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Model Driven Architecture:
Applying MDA to Enterprise
Computing

A Convergence of Business and IT Thinking?

SOA and the Business-IT Divide

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We have become accustomed to the fact that business and IT people speak different languages grounded in disparate views of the world. However, advanced thinkers in business management are discussing future trends in ways that bear striking similarities to the basic concepts of service oriented architecture (SOA) that IT is disseminating.

This convergence of thinking offers new opportunities to conduct a business-IT conversation where the parties could find common ground rather than talk past each other.

Where is IT Today?

The preponderance of IT trade press articles and analyst reports leave the impression that SOA, IT's key initiative of the decade, is spreading very quickly. However, the reality is somewhat different. Many businesses are holding back on making the large IT investments that SOA requires, and IT spending is not ramping up at a pace that compares with previous IT waves.

Big upsurges of IT investment occurred in the past when business people could see that the outlays would enable them to reconstruct their businesses in compelling ways. For example, the idea that galvanized businesses to invest in packaged software applications was that they would be able to focus on their core competency, rather than having to expend resources developing and maintaining software applications.

Similarly, the idea that businesses could develop entirely new channels for selling, distributing, and marketing their products drove the investment in Web technology. However, this last major wave of IT investment crashed hard in the dot-com bust. Hype machines pushed many products and projects that were based on flimsy architectures and business models.

As a result, despite the fact that businesses did permanently gain substantial new capabilities and levels of productivity from the last investment wave, business executives tend to view IT with suspicion. They are highly sensitive to talk about the next great IT "thing." SOA vendors and practitioners who wish to fire up business executives for yet another big wave of IT spending have to face this reality.

What IT Says About SOA

This is a quick summary of basic SOA concepts.

Loosely-Coupled Services, Composite Applications, and Eroding Silos

SOA is about reorganizing IT assets into *loosely-coupled* components. *Composite applications*, built with tools that constitute an essential part of a SOA environment, orchestrate multiple components in unique ways, thereby *spanning and ultimately breaking down the rigid IT silos* that hamper integration.

Furthermore, by focusing on service components that encapsulate data and low level execution details, composite application builders can focus on *what* the components do and less on *how* the components do it.

A Gradual Transition Governed by Enterprise Architecture

The most forward-thinking people in the IT business¹ are saying that SOA at the enterprise scale requires significant change in how IT is organized, and, thus, is not something that you can undertake simply by purchasing some SOA software; the software is surely necessary, but it is not sufficient.

In order to make SOA work, responsible IT leaders stress the "A" in SOA, which, of course, stands for "architecture." They emphasize the need to elevate the role of the disciplined enterprise architect to a central, rather than peripheral player in IT, because taking advantage of

¹ For example, see Grady Booch's comments on SOA at <http://www-03.ibm.com/developerworks/blogs/page/gradybooch/20061012>. Grady is one of the inventors of UML and is an IBM fellow.

the ability to span and collapse silos requires an enterprise viewpoint rather than a project-centric one.

They also point out that the fundamental nature of the transition to enterprise SOA means that the change has to be gradual and well-planned, starting with relatively “low hanging fruit” and scaling up over time as architectural practices and products grow increasingly mature.

What Business Thought Leaders Are Saying

A survey of recent top journals for advanced business thinking², including the *Harvard Business Review*, the *MIT Sloan Management Review*, and the *McKinsey Quarterly*, reveals a number of articles that exhibit a mode of thinking about business that parallels IT thinking in a number of ways. The fact that these articles are really focused on business and not IT, and yet talk about where the future is headed in terms reminiscent of SOA, is what is remarkable.

This section synthesizes the content of these articles. The ideas discussed here probably have had less exposure than the basics of SOA have enjoyed. Consequently, this summary of advanced business thinking is more detailed than the summary of IT ideas.

The Most Profitable Companies

The articles examine the characteristics of companies that are emerging as the most profitable as the new century unfolds. Such companies are able to unlock value that has been tied up in *organizational silos*, and create *new combinations of value* that are greater than the sum of the parts.

