

Business Process Fusion Is Inevitable

A Response to *Workflow is Just a Pi Process* Rebuttals at BPTrends.com

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Our article, Workflow is Just a Pi Process [ref 1], thirty-eight pages of explanation about business process management systems (BPMS), appears to be controversial. When originally released, it attracted criticism from certain members of the workflow community. When it was subsequently updated and published at BPTrends.com, it drew similar responses from the same people ([ref 2] and [ref 3]) Why the controversy?

Our paper explains, for the first time in article form, that there is now a new formalism for processes that can be used to create effective software products to help firms improve and manage their business processes. It goes on to explain that the formalism has been implemented and embodied in new Business Process Management Systems (BPMS), comparing the breakthrough to the significance of the first relational data management products (e.g., the Oracle RDBMS). Clearly these are controversial claims.

What ruffled some members of the workflow community was the claim that, using a BPMS, it would be possible to replicate the functionality of existing workflow engines using little more than some basic configuration information, what we call a *process pattern*. We went on to state that process patterns deployed on a BPMS could be used to break free of limited process models currently hard-coded in workflow engines. The analogy we drew is the use of an enterprise data model to configure an RDBMS to support, say, an ERP application. We described not just a new technology and a new way of providing workflow, but a *more complete formalism*.

Many aspects of computing, not only workflow, can be encompassed within the new formal meta-model of the BPMS. This is not a claim made only by us. The computer science community acknowledges that many things we used to think of as completely different (like data and procedure) can now be regarded as the same thing, an entity called a *mobile process*, and can be understood using a new calculus, the *Pi calculus*. Quite a claim, but this process calculus as well as other significant contributions used to develop the underpinnings of the BPMS were based on the multi-year breakthrough efforts of Robin Milner, a computer scientist at Cambridge and an ACM Turing Award winner, and others.

Over the last decade, powerful workflow products have provided solutions for businesses that wanted to extend data-centric applications to better manage business processes. So, should other communities also rebut our paper and the BPMS described within it? Quite possibly, for we could have titled our paper “ERP is just a Pi process,” “Data is just a Pi process,” “EAI is just a Pi process” or any number of attention-catching titles. Would this have upset those groups? Probably, but the point is that the BPMS represents a unification and extension of several pre-existing technologies by embracing the formalisms of the computer science of mobile processes.

It is inevitable that the work of BPML.org will be partly misunderstood by some members of our industry, for it's *not* creating a workflow-driven BPM layer (a veneer) over existing technologies or just combining those pre-existing technologies to create a BPM tier in the IT stack. That's what EAI and workflow products do very well in combination. While such combined systems are labeled “BPM,” BPML.org takes a green-field approach to the process paradigm.¹ But this should not be interpreted as indicating that BPMS is only applicable for a green-field--far from it. The problem companies face is not the addition of another layer over existing systems, another domain of technology to manage. What companies are seeking is process improvement that *reuses* existing systems and IT assets. By reuse we do not mean

¹ In fact, the term BPM has gained greater prominence following the formation of BPML.org. BPML.org doesn't claim the term; it claims a more complete interpretation of the term.

calling out from a process engine to a function or procedure in another system. That's easy. Instead, what we mean is the use of a tool to describe existing systems in a new way that allows the functionality they already provide to be normalized and represented as *processes*, manipulated as *processes*, managed as *processes*, and improved as *processes*, over a *process* lifecycle.

We have described this reuse before as *process digitization*, and it is similar to what happened when companies chose to digitize data using the relational model in order to get the advantages of consistent data query, data aggregation, data analysis, and so on, and, critically, to make that consolidated data available to new applications and applications of a different kind than those that existed before the breakthrough. To wit, ERP systems would not have happened without the RDBMS, and the value of ERP today rests mainly in the data models it provides. We believe the industry is taking a similar step toward process digitization and management. We call the technology to achieve this a BPMS, and we call BPM the systematic use of the BPMS, just as data management is the systematic use of the RDBMS.

The BPMS is Different and is New

We do, indeed, claim that there is something new, and as significant as the earlier breakthrough of the relational data model. The new breakthrough is a *unification* (not a combination) and extension of existing computing representations, including workflow. Why is this important?

No one would disagree that today's end-to-end business processes consist of both automated and manual process fragments. Indeed, many of these processes extend into the real world of people and machines. The IT component of a business process may be large, or it may be small. For customers of IT Services companies like Computer Sciences Corporation, the IT component is usually large. While CSC recognized that EAI and workflow products were increasing in sophistication, the company felt that something was missing. Whenever CSC developers tried to model real-world business processes, they had to dumb down the definition to fit existing IT paradigms. By contrast they just wanted to express the business process as it really is. And the reality, as far as the IT component is concerned, lay in the complex heterogeneous structures of many, many types of existing software systems, including disparate and varied workflow systems. Since they knew companies did not want to throw those systems away, their task was not linking to them (using EAI, APIs, Web services orchestration or anything else of that type), but *re-describing them as processes*. This has to be done in a consistent fashion. Hence, a new paradigm was needed.

In addressing the need for a new process paradigm, the founders of the Business Process Management Initiative sought a process modeling formalism that would allow these diverse fragments of processes (hard-coded in existing applications and servers of all kinds) to be consolidated to create larger processes that expressed more and more of what companies were trying to manage and improve. They had an end-to-end business process in mind, and that's what was driving their thinking, but they had no way to imprint it over their existing business and technology infrastructure. As BPML.org set out to achieve this, it wanted to preserve *the process as the primary object of attention*; in fact, it wanted the end-to-end process to be *the central object of attention*, a new "first-class citizen in computing."² The founders therefore proposed and built a formalism and management environment devoted to processes. This was reviewed, voted on and, following a period of public review, agreed by members of BPML.org and published as the Business Process Modeling Language (BPML) 1.0.

