 1/2-GSOF
Hummingbird Communications	OTC-\$32 41/64-HUMCF
Information Advantage	OTC-\$10 1/8-IACO
IQ Software	OTC-\$11-IQSW
MathSoft	OTC-\$4-MATH
SPSS	OTC-\$25-SPSS

Source: Lazard Frères & Co. LLC

Figure 8b shows public companies specializing in advanced data analysis software including data warehousing, on-line analytical processing, and data mining. These companies are leveraging of the maturity of operational databases to provide customers with analytical capabilities for turning their data repositories into profit sources.

### THIN-CLIENT APPLICATION ARCHITECTURES AND APPLICATION OUTSOURCING

In the adolescence of the information technology industry, efforts to build complex client-server solutions have been driven by the requirements of sophisticated user interfaces, inexpensive processing and leveraged, shared resources where appropriate. That is, there have been repeated awkward attempts to combine the best of the mainframe with the best of the personal computer. But does it make sense to build applications that run predominantly on desktop PCs while making queries to back-end, shared databases? This solution has high bandwidth requirements and complex software distribution issues. On the other hand, the older mainframe technologies accessed by simple terminal devices have associated computing costs that are too high and do not have the ability to provide high-productivity user interfaces.

The explosive growth of the World Wide Web has demonstrated the feasibility and effectiveness of the thin-client architecture for information retrieval and distribution. We believe this lesson will serve as a proof of concept for next-generation enterprise application architectures. (Note that we use the term “thin client” to refer to an application architecture rather than a hardware platform such as a Network Computer or other such appliance.) Although we believe that there will be a demand for such devices, the more-substantial impact on the software industry should emerge from the transition to software applications that deliver their capabilities to end users via standard thin-client software (e.g., browsers or desktop operating systems) that are enabled to run downloaded applications on demand.

We believe the trend toward thin-client architectures with distributed server-based applications, databases and other shared resources will be driven by the resulting benefits of lower total cost of ownership, lower processing costs (as computing resources are selected dynamically according to the most efficient execution distribution), and more-sophisticated user interfaces enabled by such architectures. Furthermore, as applications migrate off the PC and onto back-end servers, the vicious upgrade cycle of desktop computers should evolve into a more manageable, scalable-server upgrade model.

However, potentially the largest impact of thin-client application architectures will be the rise of the outsourced application or remote-server architecture. The remote-

server architecture is a natural extension of the explosive growth of the World Wide Web. In essence, a Web site is an application itself. Most are read-only, although many are emerging that have forms components for a limited degree of interactivity. Ultimately, this architecture represents a new mechanism for delivering a variety of software applications. With nothing but a generic browser running on any desktop machine, users can access software running on powerful back-end servers that they neither own nor manage. Indeed, delivering a software license in this model would be accomplished simply by allowing access to a restricted Web site. The cost of ownership to the customer is radically reduced — not only is server hardware not required, but neither is the expensive information systems staff. The remote-server architecture is one step beyond even the thin-client applications we have discussed so far — in remote-server, the back-end is supported by third-parties or the software vendors themselves. We believe the remote-server architecture represents the next generation for software applications and should emerge as a dominant platform for software companies in the next 20-year phase of the information technology industry.

## CONCLUSION

As the millenium comes to a close, and the information technology industry matures, many enterprises will find themselves with solid operational systems automating many of their routine business functions. With these building blocks in place, we believe that spending on

information technology will be diverted toward industry-specific applications, and advanced best-of-breed solutions. We also believe that businesses will focus increasingly on their own core competencies which will in turn drive the transition to application outsourcing via remote-server architectures enabled by Internet technologies. This leads us to several broad investment conclusions that can serve as guidelines in evaluating the potentials of success of emerging companies:

Companies providing targeted solutions to specific industries need to demonstrate leadership in their domains. Those that take market share early are well-positioned as the combination of their industry-specific knowledge and minimal competition should enable longer-term success.

Companies developing advanced best-of-breed solutions and can demonstrate more value to their customers than replacement technologies such as ERP should attract an increasing percentage of technology budgets. This success formula should generate a sustainable growth pattern well into the next decade.

Companies that develop their enterprise solutions using thin-client application architectures should be well-positioned to take advantage of the rise of application outsourcing we predict will emerge within the next three years. It is those software companies that will demonstrate the agility to survive architectural shifts in the information technology industry.