Much of the value being unleashed and repurposed consists of intangible assets such as business process knowledge and other forms of expertise, as opposed to traditional hard assets such as capital equipment.

Pure Orchestrators vs. Mega Companies

The articles point out that some companies have taken this trend to one extreme by becoming pure *orchestrators* of *loosely coupled* processes that they compose and recombine in different ways, with external suppliers executing the processes. Other companies have pursued an opposite path to dynamic value creation, becoming mega-companies of unprecedented size while breaking down their silos and orchestrating loosely coupled assets within the company.

Regardless of these significant differences in ownership structure, these companies have in common the fact that their net income per employee is extraordinarily high.

Crossing Barriers to Seize Value

As these companies look outward to their markets and supply sources, they have moved beyond simply positioning themselves at one point in a value chain. Instead, they constantly look for opportunities to insert themselves at multiple points in value chains in order to exert more control over supply and demand. An example is a company that buys large quantities of raw materials that its suppliers need, and then sells the materials to the suppliers.

The companies also look for ways to cross over from a position in one value chain to gain a foothold in another, parallel value chain. For instance, a major corporation that provides financing for purchasing its manufactured products repurposed its financing capabilities to take a position in additional value chains by financing products that it does not manufacture.

A company dedicated to this kind of dynamic value creation sees multidimensional value networks or value grids, where the traditional 20th century mindset sees linear value chains.

²See the “Sources: Business Journal Articles” section at the end of this article for a reading list.

Tacit Interactions

Tacit interactions are activities that knowledge workers perform that involve the exchange of information and draw heavily on the workers' creativity and on-the-ground judgment. They include coordination, monitoring, negotiating, identifying new markets and value propositions, and so on. The percentage of employee activities that constitute tacit interactions is increasing across the board in all industries, and has reached as high as 60 to 70 percent in the financial and health care sectors.

The most profitable companies have high levels of tacit interactions, but high levels of tacit interactions in and of themselves do not guarantee strong performance. In fact, the variability in level of performance is considerably higher in industries that have high levels of tacit interactions than it is in industries such as manufacturing that have lower levels of such interactions. The high variability in performance stems from the fact that tacit interactions do not lend themselves to routinization, unlike production lines or repetitive transactions.

Thus, companies with high levels of tacit interactions have a higher risk of poor performance than those with low levels, but they also have greater potential for very high net income per employee. Some companies in high tacit interaction industries have been able to empower and inspire their knowledge workers so that they are highly effective at creating value.

Rigid organizational silos stifle the effectiveness of tacit interactions because they make it difficult to create new value propositions that combine assets across the barriers, and they disrupt the flow of information that is life-giving oxygen for knowledge workers. Thus, a key to understanding the performance of the most profitable companies is recognizing that, when they break down organizational silos and proactively assure information flow with minimal bureaucratic impedance, the fact that a high percentage of their employees are oriented to tacit interaction becomes a powerful wealth generator.

Business Process Commoditization and Specialization

The articles point out two apparently paradoxical trends. On the one hand, broad-based initiatives are well under way to define and quantify business processes to an unprecedented extent. MIT's Process Handbook³, the Supply Chain Council's⁴ SCOR supply chain models, and the American Productivity & Quality Center's (APQC)⁵ Process Classification Framework are some of the most prominent of these efforts, which raise the specter of business process commoditization that will result in a new round of outsourcing that far exceeds what has occurred to date.

On the other hand, a company's unique business model and value propositions, defined and executed via tacit interactions across internal organizations and external value networks, are what defines competitive advantage in our innovation economy. The business processes associated with unique business models and value propositions, thus, have unique aspects as well.

As explained earlier, the ownership structures of the most profitable companies range from pure orchestrators to mega-companies. But even the mega-companies shy away from activities that lie outside their core competency. When they determine that they are not well-positioned to run a business unit with high profit margins, they either sell the unit, or they outsource it if its functionality is deemed critical for the company to run effectively.

