

AI tools for business-process modeling

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For more than a decade, artificial intelligence techniques have served as critical building blocks for cutting-edge business applications. Knowledge-based systems (KBS) in particular have helped numerous Fortune 1000 companies solve pressing business problems—everything from scheduling their manufacturing operations to managing their investment portfolios. AI has helped many companies improve productivity and reduce costs to meet the demands of today's competitive global economy.

Today, business management itself is undergoing fundamental change. For the past several years, business-process reengineering (BPR) has become the watchword. This move to rethink and redesign the way a company works aims at further boosting productivity and cutting costs. No wonder then that business managers worldwide are turning to explicit KBS techniques, long proven to achieve the very goals of BPR, to model change. The first wave of AI-based tools and applications for business-process modeling (BPM) is just hitting the shore.

Organizations such as IBM, EDS, the US Army, and Swiss Bank are among the first to adopt AI for BPM. Some are using traditional KBS tools such as ART*Enterprise and ProKappa, while others are turning to ReThink, the first AI tool designed specifically for BPM.

Gensym's ReThink

In late 1993, the Gensym Corporation began to develop ReThink, its object-oriented BPM add-on to its G2 process-control software. For almost two-and-a-half years, Gensym staff consulted with clients to shape ReThink into a BPM tool to speed system development. (The "Gensym" box describes that company's remarkable resurgence in recent years.)

The product came on the market in spring 1996, with a starting price tag of \$19,000 (which includes a copy of G2). Gensym has sold approximately 100 copies to the pharmaceutical, utilities, insurance, manufacturing, and telecommunications industries (see Figure 1).

ReThink enables users to build a process model in an object-oriented architecture and encode business rules that are applied when a scenario is run through the model. Application development with ReThink starts with construction of a top-down model of the business processes involved, beginning with the flow of work from task to task. Next comes a model of the kinds of work objects that each process acts on—an order or inventory, for instance. Last is a model of the resources used by the tasks and other factors, including costs, bottlenecks, and durations of the tasks. ReThink can roll up costs, durations, utilization, and other factors such as process cycle time, to provide a snapshot of a complex, multi-dimensional process. Users access this metalevel view of their business processes via a graphical user interface. As Figure 2 illustrates, they can build control panels for controlling and monitoring a scenario. By cloning a panel, they can run side-by-side comparisons of different conditions.

"ReThink is very different from other BPR tools," asserts Tom Foley, ReThink progenitor and product manager. "Customers, largely resellers, can link high-level consulting directly to implementation using the same tool. Other BPR tools are stand-alone drawing tools, for instance. Then you have to throw them away. Consultants will design a process for simulation, but then can't get the picture easily to the simulation tool to understand the performance of the design. Then they move to a CASE or software development tool. ReThink goes from front-end high-level modeling, to simulation, to understanding the performance implications, to putting it on line with real-time data feeds to the model to run the business." G2, which sits under ReThink, wires applications to live data sources.

Turning on the model

IBM is tailoring ReThink to the utilities industry. IBM's utilities-consulting staff has pooled internal expertise about the industry and poured it into ReThink. Its members are developing a generic but

Gensym: The AI Phoenix

As one the many entrepreneurial companies that emerged in the mid-eighties during AI's 15 minutes of fame, Gensym exemplifies the story of the phoenix. Since rising from the ashes of a defunct company during the "AI Winter" of the late eighties, Gensym has soared to considerable success.

In the early eighties, 14 Lisp machine gurus at MIT started Lisp machine companies—just before workstations and personal computers emerged and before innerconnectivity, LANs, and WANs became common terms. Thirteen of the gurus founded Symbolics; one founded LMI (Lisp Machine Inc.). When LMI went belly up in the mid-eighties, its process-control software, Pycon, rose from the ashes as G2, and Gensym was formed. Since then, Gensym has grown modestly and consistently into a \$28-million company in 1995. Now publicly held, it has built a strong track record, largely in the process-control world. It has since branched out, and its latest offering is ReThink, an add-on module to G2 for business-process modeling.

intricately detailed model of the industry, which lets them run simulations of changes in business processes and resources, pricing, and demand, for instance. They can do rapid what-if analyses and quickly grasp the resulting scenario displayed in the GUI.

