



Extreme Competition

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Get Your Head Into the Clouds

*The Next IT Platform Shift and a Really Big Question:
"Why is Consumer IT so simple and Enterprise IT so complex?"*

What is the Cloud?

*Look! Up in the sky! It's a bird! It's a plane!
No. It's Hadoop, the elephant in the Cloud!*



Doug Cutting, a search specialist, named his new creation Hadoop, after his son's stuffed elephant. Cutting's creation, Hadoop, is an Apache Lucene sub-project, a Free Java software framework that supports *distributed applications running on large clusters of commodity computers that process huge amounts of data. It's a globally accessible fabric of resources, rather than local machines or remote server farms.* The driver has been making the hundreds of petabytes of data searchable.

Now, what search pioneers like Cutting have been pursuing has turned into **general-purpose computing platforms, vastly more powerful than any ever built before – a massively parallel, scalable architecture that happily accommodates multifarious software.** In short, **"the Cloud is the computer."**

Here's a simplified definition of cloud computing from Wikipedia, "Cloud computing is a computing paradigm shift where computing is moved away from personal computers or an individual application server to a "cloud" of computers. Users of the cloud only need to be concerned with the computing service being asked for, as the underlying details of how it is achieved are hidden. This method of distributed computing is done through pooling all computer resources together and being managed by software rather than a human." All this new capability is driving the need to manage these advances as a unified *Cloud*.

Did you know that Google chose the little Oregon town of The Dalles, at the end of the fabled Oregon Trail along the Columbia River Gorge, to build a new 30-acre campus? This campus will be the base for a server farm of unprecedented scale. You see, there's a dam there with a 1.8-gigawatt power station serving up electricity at one fifth the cost of Silicon Valley electricity, plus a fiber-optic hub linked to Harbour Pointe, Washington, the connection point of PC-1, a fiber-optic superpipe that was built to handle 640 Gbps between Asia and the U.S., and taps into the Northwest Open Access Network, a node of the experimental Internet2. (Yeah, I know Alaskan Senator Stevens calls them "tubes.")

The ideas behind cloud computing aren't new. So, before continuing, I'd like to set some historical context, via the WayBackMachine, as I did in my last column where I took us back to GTE Data Services (GTEDS) in 1979, only this time to GTEDS in 1969. General Telephone and Electronics, one of the largest telephone providers in the world, took to heart the ideas of *Grosch's law*, "Computer performance increases as the square of the cost. If you want to do it twice as cheaply, you have to do it four times faster. The law can also be interpreted as meaning that computers present economies of scale: Bigger computers are more economical." According to Dr. Herbert R. J. Grosch, "Grosch's Law was originally intended as a means for pricing computing services. IBM's Tom Watson Jr. ordered me to start a service bureau in Washington. The first question was 'How much do I charge?' So I developed what became known as Grosch's Law." While Grosch's law was far more pertinent to the 1960s and 1970s mainframe era, the underpinnings of "utility computing" were quite the same as today's rationale for cloud computing. In other words, rather than companies, such as Savings and Loan institutions, buying and maintaining their own mainframes, they could instead turn to a "computer utility," such as the one envisioned by GTEDS, and gain the efficiencies of Grosch's law. GTE could make a profit by consolidating its data centers and becoming a "service bureau," as it was called back then. Being fresh out of college, my colleague Ken Bruggeman and I, along with our former IBMer boss, Ken Gold, went to downtown Tampa with a shovel and camera to take some pictures of ground being broken in front of the big billboard announcing the place where the GTEDS data center would be built. We were, of course, impatient youngsters with a passion for this new idea of a computer utility.

Oops. Darn. It sort of never really happened. Along came lower cost minicomputers (Dec's VAX, IBM's System/3, et al.). Then came the PC revolution. Then the *almost* killer revolution proclaimed by Sun Microsystems' John Gage in 1984, "The Network is the Computer." Another oops, sorry, John the passionate, that didn't happen either, because the network wasn't fast enough in 1984. And, oops, sorry, Larry Ellison of Oracle, the Network Computer (NC) was also before its time; the typical home had dialup Internet access in 1996 – the network still wasn't fast enough. As Eric Schmidt, former CTO of Sun Microsystems and now CEO of Google, observed, "When the network becomes as fast as the processor, the computer hollows out and spreads across the network." Ah, so now that the overabundance of dark fiber laid down during the dot-com boom is being lit up, perhaps it's time for a "computer utility redux;" perhaps it's now time for the great computer in the sky; perhaps it's now time for cloud computing.