Although, on the surface, the forces of commoditization and specialization appear to be countervailing, they are actually complimentary. Orchestrators of loosely coupled processes – whether they are coordinating externally- or internally-provided processes – need to understand

³ ccs.mit.edu/ph/

⁴ www.supply-chain.org

⁵ www.apqc.org

certain things about *what* those processes do, but at some point do not care about *how* they do it so long as they do what they are supposed to do effectively. Thus, there is an aspect of a process that an orchestrator must understand in order to combine processes effectively, and there is an aspect that is private to the process provider and ideally defines the provider's specialized expertise.

Accordingly, process definition efforts are evolving to include the definition of performance and quality metrics for each process, and eventually will establish benchmarks based on those metrics. This will make it possible to measure how well a process provider performs.

A Gradual Transition

The advanced thinkers clearly understand that companies must undertake the transition to these 21st century forms of organization gradually, identifying the best opportunities for early gains and building on success. They know that the changeover involves much more than issuing some executive orders and quickly bringing everyone into line.

Restarting the Conversation

Some key questions present themselves at this juncture: Do these articles matter? – That is, does anyone in the business world really listen to what appears in these journals? If so, what is the best way for IT to take advantage of this influence?

Thought Leaders Matter

History shows that the publication of vanguard business thinkers' ideas in top business journals can have significant impact on the business world. For instance, Michael Hammer's *Harvard Business Review* (HBR) 1990 article "Reengineering Work" was a major factor in the launch of the business process reengineering movement that had wide impact in the 1990s. Nicholas Carr's "IT Doesn't Matter" HBR article in 2003 significantly reinforced business executives' suspicions about IT and their strong tendency to pull back on IT spending.

Thus, there is a potential for the cutting-edge business concepts outlined above to generate momentum in the business world and thereby push the ideas beyond the relatively few forward-thinking companies that have already embraced them. That means that the similarity of this thinking to that of IT thought leaders presents an opportunity for IT to work its way back to the mainstream of the strategic business conversation.

Re-establishing Confidence

This is a situation where some humility could help our IT community. We must acknowledge that we have created our own set of rigid silos, and that we have a lot of work to do to remedy the situation. SOA is simply the IT version of the move to evolve to more flexible organizational forms. But if we claim that IT can make the full transition to SOA quickly, or even that we have solved all the problems inherent in such a transformation, it will not take savvy business executives long to recognize the emptiness of such claims.

In an atmosphere where IT approaches the business with candor, we can start a new conversation. We can point out to business executives that if they want to break down organizational silos, arrange the business as a set of loosely coupled assets, and combine and recombine those assets dynamically, then IT must organize its systems that way as well.

What we can offer the business is a partnership entailing a coordinated, at times wrenching, long-term process of change on both sides of the house. If we manage this partnership well, there are ample gains within reach in the short term, and profound advances in the offing for the long term.

IT is going to have to act like a mature business unit in order for such a partnership to work. We must recognize that our part of the transition requires more than just "air dropping" an SOA package into picture. We have to take enterprise architecture extremely seriously; the "top gun" mentality that too often prevails in IT is a characteristic of immaturity.

Conversation Pieces

A successful start to the conversation should allow us to begin drawing more connections beyond the basic correspondence of the two camps' thinking about silos, loosely coupled assets, and dynamically composing assets.

Process Commoditization, Specialization, and Management

Business process management (BPM) systems are important to the SOA value proposition, because they represent a potentially compelling way to orchestrate loosely-coupled services. BPM systems require precise business process models that drive business process simulation and execution engines. A new role is emerging in forward-thinking companies, called the *Business Process Expert (BPX)*, to assume the pivot point for these activities on the business side of the house. The BPX is a knowledge worker with special training who takes innovative value propositions and, working with an IT process architect, models the associated executable business processes. BPXs feed the models to simulation engines to play "what if" games and refine the processes. IT process architects configure the models to orchestrate the invocation of service components, and thereby the BPM system "executes" the models.