BPML has enabled the development of products that manage the entire lifecycle of end-to-end business processes, just as the RDBMS manages the lifecycle of business data. The conception of business process lifecycle management need have nothing whatsoever to do with IT automation, for even business processes that consist only of human activities need to

² For us, the BPMS represents a new process technology, just as CORBA represented a new object technology.

be documented and rigorously managed as they are conceived and changed over time. When a company builds a network monitoring system it does so to 1) describe the network, and then 2) manage it. While by no means a precise analogy, we do wish to stress that there are many reasons for digitally representing business processes, not just to replace a manual process with an automated IT process. Automation will often be a goal, but many elements will remain non-automated. Nevertheless, those elements of a business process may still be digitized and manipulated and analyzed, using the BPMS to manage the *white space* in the organization—the undocumented activities and hand offs that don't appear on the organization chart, the space where many of the messy dynamics of day-to-day business activities occur and which is often a large space.

BPML.org is Not Trying to Hijack the Language of BPM

The founders of BPML.org chose their language carefully. To explain their reasoning:

1. BPML.org's work was inspired by the computer science of mobile processes steeped in the Pi calculus. The founding members saw no reason to replace the word "process," as used by Robin Milner, with another word, particularly as our aim was the creation of a tool for business people to manage business processes, a term they already understood. If they had chosen another term, there would, indeed, have been confusion. It would be like choosing not to use the word "formula" from the field of mathematics when designing and implementing a business spreadsheet.
2. BPM, as a term, existed before BPML.org, and so the term was chosen, rather than creating a new one, since the envisaged BPMS (see 1999 White Paper at BPML.org – reproduced and updated as Appendix B in *Business Process Management: The Third Wave*) was designed to support BPM precisely as set out by the post-reengineering (BPR) community. In reality, BPML.org was a response to BPR's lack of a path to execution.
3. BPML.org appended the word "business" to "process," as used in the computer science formalisms for mobile processes, to make "business process," because members are developers of tools to support business people, that is, the implementation and improvement of commonly understood processes such as Order To Cash, Engage To Close, Transact To Fulfil, Build To Order, Plan To Produce, Resume To Work, Goal To Reward, and many others.
4. Such "process processing" (using an IT tool to manipulate processes, like using a spreadsheet to manipulate numerical data) should not be confused with IT automation. While automation can be readily achieved with a raft of existing technologies, BPM has a wider meaning. Not only does it encompass the discovery, design, and deployment of business processes, but also the executive, administrative, and supervisory control over them to ensure that they remain compliant with business objectives for the delight of customers. Processes are the main intellectual property and competitive differentiator manifest in all business activity, and companies must treat them with a great degree of skill and care. To develop tools to support BPM, e.g., a BPMS, the tools must be able to represent business processes in a unified, normalized fashion. That is the purpose of standards such as BPML. They play a role analogous to the role the relational data model plays in the RDBMS.

All Potentially Significant Innovations Create Controversy

Some of us remember the debates among business and technology leaders and at companies like IBM as they decided whether to switch from using the hierarchical model of data toward the new-fangled unified relational form of innovator Ted Codd.

Edgar F. Codd, an IBM computer pioneer who created the "relational database model" that underlies a \$7 billion industry of storing the world's online business data, died of heart failure at home Friday in Williams Island, Florida. He was 79. Bank accounts, credit cards, stock trading, travel reservations, online auctions,

and innumerable other now-routine data transactions all rely on Codd's model, based on highly abstract and complex mathematical theory.

Before Codd's landmark research paper in 1970, it was possible to store lots of information -- but analyzing it was difficult, requiring lines and lines of code for even simple tasks. His model made it possible to access large amounts of data from small computers, giving businesses and government agencies something they desperately needed: quick and easy access to information.

"He had a vision about data that was considered radical at the time," said computer scientist Don Chamberlin, also of IBM. Larry Ellison of Oracle used Codd's model to build the first commercially available relational database management system. As complex and abstract as the math he loved, over the decades Codd retained his British accent, his dry wit, and his love of a strong cup of tea, say family members.

Extract from an article that appeared in The Mercury News, April 2003

Sceptics and those with vested interests cast doubt on the viability of the relational database. We are sure that some dismissed Ted Codd as an unrealistic purist. The unification that the BPMS represents, based on the achievement of the Pi calculus, will come under similar fire. Yet, business people understand the value of processes. No one disagrees with that. The issue that is creating controversy is over how those processes are represented. Some wish to preserve the past; others want to go to something new. There is nothing wrong in preserving the past, but innovators, by definition, will always seek that *something new*, a paradigm shift.

Commercial Workflow Products Use Different Workflow Metamodels

Even a cursory glance at products that used to be consistently labeled as workflow, and that are now consistently relabeled as BPM, shows huge *variations in the ways processes are represented*. Examples are:

- Operational workflow, as epitomized by products such as Staffware Process Suite;
- Document-centric workflow, as epitomized by products such as FileNet ECM;
- Collaborative workflow, as epitomized by products such as Fujitsu i-Flow, to
- Recursive workflow in support of negotiation and coordination, as epitomized by products such as Action Technologies BPM Suite.