Who is leading the charge in massive-scale computing, the kind needed for Web 2.0 and beyond? All the titans shown in the figure below have stepped up to the plate, along with spades of smaller players, such as Ribbit, "Silicon Valley's First Phone Company," the startup that wants to take your telephone to the Cloud.



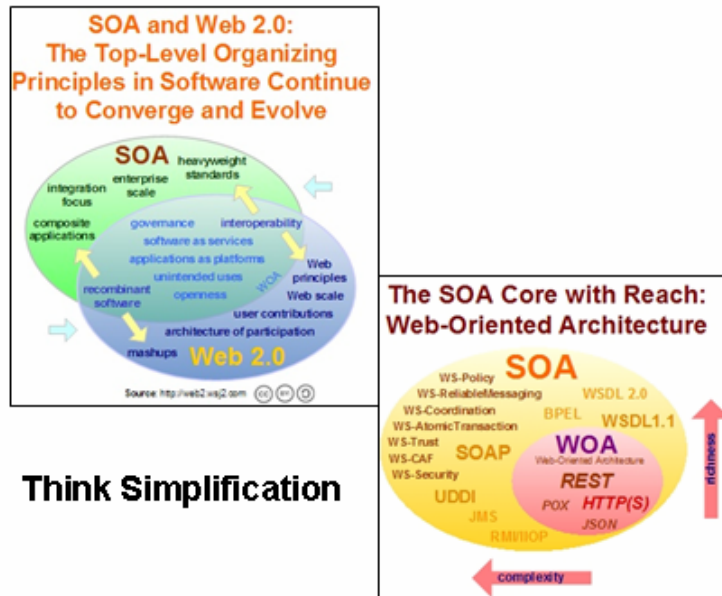
Web 2.0 and BPM

Now, what about that Web 2.0 thing? No, it's *not* new Internet technology, as Tim Berners-Lee would quickly tell you. But Tim O'Reilly would counter with, "Web 2.0 is the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the

intrinsic advantages of that platform: delivering software as a continually-updated service that *gets better the more people use it* [e.g., Wikipedia], consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating *network effects* through an ‘architecture of participation,’ and going beyond the page metaphor of Web 1.0 to deliver rich user experiences.”

In other words, Web 2.0 is not based on a technology shift, but rather a *usage* paradigm shift. That shift has come about largely by the *simplicity of use*; call it Consumer IT, if you will. You don’t need to write even one line of code to participate in Facebook, YouTube, MySpace, Second Life, Wikis, blogs, or Google Apps. And, the more these easy-to-use services get used, the better they become, and the more value they deliver to the users. In short, Web 2.0 provides a platform where everything is a *service*, not an application or software code. Which then leads to the question, “Why is Consumer IT so *simple* and Enterprise IT so *complex*?” Answering this question unfolds many challenges and opportunities for the worlds of IT and business process management (BPM).

Michael Hugos, author of *The Greatest Innovation Since the Assembly Line* (Meghan-Kiffer Press) and award winning CIO wrote, “You are going to have to own up to the fact that we in IT are addicted to complexity. And our addiction to the complex, the expensive, and the clunky is increasingly indulged at our own peril. That’s because business people have discovered that consumer IT is better than corporate IT. It has more features and is more responsive, easier to use, faster to install, and a whole lot cheaper to operate.” This not only strikes at the heart of IT in general, but also BPM systems. Web 2.0 and the emerging Web-oriented Architecture (WOA) are all about a quantum leap from complexity to simplicity, especially from the user’s perspective.



Think Simplification

Source: <http://blogs.zdnet.com/Hinchcliffe/?p=27>

If you can build a vision of an agile and innovative company – and show how to interweave the easy-to-use Consumer IT and complex Enterprise IT systems, tools and techniques to go where neither has gone before – you’ll become a true pioneer. It’s about connecting the dots, and there are many new dots to connect, with Everything as a Service (EaaS). Ultimately everything – infrastructure, information, widgets, and business processes – could be delivered as a service, and delivered via the Cloud, as indicated by Gartner’s 14 Alternative Delivery Models.