While being very circumspect about their activities, IBM's Utilities Group has customized ReThink in consulting engagements as well as on internal projects. "Our work has been heavily in G2 and ReThink," says Rick Ahlgren, IBM's Chief Architect for Utilities. "The expert systems capabilities coupled with object-oriented [programming] make a good combination in a tool."

ReThink is one of several tools IBM is using to develop a modeling environment for BPM in an approach that starts with consulting at a fairly high level, then moves to implementation and software solutions. It is part of a broad BPM effort in IBM's 14 vertical industry consulting groups, which

AT&T • Bombardier • Budget Rent-a-Car •
Deloitte Touche • Diners Club • EDS •
Hoffman LaRoche • Honda • IBM • Liberty
Mutual • Miles Chemical • Pfizer • Raytheon
• Sears Canada • Smith Kline Beecham •
Tokyo Electric • TRW • US Army • US
Department of Defense • Xerox

Figure 1. ReThink partial customer list.

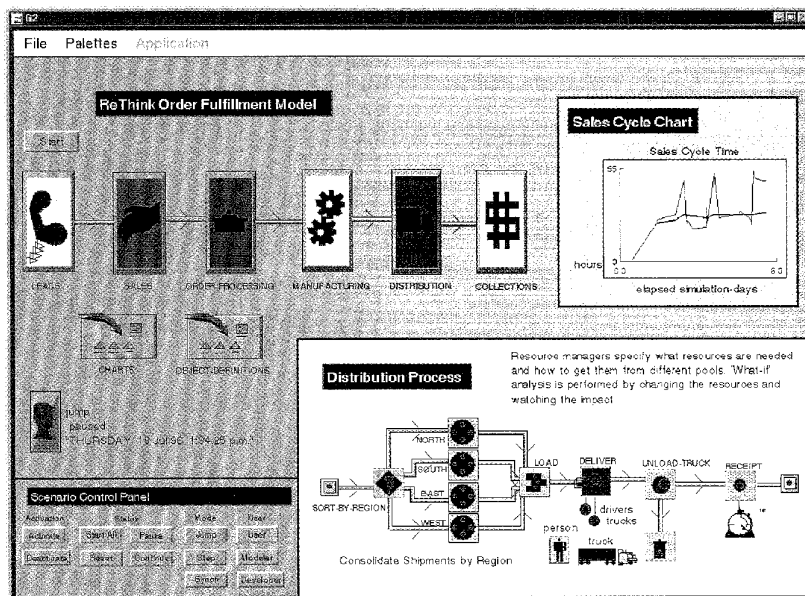


Figure 2. In this ReThink model of an order-fulfillment model, resource managers specify what resources they need and how to get them from different resource pools. They perform what-if analyses by changing the resources and watching the impact.

target such areas as telecommunications and utilities.

"We've had pretty good results with ReThink," Ahlgren continues. "It's helped us work with clients to model and visualize change. We have used it for object modeling—we haven't yet gone on to implementation. From the perspective of a tool for business engineering and modeling, we're getting good results. We can quickly model business environments and give feedback to customers; visualizing change helps their understanding."

In a similar vein, EDS is working on a prototype ReThink system for modeling economic decision making in the oil and gas industry, according to Bob Stafford, EDS Vice President, Oil and Gas. Stafford plans to tie the model into forecasting demand and prices over 30-, 60-, and 90-day periods and out one, two, and five years. "With ReThink you can model either one and tie the forecast of demand to the crude you buy and run it through the model," he says. "No other tool lets you do this." Stafford sees the potential to combine ReThink's macromanagement capabilities with G2's operations management capabilities, tied to real-time data to optimize the managing of the entire production facility.

Stafford gives ReThink's approach to BPM a thumbs up. "It's built around the way people make decisions. Its real value is for complex decisions with multiple variables. It's definitely the best reengineering tool I've seen for across the vertical lines of

an organization. With ReThink, you can go across organizational walls."