From the perspective of computer science, there is no doubt whatsoever that the Pi calculus and languages based upon it, such as BPML, can provide for the expression of all these models. Whether today's BPMS products can do so with equivalent scalability and end-user functionality is quite another matter, but the potential is there. Initially, the RDBMS did not scale well, but, over time, its superior model of data won out, and vendors found ways to make it scale. Pioneering companies that perceive the BPMS potential are taking the following steps:

- Understanding it
- Performing pilots
- Doing controlled operational deployments

ERP and other enterprise software companies are questioning whether the data model of the RDBMS is a sufficient center for the applications they wish to bring to market to meet ever more complex business requirements. They are looking beyond the RDBMS and toward new innovations. Some of these will come from the field of workflow and others from the field of BPMS. Systems integrators such as Computer Sciences Corporation are following both the development of BPMS and the development of WfMS. Indeed, at an early stage in its journey, CSC published its perspective in an article entitled *A Systems Integrator's Perspective on Business Process Management, Workflow and EAI*.^[4]

Pi Calculus is Critical to BPM

Is Pi calculus critical to BPM? ^[1] We made an early effort to shed light on this in Appendix C of our book, *Business Process Management: The Third Wave*. ^[5] Several articles followed on the same topic, culminating in *Workflow is Just a Pi Process*. So what's the bottom line? Is Pi calculus critical to BPM?

It is well known that Microsoft was, and still is, using Pi calculus in the design and implementation of XLANG at the plumbing level in BizTalk (the language they are still evolving, which has also been thrown into the OASIS hat, with IBM's WSFL, to form WSBPEL). Microsoft became aware of the significance of Pi calculus at roughly the same time as BPML.org. Like Microsoft, BPML.org observed that Milner's work shows us clearly that *mobility*, as underpinned by the Pi calculus, is an inherent attribute of processes in the real world. Until someone proposes a better model that can explain real processes, mobility is the best we have. Mobility exists, whether people choose to embrace it or not. Other ways to represent it may emerge, and, upon these, other software products may be developed. We do not write to prevent these alternative paths; we write to highlight the breakthrough that has already been developed, the BPMS.

One critique plays down the significance of Pi calculus, stating that, "The only thing which distinguishes Pi calculus from classical process algebras like CCS, CSP, and ACP is the notion of mobility." But that's the whole point. The Pi calculus differs from other underpinnings of communicating behavior mainly in its treatment of mobility. The movement of a piece of data inside a computer program is treated exactly the same as the transfer of a message—or, indeed, an entire computer program—across the Internet. Using the Pi calculus, one can describe, in a formal process model, entire networks of processes that reconfigure themselves. Several examples are explained in *Workflow is Just a Pi process*.

Milner's 1991 ACM Turing Award recognized his wide-ranging contributions to computer science, including LCF, ML, and CCS. In the late 1980s, along with two colleagues, he devised the Pi calculus, a basic model for mobile communicating systems. These calculi are part of a continuing quest for a theory that unites *computing* and *communication*, a unification that is critical to understanding the behavior of processes in computer systems and in the real world. Some of this work is widely accessible through his books, *Communication and Concurrency* (1989) and *Communicating and Mobile Systems* (1999). We've also made some information available at www.bpm3.com/picalculus. In sum, Milner shows us mobility at the heart of process.

Another critique claimed that, "Anything that can be expressed in terms of Pi calculus can also be expressed in other process algebras (extended with some notion of data) and in other process models like, for example, high-level Petri nets." The BPML.org founders simply chose to focus on Pi calculus, rather than extensions to other formalisms. Pi calculus unifies *processing* with that being *processed* (data) to create one single thing, the mobile process. Such unification provides the basis for a unified process representation in IT. We acknowledged in *Workflow is Just a Pi Process* that, "workflow theorists will continue to pursue further developments in the field of adaptive and concurrent workflow." Indeed, we explicitly stated that, "Petri nets are being extended in a host of ways, including taking over ideas from Events, Agents, and Actors. Concurrency within and between Petri Nets is also an active area of research."

Are BPML and BPEL Based on the Pi Calculus?

In response to our article, another very good question was posed, "It is suggested that BPML and BPEL4WS are based on Pi calculus, but I dare to question this." What we actually said in the introduction to *Workflow is Just a Pi Process* is that "Along the way, we explain how languages such as BPML, inspired by the mathematics of Pi Calculus, can model all workflow patterns and the services provided by workflow engines." Later in the piece, we clarified that "the Join Calculus, was actively used in the development of BPML."

More will, no doubt, be written on the influence of Pi calculus in the BPMS in the near future, but some aspects may remain obscure for intellectual property reasons as BPMS vendors will not want to give away how they have used the math constructs in their products. In particular, it is not obvious from reading the BPML specification that it describes only one process thread, sometimes called a “swim lane.” For those familiar with Role Activity Diagrams (RADs), that’s pretty much the same as a Role. For those familiar with Agents, a BPML process can be thought of as a primitive agent.

But the real world of business is, in fact, composed of end-to-end business processes that encompass multiple swim lanes. Pi calculus is critical to understanding and representing how these process fragments interact, *and evolve* through their *interactions*. And that’s what a BPMS provides. The BPML specification allows a description of those discrete participating systems, so that existing IT assets such as ERP and CRM and databases and workflow engines, etc. can be projected into the BPMS environment.

The influence of Pi calculus extends to the design of the process virtual machine, at the heart of the BPMS, where swim lane interactions must be managed. While BPMS product innovators will gladly tell you that Pi calculus deeply influences their products, they won’t hand you Col. Sanders’ secret chicken recipe. Nor will they just give you the code demonstrating the influence of join calculus or their recipe for *Petri-Pi* (indeed, Petri Net constructs are also unified within BPML into the underpinnings of an innovative BPMS). To be clear, BPML was the first language to unify what were previously separate representational paths. IBM and Microsoft recognized this when, following the publication of BPML, they combined (in a somewhat ugly fashion initially) the Pi calculus-inspired XLANG and the Petri Net-inspired WSFL. BPML, by contrast, offers a consistent and unified model that allows for the modeling of block structured, hierarchical, network, and recursive process models.