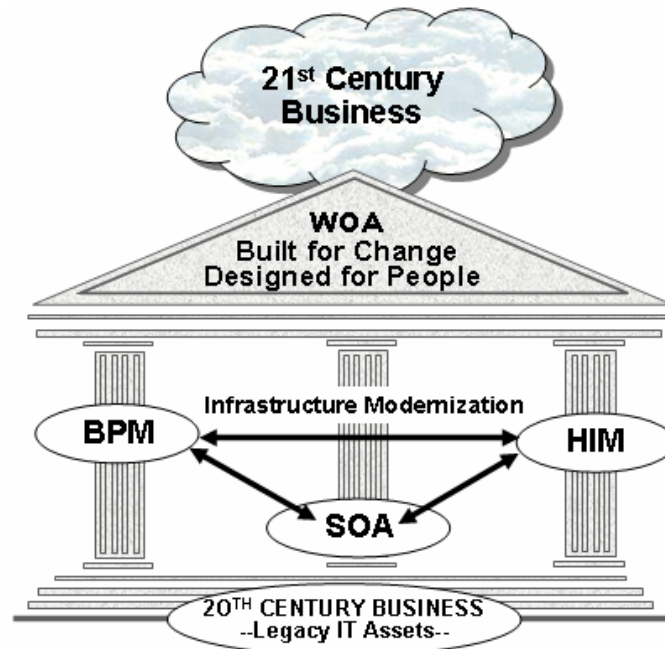
EaaS – Everything as a Service

AaaS - Architecture as a Service
BPaaS - Business Processes as a Service
DaaS - Data as a Service
FaaS - Frameworks as a Service
GaaS - Globalization as a Service
GaaS - Governance as a Service
HaaS - Hardware as a Service
IDaaS - Identity as a Service
LaaS - Lending as a Service
MaaS - Mashups as a Service
PaaS - Platform as a Service
VaaS - Voice as a Service

**Gartner's 14 Alternative
Delivery Models**

1. Business process utilities (BPUs);
2. Infrastructure utilities (IUs);
3. Storage as a service;
4. Grid computing;
5. Communications as a service (CaaS);
6. Utility computing;
7. Capacity on demand;
8. Remote management services;
9. SaaS;
10. Web platforms;
11. Community source;
12. Software streaming;
13. Software-based "appliances" (SBAs);
14. User-owned devices.

But you'll need a framework for showing how it all fits together – your existing IT assets, service-oriented architecture (SOA), business process management (BPM), and human interaction management (HIM) combined to bring your enterprise to the Web 2.0 table through a Web-oriented architecture, WOA, an acronym coined by Gartner's Nick Gall, is a substyle of SOA. It's essentially a more lightweight and RESTful (Representational State Transfer) rendering of SOA, that capitalizes on the Internet's native capabilities to provide reach without complex middleware.



What Does All This Mean for BPM?

Let's look up from our daily grind and deadlines and scan the horizon to ponder some of the foundations of BPM systems that *could* evolve as businesses move to the Cloud and Web 2.0. Let's keep it brief and look at just three aspects: Business Process Analysis, Business Process Utilities, and Human Interaction Management.

Business Process Analysis 2.0: Business Analysts and IT Developers. Something, anything, has got to take on the growing complexity of IT, and it goes to the heart of business process modeling and analysis. Can anything be done to bring the simplicity of Consumer IT to the task? Actually, yes, but let's define who does what. First, there's the Business Analyst, who is an expert in some domain of the business, but likely has little IT knowledge or skills. Then, there's the IT Developer who has a strong IT background and a general understanding of the business. Here's the line that can be drawn in the sand between the two: If the creation or major modification of a business process touches on the back-office systems of record, that's the world of the IT Developer. If it doesn't and is aimed at business people getting their work done, then a whole new world of simplified Web 2.0 opportunities open up. Then there's a grey area between Business Analysts and IT developers that we'll get to in a minute.

To understand the process support needed for the domain expert, the Business Analyst, think of a spreadsheet. When you design a spreadsheet you just execute it; you don't use it as a model to front-end an IT systems development lifecycle. Ditto the growing number of Web 2.0 document and task-centric workflow tools. Such tools are typically purchased or used for free by individuals or work groups completely outside the purview of the IT department. Such tools are generally browser-based, and don't require in-house IT resources. Nor do they require extensive process models as most of these tools are provided as templates that users customize. But the growing demand for such tools indicates that lightweight process-oriented productivity tools are sorely needed in today's complex business world. However, using such tools willy-nilly in an organization can wreak havoc by splintering information resources and causing redundancy and synchronization problems.

Process modeling support for the IT Developer is far more formal. Most of the modeling tools of the BPM suite vendors have been developed by IT Developers for IT Developers, and incorporate technical elements that business managers find difficult to follow. Worse, the BPM suites vendors' notations are proprietary and incompatible with other vendors' notations. On the other hand,

business-friendly modeling tools, like Proforma's ProVision, have been around long before the advent of BPM suites and are in widespread use. Companies don't want to throw away the many process model libraries they've built over the years. So, in 2005, an effort was initiated to create a Common Interface Format (CIF) making it possible to transform the widely used ProVision process model to a BPM suite vendor's proprietary process models, and vice versa. This closes the gap between process modeling and the execution engines of each BPM suite vendor that joined the CIF Consortium. But we need more than just a few vendors sharing metamodels.