Montreal-based Bombardier is, perhaps, the furthest along in wiring ReThink into its operations. When the company was designing a new factory, it used ReThink to develop the specification for the actual plant, and to simulate and optimize the flow of materials through the plant. Bombardier has integrated scheduling and dispatching to run the plant using G2 with ReThink. The company will soon begin running and controlling the plant from the ReThink/G2 software, which has been wired into the plant. (See the "Swiss Bank" box for yet another approach.)

US Army forced to change

The shrinking Defense Department budget is forcing the US Army to change. "If you look at the goals of the DoD," explains Lt. Col. Steve Woffinden, director of the Army AI Center, "and the Information Age, with its complexity and quantity of information—without AI you can't get there. People are beginning to realize they need these techniques if they're going to deal with the Information Age."

Operating out of the Pentagon, the Army AI Center has a dozen years of experience in applying AI. Recently, staff used ReThink in a proof-of-concept demonstration system that models human resources Army-wide. With 508,000 people on active duty, keeping track of the status of each one—his or her grade, skills, languages, promotions, fami-

Software tools discussed

ART* Enterprise, from Brightware
350 Ignacio Blvd.
Novato, CA 94949
(415) 884-4744
<http://www.brightware.com>

ProKappa, from IntelliCorp
1965 El Camino Real
Mountain View, CA 94040
(415) 965-5500
<http://www.intellicorp.com>

ReThink & G2, from Gensym Corporation
125 Cambridge Park Dr.
Cambridge, MA 02140
(617) 547-2500
<http://www.gensym.com>

lies, location, and so forth—is no small task. "The process is very complex," explains Maj. Dave Williams, of the AI Center. "There is data from every kind of data warehouse imaginable." There can be as many as 100 data sources at a time.

For several decades, the Army has been automating and upgrading its personnel management system. "Now we're trying to do more with less—with the right tools," adds Williams. For this proof-of-concept demo, he reports that they were able to quickly model the process in ReThink and link it to a database, using Gensym's Oracle Bridge package.

They were able to show the powerful modeling capabilities available for BPM and, once the model is built, how to run various what-if scenarios to assist with planning personnel changes. Williams reports that for such a complex system, the pictures in the GUI were useful and made changes easy. Apparently, the decision makers who viewed the demo liked what they saw. The AI Center got the green light to model the entire process in higher fidelity to help modernize personnel management.

Getting the big picture

In a grander BPM project, the Army AI Center is working on the Army Flow Model (AFM)—a command and control dashboard of sorts—to assist executive-level decision makers in structuring, staffing, equipping, and sustaining the Army in the field. That's no small task, when you consider its constantly changing staff and the variety of factors involved.

The model's foundation is the life cycle of an Army unit, from force development to final separation of personnel, equipment,

Swiss Bank's business modeling: generic platform, internal applications, and product

Swiss Bank, a \$220-billion operation, is making sweeping changes in its business practices. Its IT group (formerly known as MIS) is a catalyst for this change with its AI technology. The group has built a Fractal Business Service Modeling Environment (FBSM-E) as a high-level general tool for business-process modeling. It is based on ART*Enterprise, an advanced object-oriented KBS toolkit.

The system architecture relies on cooperating agents. Agents are grouped together in a work cell to model a process (see Figure A). At a higher level, a process coordinator agent manages all the pieces.¹

At the BPM system's core is a central model of the bank's business. Financial managers can use FBSM-E to model and integrate any number of business processes. One such process is embodied in the Balet system (*balance sheet estimation tool*), which automates the assessment of financial indicators. With the push of a button, a chief financial officer or corporate treasurer can perform the kind of financial analysis that takes a term or two to teach at MBA schools. Such analyses can take days or weeks to perform on real data, depending on the level of automation; the quantity of information to be reviewed, summarized, and analyzed; and the analyst's skill.