YAWL is Not a BPMS

YAWL (Yet Another Workflow Language), and its implementation, is an example of a complete implementation of workflow patterns, documented by professor W.M.P. van der Aalst and his team in the Netherlands. We have no doubt that YAWL is a step forward in the domain of workflow. But even in the description of YAWL from its home page, there are pointers to some of the issues we raise about workflow in our paper: “Based on a rigorous analysis of existing workflow management systems and workflow languages, we have developed a new workflow language. To identify the differences between the various languages, we have collected a fairly complete set of workflow patterns. Based on these patterns, we have evaluated several workflow products and detected considerable differences in expressive power. Languages based on Petri nets perform better when it comes to state-based workflow patterns. However, some patterns (e.g. involving multiple instances, complex synchronizations or non-local withdrawals) are not easy to map onto (high-level) Petri nets. This inspired us to develop a new language by taking Petri nets as a starting point and adding mechanisms to allow for a more direct and intuitive support of the workflow patterns identified.”

While YAWL is not intended as a commercial product, and while it will clearly help in the evolution of workflow technology, it is not a BPMS. As we have explained, we do not position the BPMS as an alternative to workflow, but in a much wider role that can also support essential workflow patterns. Businesses don’t need yet another workflow engine, or a new way to develop software, but a *lens* through which they can view existing IT and other business assets as *processes* and, hence, digitize them, improve them, and manage them in the enterprise. The fact that BPMS can represent and capture workflow models is only a part of the full business process picture. It can do the same with database procedures, embedded ERP process fragments, and other elements of IT. What the BPMS does is re-position all existing process fragments as process assets to be managed, rather than as rigid assets embedded in software. In the future, companies will think of processes as they do data today—easily acquired, shared, and manipulated. The idea that processes exist only in rigid back-office applications, accessible only to IT staff, will seem quaint in years to come.

Companies have workflow systems, and they work well. They have lots of other technologies as well. But they want business processes. The BPMS gives them whole business processes because, at the current time, it and only it embodies a unification of computation and communication, across multiple technical systems at all levels of granularity, from the simplest expression $1+2=3$, to linked lists, to schedulers, to EAI, to workflow, to ERP, to supply chain, and to ambitious models such as Product Lifecycle Management.

YAWL, despite the claims that it supports all workflow patterns, cannot be used to implement all the business processes the BPMS is already representing, for not all business processes are workflows—for example, a complete introspection over SAP R5, Siebel, LDAP, WSDL, BPEL4WS, Oracle Stored Procedures, and SMTP. We make this point to illustrate fundamental differences between the WfMS and the BPMS. The BPMS is a new category of enterprise software. It is not a replacement for the WfMS—it just happens it can do workflow as well. Whether CIOs will choose the BPMS for problems adequately handled by workflow is a quite separate point. That will depend upon many factors, for dedicated workflow products are, indeed, powerful and appropriate solutions to certain types of business problems. The real driver for the BPMS is not an alternative to workflow, or a better workflow mousetrap, but a unification of the IT environment, including workflow engines, as a holistic platform for end-to-end process management. It's this new territory where the BPMS comes in, and we have just now set off from the foothills along a journey that will take the use of computers in business to new heights.

BPMS is Only the First Step

RDBMS products were used in their own right, for specific purposes, long before applications such as ERP were built atop them. Likewise, early BPMS products are being introduced in pioneering enterprises to address specific process problems—that's the way enterprises adopt new technologies. In fact, some initial deployments of BPMS platforms have little or nothing to do with workflow. For example, one company used a BPMS to provide a normalized extension to the ERP data model in order to accommodate process changes. Another used it to manufacture custom order processes that deliver custom information products on-demand.

The next few years will see the emergence of process-centric applications that leverage the digitized processes collected in BPMS systems. As the BPMS process repository grows, companies will access the BPMS, using BPQL just as today's applications access the RDBMS using SQL. Everyday use of the BPMS will generate process assets, first in pockets in the firm, and then toward enterprise-wide process models. Each use of the BPMS has the potential to consolidate processes between systems, between departments, between information sources, between people, and between companies. It does this not by running a workflow over them, but by re-describing and combining those assets. The BPMS represents a shift from shared data to shared services, to shared processes.

ERP companies are trying to preserve their investment in enterprise data models by componentizing ERP applications and extending them with orchestration, integration, and composite application frameworks. These include SAP xApps, Siebel UAN, Oracle Process Connect, and so on. These efforts are being made because the data model foundation of the classical ERP model has come to an end; it won't take us past where we are today. Enterprise software companies are increasingly recognizing this and conceiving of the first process-oriented applications built on a BPMS, not a RDBMS. We've crossed the threshold and are in a transition period where people will naturally have different views about the direction and the length of time the transition will take to complete. Indeed, in this transition phase, application extension, as it is called, will be a considerable market for the BPMS.

BPMS is Not an Attack on Workflow, But Eventually BPMS Will Support a Fully Functional Workflow Metamodel

Was the RDBMS an attack on the HDBMS? Is BPMS an attack on workflow and ERP? We don't think so. The RDBMS was an innovation. The BPMS is an innovation. Like the RDBMS, the BPMS must find its way. No matter how much effort innovators put into trying to explain it,

some IT practitioners may never get it until they touch it and feel it. But, as in all innovation, the only thing that ultimately matters is crossing the chasm of adoption. We acknowledge the success of Petri nets and workflow in this regard. We see the advent of the Pi calculus-inspired BPMS gaining initial adoption on a scale similar to that of the early RDBMS platforms, but only time will tell.