Because BPM systems require business process modeling, they call to mind the process definition ventures that MIT, the Supply Chain Council, and APQC are conducting. In that sense, there is an opportunity for dialogue and coordination. However, there are also some issues to overcome in order to progress on this track.

The business process models that BPM systems require are quite different from the process definitions that the Supply Chain Council and other business-focused groups produce. The Supply Chain Council, for example, deliberately excluded IT people from its process definition activities in order to ensure that the exercise remained oriented to business and not to technology. BPM systems, on the other hand, require process models to be precise enough to be machine readable, so that simulation and execution engines can consume them. BPM aficionados⁶ like to think of BPM as a business-focused discipline, but there is a gap to be bridged between BPM models and the process definitions that authentically come from the business community. The abstraction and precision that is second nature to IT architects and engineers, and that BPM systems require, are alien to most business people.

This is why training a new generation of BPXs who know how to work with IT process architects to define executable business process models will be necessary in order for BPM to succeed on a large scale.

What vs. How

The fact that SOA separates a service's public contract from its private implementation is analogous to the business idea that an orchestrator should be able to modify an orchestrated process by swapping one loosely coupled asset with another, as long as both fulfill the same well-understood contract. It thus establishes the basis for supporting the business need to draw the line between commoditized and specialized aspects of business processes when automating those processes.

It is important to note that, while the IT industry has made substantial progress in providing ways to precisely model the public, collaborative aspect of a process and the private, internal aspect, we are still in the early stages of learning how to integrate the two views smoothly.

Model-Driven Composite Applications

When knowledge workers devise value propositions that combine business assets in innovative ways, they are going to need composite applications that bring together related IT assets in order to support the execution of the new initiative. Thus, the capability that SOA offers to assemble

⁶ Including the author

composite applications from components is the direct analogue of the business notion of dynamic value composition.

Composite application construction is one of the key fulcrum points for direct collaboration by business and IT. The new wave of model-driven composite application development tools makes it possible for non-programmers such as BPXs to have a greater role in producing such applications than has been the case up to now.

Here again, we must temper our enthusiasm with the recognition that, while the idea of BPXs creating composite applications is compelling, in practice there are obstacles to doing this on a large scale, and therefore the transition to this part of the vision is, like all the rest, going to play out over an extended period of time.⁷ Non-transactional composite applications, such as specialized analytics and reporting systems, are more amenable to construction by BPXs, and thus are the “low hanging fruits” that early adopters are successfully harvesting. There has been substantial progress that has real business value, but there is still a considerable distance to go.

Collaboration Tools and Web 2.0

Since business thought leaders emphasize that those who formulate and manage innovative value propositions are “tacit interaction” professionals who require the ability to collaboratively exchange information across organizational boundaries, IT also has the opportunity to point out the value of collaboration tools appearing under the Web 2.0 banner.

Recently I heard some people debating whether the next big wave of investment by corporate IT will center around enterprise SOA, or whether it will be Web 2.0 that drives the lion's share of new IT initiatives. I found this discussion troubling because it assumes that SOA and Web 2.0 are separate trends. In actuality, SOA and Web 2.0 reinforce one another, and are two sides of the same coin. In fact, descriptions of Web 2.0 environments typically mention composite applications, or *mashups*, which combine information from multiple sources. They also include collaboration tools that promote the rapid setup of communities for exchanging information and aggregating information.

Web 2.0 requires SOA in order to progress on a large scale so that the information and behavior being “mashed up” from multiple sources is available through channels that provide a consistent technology for accessing the sources. Otherwise, Web 2.0 tools have to support myriad adapters for literally dozens of different access technologies. On the other hand, Web 2.0 tools amplify SOA's usefulness by providing a means for exploiting the systematic offering of services.

Incentive Structures

Business thought leaders have pointed out that the MBOs governing late 20th century style incentive programs tend to reinforce silos by rewarding performance within narrow confines, while failing to reward work that contributes value outside the scope of a project. The problem exists both on the business and IT sides of the house. Changing MBOs to reward thinking beyond silos and to encourage managers, architects, and engineers to look beyond the current project is a journey that business and IT have to take together.