Balet is designed to reduce an organization's financial exposure—especially exposure to interest rate fluctuations. Balet's architecture consists of five intelligent agents that define and simulate the options available to reduce risk, analyze the alternatives, generate hedges, explore various interest assumptions and their implications, and generate intelligent reports. The agents operate over a business model of the company's balance sheet.²

Since early 1995, Swiss Bank has not only reaped the benefits of an improved process via intelligent automation; it has also recovered the costs of Balet's initial development through sales of the system to 12 of its customers. Because the system was built using the FBSM-E platform, the entire development cycle ran only 10 person-months. User adaptation of Balet to a specific process took an additional two months to define the simulation models and test the working system. It runs on

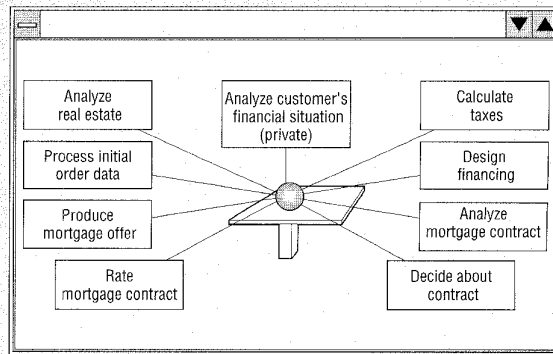


Figure A. Selling mortgages. A group of agents, each with a specialized task, work together to perform a business process. The object-oriented multiagent architecture is well-suited to modeling such a process.

a Pentium PC with 32 Mbytes of RAM. The system has won a 1996 Innovative Applications of Artificial Intelligence award.

About 20 Swiss Bank employees currently use FBSM-E, and various divisions are evaluating how to use it. System developers are adding new features—response time, for instance—to the platform: if customers have a request, for example, how long will it take to provide service to them? The work at Swiss Bank represents some of the most advanced, sophisticated, cutting-edge business process modeling today—enabled by AI.

References

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2. U. Buehler, L. Bosatta, and L. Poynter, "An Intelligent System for Asset and Liability Assessment," *Proc. AAAI-96/IAAI-96, Vol. II*, Am. Assoc. for Artificial Intelligence Press/MIT Press, Cambridge, Mass., 1996, pp. 1455–1460.

and facilities.¹ In addition, AFM models the interactions of the unit life cycle for five functional areas: force structure, personnel, logistics, installations, and dollar costs.

Senior staff thus can see the effects of policy decisions over time. With current computer systems, staff can look at each of the functional areas in isolation. In contrast, AFM will provide a big picture that provides vertical integration across each functional process and lets staff evaluate the effects of proposed changes, running various scenarios—over time—before implementing those changes.

Using the KBS tool ProKappa, AI Center staff members have been developing the AFM. ProKappa's flexible, distributed, object-oriented environment, so long enjoyed by AI practitioners, is well-suited to modeling the complexity of this process. Data from various, disparate databases feed into the model. Allocation rules, acquired from experts in each of the functional areas, power the model. Each functional

model, which executes as an independent, asynchronous process, consists of four major components: objects, inference engine and associated rule sets, one or more databases, and a GUI. These loosely coupled models link through a blackboard. An X Window-Motif GUI front end lets users quickly see the results of various changes. The model runs on five Sparc 10s networked to a dedicated Sparc 670 server running Oracle.

When AFM is complete, Army leadership will be far better equipped to make sure that the right configuration of officers and enlisted personnel, with the right skills and equipment, are in the right place at the right time—all within budget—to get the job done.

A promising bridge

Much of the leverage of AI approaches to BPM is in the object-oriented modeling capabilities combined with rules and GUIs. Judging from the experiences of early adopters such as Swiss Bank, IBM, and the

Army, modeling business processes in an AI-based architecture seems a natural fit. "This is a very promising area—applying approaches we've developed, supported by tools like Gensym's for modeling business, communicating change, and visualizing change," notes IBM's Foley. "It bridges the business and software worlds more seamlessly than in the past." Once again, AI is showing its unparalleled value as a tool to meet the most pressing business threats and opportunities of our times.

Reference

1. R. Roberts, "The Army Flow Model," tech. report, US Army Artificial Intelligence Center, Washington, D.C.

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