BPMS products have already been implemented by companies and are influencing the design of the next generation of their applications. Systems integrators are building new value propositions based on the BPMS. For them, it's the most exciting new development in enterprise systems for decades, for it grasps hold of an aspect of business that has evaded automation since the advent of computers—the dynamic and even messy *business processes* that cross the white space inside companies and across the value chain of trading partners. In today's business world where success depends not on finding new markets, but on relentless time-based execution, the ability to take control of the humble, yet mighty, business process is, indeed, the key to producing the results companies so desperately seek. This is precisely the business capability requirement that led to the development of the BPMS and to going beyond ERP, workflow, and EAI to include the digitization all facets of real-world business processes.

The Definition of BPM

Traditional definitions of business processes and business process management, including those of journalists and analysts, abound. But companies have been doing those things defined therein for years. The number of definitions of "business process" and "BPM" in the reengineering and workflow literature probably can be counted in the hundreds. We even add one more in our book *Business Process Management: The Third Wave*, so we are just as guilty. Regardless of definitions, "BPM" embraces a broad array of management disciplines, and automated tool support, to date, has been sorely lacking. It is, indeed, the fact that tools to help people in doing their process work have finally emerged—whether that be various combinations of reengineering, Six Sigma, SCOR, lean manufacturing, or other business disciplines—that has propelled the acronym BPM onto the front pages of business and IT literature. The holistic BPMS platform is the antidote to both fragmented process technologies of the past and piecemeal management disciplines that address various aspects of process improvement and innovation. The BPMS is a holistic tool that can empower business people to take a holistic approach to BPM and apply that tool to *all* their process improvement initiatives.

For core processes today, most companies rely on inflexible ERP systems, supplemented in some cases, using workflow and often using EAI integration brokers to bring in other applications. Workflow is also used in a stand-alone mode. On the other hand, a number of business process modeling tools have provided the ability to capture and understand processes, but these have no direct path to execution. Instead, they create requirements that must be thrown over the wall to IT for software development, and hardly cover the richness of business in light of the changing dynamics of processes in everyday operations and the elements of those processes that are embedded in IT systems. These piecemeal approaches, and other deficiencies in tools support for process work, were factors that led to the formation of the BPMI.org. We believe a step change in BPM tool capability is needed. While the BPMS is nowhere as mature as the different workflow-based systems, those technologies were innovations themselves a decade or more ago. Yet, we would ask, "Is the workflow innovation, indeed, the end game? Should we close the patent office, for all that needs to be invented has been invented?"

Others have stated, "BPM is nothing new." In our January 2004 column at BPTrends we made a similar, but subtly different, point. While people have forever sought to improve process, BPM is emerging as a convergence of management disciplines. We go on to explain how to move forward on BPM, using BPM tools. Just as business processes exist, whether we choose to call them processes, outputs, services, tasks, activities, supply chains, work patterns, or collaboration, *business process management* exists, albeit mostly implicitly. BPM efforts go by many names, including industrial engineering, ISO certification, Six Sigma, business process improvement (BPI), business process re-engineering (BPR), Rummler-

Brache, Integrated Definition Function Modeling (IDEF0), and Lean thinking, to name a few. Rooted in the heritage of practices across numerous industries, they are all manifestations of one and the same thing—efforts to improve business performance. That thing is not just workflow. Workflow patterns are but a part of the solution, for there is nothing in such patterns that in any way addresses data manipulation, calculation, or other aspects of computing.

While some people are uncertain about whether BPM or BPMS is new, others go on to assert that nothing new is needed! There is no doubt that some workflow vendors use the term BPM as a refreshed marketing term with nothing refreshed in their products except for perhaps combining them with EAI tools in a so-called process tier. Others have genuinely new features. But these pale in comparison to breakthroughs in the Pi calculus-inspired BPMS, BPML, and BPEL that bring new underpinnings needed to give the business process a paradigm of its own, a paradigm that supports all aspects of business processes, not just workflow and EAI.

Standards for BPM

Some observers rail against the number of standards that seem to be proliferating in the BPM space by several standards organizations. They also point to the complexity and length of some standards proposals. By contrast, we see this as a healthy sign of a powerful resurgence of interest in processes. For example, work at the OMG is extending beyond objects and into the realm of processes. The same is occurring at OASIS and the W3C. This process standards proliferation is obviously distracting to groups that have unsuccessfully worked for years to gain traction for workflow standards. Similarly, we are sure that established workflow vendors don't want their customers "confused" by another three-letter acronym, BPM, which they say they have been doing for years. There is always some confusion when a true innovation appears before an unsuspecting public, for people naturally try to equate that something new and different to what they already know and understand. The fact that other groups are looking at processes and trying to make progress is to be applauded, for it validates the recognized need to address the business process in a new, more powerful way to bring about the comprehensive BPM capability for which businesses are crying out.

The word "standards" is often used in a very loose and ad-hoc way, and *technology standards* should not be confused with *innovations*. Standards are important for *technology interoperation*, to wit, HTTP, CORBA, COM, and now Web services. For example, standards forwarded by WfMC deal primarily with providing the basis for disparate workflow systems to interoperate. On the other hand, the BPMS specifications are aimed at the semantics needed to build a BPMS innovation, not to address pre-existing technology interoperation. So, when it comes to comparing technology interoperation standards to innovations, consider Ted Codd's relational algebra and relational data model. It was not a technology standard for interoperating DBMSs; it was an innovation upon which future database standards were built.