Standards and Intellectual Property

Some business thought leaders who are pushing the public definition and quantification of business processes explicitly recognize that similar kinds of standard business interfaces at the IT level are necessary in order for IT systems to support the combination of loosely coupled assets. This presents an additional opportunity for cooperation and synergy.

Getting involved in standards organizations introduces a number of intellectual property (IP) issues. Therefore, it is essential that a business-IT partnership for setting standards involve IP

⁷ See my December 2005 issue of MDA Journal for an exploration of the scalability issues and a survey of promising approaches to dealing with issues.
<http://www.bptrends.com/search.cfm?keyword=%22MDA+Journal%22&gogo=1>

attorneys. A three-way partnership of business, IT, and IP, when properly governed, ensures that business strategy and due consideration of the company's IP portfolio drive decisions about involvement in and implementation of standards.

Challenging IP issues are arising not just in the realm of technical IT standards. There is much discussion in the industry currently about patents on business methods. Recently, IBM launched a public initiative seemingly to avert an innovation-choking arms race potentially involving tens of thousands of filings for patents on business methods. IBM pledged not to file applications for patents on "pure business methods without technical merit."⁸

However, soon thereafter, IBM filed a suit alleging that Amazon.com infringed on patents that IBM holds having to do with conducting Web-based commerce. Since IBM rarely files patent infringement suits, this action, coming so soon after the start of the patent arms control initiative, raised eyebrows. IBM stated that the allegedly infringed patents were not for "pure" business methods, but, rather, for business methods coupled with technological innovations.⁹

It is still not clear how this issue will play out overall in industry. As the trend to specify business processes using machine-readable modeling languages advances, a key question will be whether patent applications are filed and granted for these kinds of mathematically precise business process models, and how that will affect process specialization and commoditization.

Summary

In a number of respects, business thought leaders are talking about SOA, but generally do not realize it. At the same time, the IT community is on the whole not aware of these comparable lines of advanced business thinking, at a time when IT is trying to engage the business in SOA.

Attempts to sell SOA by pointing out to business executives the similarity of thinking must take into account the fact that the excesses of the dot-com era tarnished IT's reputation. Since a transition to SOA cannot be undertaken in a short period, we have to be careful to manage expectations accordingly, lest we reinforce the worst perceptions of IT. The good news is that the parallel transition on the business side that the thought shapers are talking about is also of necessity a gradual transition. Thus there is a potential for an honest partnership to prepare companies for the rigors of 21st century business.

Special Credit to Jeff Pendleton

Recently I have had the pleasure of meeting an independent businessman and former BEA and HP executive named Jeff Pendleton. He has contributed greatly to the ideas that I discuss in this article. Jeff compiled the reading list of business journal articles provided in the Sources section below, and alerted me to the fact that business thought leaders are talking about SOA-like concepts, having arrived there through their own, independent lines of thought.

⁸ "IBM Establishes Worldwide Patent Policy to Promote Innovation" <http://www-03.ibm.com/press/us/en/pressrelease/20325.wss>

⁹ "IBM Takes on Amazon," BusinessWeek.com, October 23, 2006.

Sources: Business Journal Articles

My synthesis of business thought leaders' SOA-like thinking is derived from the following articles. Again, I credit Jeff Pendelton for compiling this reading list.

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Thomas H. Davenport, "The Coming Commoditization of Processes," *Harvard Business Review*, June 2005, Reprint # R0506F.

Lowell L. Bryan and Claudia Joyce, "The 21st-Century Organization," *McKinsey Quarterly*, 2005 Number 3.

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Scott C. Beardsley, Bradford C. Johnson, and James M. Manyika, "Competitive Advantage from Better Interactions," *McKinsey Quarterly*, 2006 Number 2.

John Seely Brown, Scott Durchslag, and John Hagel III, "Loosening up: How process networks unlock the power of specialization," *McKinsey Quarterly*, 2002, Special Edition: Risk and Resilience.

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