Mathematics and computer science breakthroughs are usually orthogonal to technology interoperation standards, and should be judged by their rigorous computer science content as it relates to a fresh solution to previously intractable problems. The most successful innovations in IT have been based on clean conceptual models, good foundations, and useful mathematics. It won't matter one iota to business users of a BPMS if its semantic model ever becomes a "technology interoperability standard," as long as the BPMS provides business benefit. More important to business users is whether new innovations, such as the BPMS, become widely deployed platform capabilities, like the capabilities inherent in RDBMS platforms. The standards for the BPMS simply provide software companies a process blueprint for building a BPMS implementation.

In short, standards are most often about interoperability, such as between products—but not about foundations. Even technical interoperability is not always so important. How many businesses have sought interoperability between RDBMS products? To what extent do people ask about run time interoperability between Oracle RDBMS and IBM RDBMS? Rather, they want to know about the ability of the RDBMS to adhere to SQL. It's a platform issue. The analogy in the world of BPMS is BPQL. BPQL has yet to be made available, BPML being a

first step. That innovation will come in time. BPQL provides a consistent set of process semantics across heterogeneous BPMS implementations, just as SQL provides a common and consistent set of semantics across Oracle and IBM DBMS implementations.

A Single Unified BPMS is Both Viable and Desirable

Some dismiss the idea of a unified platform for BPM. They state, "One size will never fit all. No one solution, method, technology, or mathematical notation can solve the hard problems we face. As Albert Einstein said: '*The significant problems we face cannot be solved at the same level of thinking we were at when we created them.*'" But no one ever claimed so. Rather, we claim that a step forward has been made. Things that were previously thought of as different (data, procedure, list, function, task, resource, plan, and so on) have been unified, and this has made it possible to develop a platform innovation, the new BPMS, that moves the old "BPM," to the next level. Einstein's words reinforce our notion that *the significant business process problems we face cannot be solved at the same level of workflow and EAI thinking we were at when businesses created them.*

Business people have long been hostage to information technologists. Core processes have been cast in stone in inflexible packaged applications. BPMI.org seeks to change this. BPMI.org wants to see processes owned by the business and managed by the business, that is, defined, deployed, operated, and improved directly by business analysts. How? By creating a unified digital representation and foundation for all processes, enterprise software companies can then create holistic business process management tools. This digital process foundation must be rich enough to cater to work with processes and work in process management across all kinds of business processes, including workflow processes.

The BPML specification provides the basis for a major step forward in IT platform capability. It will, no doubt, evolve over time. Once elements in BPML that are currently missing in BPEL are added, the same will be true for BPEL. Right now, it's just called BPEL, but, once the missing elements are added, we might call it BPEL++ to reflect the shift from C to C++ with the addition of classes to embrace object-orientation. What's in a name anyway? Convergence is both desirable and inevitable. Business users of a BPMS should not be distracted by terminology and look to the substance. Key players in the IT industry are moving in the same direction—toward the BPMS.

IT industry leaders recognize that a single, unified process platform is not only viable and desirable; it's required to move the business-IT relationship forward. A unified representation was a good thing for data management, and the time has come for processes to enjoy similar success. For this to happen, that means moving beyond differences in workflow semantics inherent in different workflow products, and toward a process representation that goes well beyond workflow languages to encompass information manipulation and calculation. Few would argue that real world processes are richer than typical workflow models, else that new three-letter acronym, BPM, wouldn't have popped up in the business and IT scene with a new meaning—or, as U.S. Defense Secretary, Donald Rumsfeld might call it, *new BPM* versus *old BPM*, alluding to his now infamous remarks about *old Europe*.

Here's one scenario of what's happening and about to happen:

- BPMS vendors are going to continue to develop their products, with or without technology interoperability standards, and they will use the new mathematical foundations to show the value of the approach.
- The standards community members are going to compromise. Why? Already it's happening. BPEL is a compromise combination (and not a very pretty one so far) between XLANG and WSFL. That may get resolved, but more compromises may be needed going forward, as companies understand how difficult these specifications are to implement as a robust BPMS.
- There is currently a standards debate about incorporating transactional processes (see section below for a description of transactional business processes) in a BPMS? For vendors who cannot implement process-centric transaction processing

capabilities, adding such features to the spec creates difficulties at spec launch parties. Can they claim compliance? Do they have to claim partial compliance?

- While companies in different formalism camps might give lip service to a possible convergence, that may not be possible. The maths might not fit together easily without someone having to do major rework in the technology. Already people are asking how multiple existing engines (EAI, workflow, and application servers) can fit together in new bundled products. It's complex. The answer is a new, unified engine, but few can, or won't be willing to, make the effort to develop one.
- The *winning* formalism will be able to encompass a unified description of components and IT elements that, once unified, create the maximum value for customers. Milner's mobile process work is key.
- The Petri net and Pi calculus worlds may or may not find a way to co-exist. The maths are there, but will IT companies be able to use them, and implement them? We may see two different technical platforms emerge. Getting IT vendors to agree on one may be a step too far, for, while they may be attached to theory, if they cannot meet the requirements for comprehensive process management, they are "out of the BPMS game." If the Pi calculus and BPML were minor changes to the workflow model, no one would be arguing. The differences are considerable and, for some, insurmountable.

To illustrate sources of insurmountable differences, members of the OASIS BPEL Technical Committee fall into the following camps:

1. Vendors with large resources that will attempt an implementation of BPEL, and, following that, additional features already specified in BPML.
2. Vendors that realize they do not have the resources to make an implementation, but are motivated to provide integration with BPEL or BPML compliant technologies.
3. Vendors that are observers, influencing the direction of BPEL, but with no intention of developing any BPEL core technology.
4. Vendors that don't understand what BPEL and BPML represent, and have a muddled strategy with respect to those languages.
5. Vendors that want to develop prototype or low-end implementations of BPEL to extend existing products in limited ways, or create solutions in the Web services space.
6. Vendors that want to use the BPEL schema only as an import/export mechanism.

The Focus for BPMN

BPMN is the business process modeling notation, a notation for business processes that mirrors, as far as practical, constructs in BPML and BPEL. BPML.org; modeling tool vendors sought such a visual notation as the counter point to text-based XML schemas. Their belief was that any new approach needs a visual form if it is to succeed, and that a visual form is useful for business people who are capturing and re-designing processes. Past differences in notation among process modeling tool vendors led to the proposal for a standard BPMN. BPML and BPEL represent the executable bedrock upon which BPMN was developed.

BPMN is important work, and, if it can remain firmly lock-stepped to a sound execution model, it will offer businesses great value. BPMN should be directly executable by a BPMS, not just be a requirements entry point into a UML-based software development lifecycle—just as a RDBMS directly executes SQL without being an entry point into a UML lifecycle. Nor should it be necessary to map BPMN to other execution systems as this misses the point that the BPMS *is* the execution engine.

Definition of Mobility

Some have argued that BPML.org's understanding of Milner's notion of mobility is somehow wrong. We think not, for this is what Milner has said: "I'm delighted that Business Process Management (BPM) and its modeling language, BPML, have found good use for the concepts of process calculus. For over two decades the process calculus community has sought to

combine two things: the way you define and analyze mobile distributed processes and the way you program them. We believe we've found the basic maths to meet this challenge, and it is heartening to hear that it is being applied to the management and automation of a company's most basic economic assets, its core processes. For computer scientists, the practical observation of the use of process calculus within the IT industry's newest software category, the Business Process Management Systems (BPMS), will help us to deepen our theories, particularly in terms of higher level process representation. We aim not just to build, but also to understand, the colossal global computer in which we live. It is exciting that business systems can now not only use what we have done so far, but will also help us to come closer to our goal."

Electronic Mail and Workflow

Our paper *Workflow is Just a Pi Process* used electronic mail as an example of a mobile process in an attempt to help explain the Pi calculus. Milner does something similar with the analogy of a cocktail party. Some dismiss our everyday analogy, as in this response: "[Smith and Fingar] claim that, without exception, no workflow system can do the email pattern they describe. This is just false. You need only look at some early workflow products to see what was achieved using email as the fundamental basis for their technology. Examples include Action Technology's *Coordinator* and Banyan Systems' *BeyondMail*."

This is a misunderstanding. The email pattern in our paper was shown as BPML, using three swim lanes (sender, receiver, address book roles, or participants) driven by correlation. We are not aware of a workflow engine that can support these ever extending types of mobile processes. If there is one, please show us how by drawing the email process using a workflow diagram. Calling Action Technology and Beyond Mail examples of email-based workflow systems misses the point completely. Nor can ActionTech serve as an example. ActionTech is not a workflow engine. Far from it. It's a special purpose engine that implements recursive coordination and negotiation processes, and does so really well. It is not classical workflow by any means. The fact that some call it "workflow" only highlights the fact that there is no standard model of workflow among workflow vendors. There is virtually nothing in common between the engine in Action Tech and the engine in Staffware, for example. It was precisely to develop a consistent meta-model for process (and workflow) that BPML.org was formed. In past years, Action Tech called their technology a workflow engine, but, in conversation with them, we found out that this was only because "workflow" was a term business users might respond to. Today, Action Tech uses the term BPM for similar reasons. But it is neither. It's a proprietary, but highly effective, approach that enables coordination and negotiation processes based on the groundbreaking innovation in computer science of Flores and Winograd. It too could be modeled in BPML. Whether one would do that is not the point. The fact is, it could be done, and relatively easily we suspect. Would this break patents owned by Action Tech? Maybe. Would such a BPMS-based Action Tech process implemented in BPML scale? It's difficult to tell without trying. In any case, the purpose of BPML is not the commoditization of key technologies such as Action Tech's. No customer will pay for that. Rather, the BPMS can project Action Tech processes so that they can participate in wider end-to-end processes, for example, incorporating an Action Tech coordination process in an overall supply chain model.

The First Transactional BPMS

In our paper we stated that Intalio n|3 was the first transactional BPMS, and this was countered with, "The assertion that Intalio has the first transactional BPM system is also false. There are several transactional BPM tools around, including Fujitsu iFlow and Staffware iProcess Engine." In order to understand this difference of opinion we restate our definition of "transactional BPMS" that we used in our paper:

A transactional BPMS is one in which the processes themselves can be regarded as transactions. Such transactions, extending across process participants (expressed in swim lanes), can be nested at all levels of the process model. This is in contrast to products that only allow for the calling of transactions implemented in other technologies. A transactional BPMS, therefore, allows for the re-combination of projected transactional processes from

other systems, and provides transactional capabilities similar to Transaction Processing Monitors inherent to application servers. But where these are restricted to transactional data operations, BPMS provides transactional process operations. On a BPMS, transactions are a business semantic available to business people to use as part of their process model development.

To our knowledge, no workflow system provides this capability. Unlike a stand-alone engine, a BPMS supports a BPML model that describes a process that might extend, in breadth and depth, over many heterogeneous technologies and express fine-grained details of those technologies' execution models. While details of this may have no obvious "business case," they arise when one wants to make it easy for business users to create and deploy new processes. Think of an end-user desktop application from which ERP-scale processes can be modeled, deployed and operated, and which include databases, CRM and SCM systems, and you'll get the idea of what we meant by a transactional BPMS managing the process transactions (interactions) across swim lanes. Think TP monitor for processes.

BPMS Implementation Challenges

Another misconception of BPML is embodied with the dialog that, "Despite the hype and the talk of a 'third wave,' the proposed standards defined in the Business Process Modeling Language specification will probably wither on the vine. They will do so not because they are, so to speak, sub-standard, nor because they are essentially the product specifications for Intalio. They will fail because they are limited in process functionality, too prescriptive and too difficult to implement. Vendors will find it too expensive, in every sense, to move forward with them."

BPML.org's policy was not to move ahead in standards development without implementation, in order to validate the efficacy of proposed standards. The same approach will be applied to the specification of BPQL and vendors that have serious intentions of developing it will be fully involved in an open process of development, as occurred with BPML. It is true that the implementation of BPML is challenging. Even the implementation of BPEL, which is, in effect, BPML, is challenging. Few companies will be able to make the effort. The same was true of the relational model of data, but Larry Ellison found a way to implement a RDBMSbased on complex relational algebra. However, these illusions to things "withering on the vine" could lead people to understand that the BPMS is going away, or that businesses, not just IT vendors, might find it hard to deploy a BPMS and move forward with it. This is not our experience.

Moving ahead with a BPMS is no harder than moving ahead with a RDBMS. The BPMS is installed by a business. The BPMS is used to introspect existing systems, making their process fragments available to the process designer; business and IT teams then work together to build and deploy end-to-end processes. While we acknowledge that the BPMS is less mature than the WfMS, and, therefore, the first BPMS projects will, for a time, be challenging, this is hardly reason to state it will wither on the vine. BPML may be *complex for vendors* to implement, but this makes BPM *easy for business users*, for, as an old computer science adage instructs, making things complex is simple, but making things simple to use is complex.

BPML.org set the bar high in order to create something new and genuinely useful to business. BPML is not a lowest common denominator standard among a host of vendors in order to enable interoperability in a fragmented market. Ted Codd would not have gotten very far with the relational data model breakthrough thinking that way. BPML is challenging, as are most major innovations. BPML is challenging because BPM, as defined by BPML.org, is challenging. Expect only the well-endowed, established IT companies, or the smartest and most agile start-ups, to make the attempt.

A BPMS is Required

Is BPM nothing we have not done before, as the following asserts? "Business processes are the nervous system of an organization. They set a business apart from its competitors.

Automating and, as a result, managing these processes can increase their value to an organization many times over. Doing this demands nothing we have not done before.” We disagree, else we would now be experiencing the great Workflow Renaissance, Workflow II, and that pesky three-letter acronym, BPM, wouldn’t fill the pages of the business and IT literature. If it were the case that existing workflow products were sufficient, BPMI.org would not have drawn industry interest and a large membership, and spawned new products funded by very smart venture capitalists, industry veterans, and institutional investors. Nor would BPEL have arisen so quickly in response to BPML. Nor would SAP be an investor in an innovative BPMS start-up. IBM would not be planning a BPEL runtime to replace existing workflow technology that will presumably sit at the heart of WebSphere.

The Third Wave of BPM is challenging. Existing workflow products have already demonstrated their ability to step up to part of that challenge. Yet the industry’s judgment is that steps beyond workflow can be taken to move the industry to the next level of capability. As two ERP vendors told us, “Even with workflow, it is taking us and our customers far too long to develop processes.” That’s because there is no unified process platform and, therefore, no higher-level tools to help. The resolution to this is similar to what happened with data, and it’s going to happen with process. ERP hadn’t surfaced atop the HDBMS, while MRP was just barely possible on the HDBMS, but without the richer application set and models of ERP.

The BPMS might take some time to come to market, or it might just be a storm. We leave that to pundits and analysts to debate. The vision stands. The real challenge is to unify workflow, programming, computation, and communication to create a solid foundation for all process work, the BPMS, and to address 80% of common process needs. Just because workflow already exists is no reason not to try to address the broader world of business processes. The real action in the next few years will not be a debate over WfMS or BPMS, but the use of WfMS and BPMS as the foundation for new applications--applications that manipulate processes. The process designs themselves, rather than being the strictly controlled intellectual property of ERP vendors, will be owned by enterprises and managed by them in pursuit of unique, differentiated, best-in-class processes.

A Vision of BPM

Bill Gates recently expressed our viewpoint quite succinctly, “We are very optimistic about ... letting people use models to define how their business processes work and not have to write code - just work at a visual business process level.” The immense heritage of workflow is part of that. As we stated clearly in *Business Process Management: The Third Wave*, a book endorsed by both the BPMI.org and the WfMC, “The reengineering and ERP eras were focused on one-time process change events. Workflow was the innovation that signaled the coming of the third wave.” However, workflow is not the third wave we define in that book. Let’s call it wave 2.5. But there is little to stop BPMI.org and the WfMC.org working together to create that “Third Wave” of BPM. To do so will require the workflow community to move beyond what BPML *cannot* do and to investigate what it *can* do. Credence being given to the integrity of *Workflow is Just a Pi Process* comes from practical work already undertaken by *Fortune 1000* companies that have used workflow for many years but are now embracing the BPMS. Paper analyses of our report have not distracted them from adopting the BPMS innovation for a new source of competitive advantage.

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