Clearly, industry-wide standards are needed. The Business Process Definition Metamodel (BPDM) is being developed by the Object Management Group (OMG). BPDM provides an explicit metamodel for the storage and exchange of Business Process Modeling Notation (BPMN) depictions. BPMN has gained recognition as a flexible and business-friendly notation for process orchestration. If Vendor A and Vendor B both support BPDM as their process exchange mechanism, then a BPMN drawing created using Vendor A's modeling tool could then be opened and *executed* using Vendor B's business process management system.

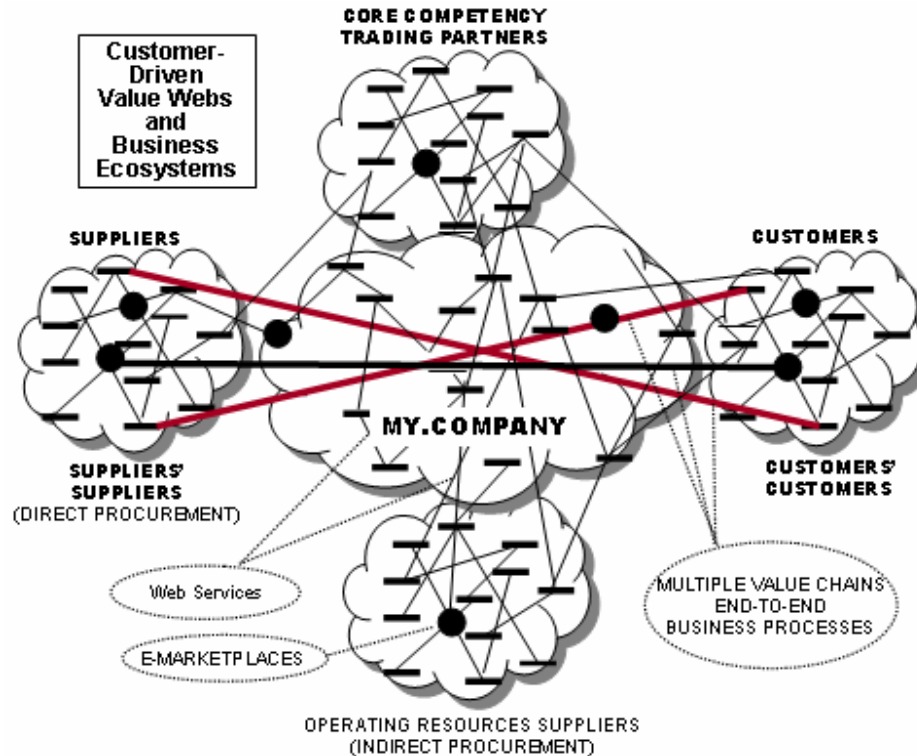
Once these standards are mature, we can expect to see people asking how much of the work now done by IT Developers can migrate to the Business Analyst. Companies will ask that question again, "Why is Consumer IT so *simple* and Enterprise IT so *complex*?" Just as companies have spreadsheet "power users" outside IT departments, Business Analysts may evolve into Web 2.0 "process modeling power users," reaching across that line in the sand with Web 2.0 Modeling Tools, just as WOA has extended the use of SOA through simplification.

That is, Business Analysts may move up a bracket in process management, from lightweight to middleweight processes, leaving only the heavyweight stuff to IT specialists. This also brings up that grey area I mentioned earlier. In my column, "The Greatest Innovation Since BPM," I wrote about the Human Interaction Management System (HIMS, which is also discussed below). From a Web 2.0 perspective, using a HIMS should be as easy as using consumer IT offerings like Skype, and IT need not be involved at all. On the other hand, team members don't interact in isolation from the IT and BPM systems that surround them in their work. So, IT specialists are still critical to the use of the HIMS when back-office IT systems are involved (see Figure 4 of that column). This blending of consumer IT with enterprise IT is one big step toward greater business agility. Business Rules 2.0 (to govern who can do what to what process) will no doubt play a key role in making this vision come to pass, a vision first laid out in the book, *Business Process Management: The Third Wave*. Business architect Gene Weng netted it out with a quote from Leonardo da Vinci, "Simplicity is the ultimate sophistication."

BPM Suites 2.0: Business Process Utilities. The days of the monolithic, vertically-integrated company, owning everything from raw materials to production to selling, are over. 21st century corporations thrive in a business world where the traditional linear supply chain gives way to dynamic, customer-driven value *webs* (call it the extended enterprise if you like). This brave new world can be understood by examining how the business processes and activities of Harvard professor Michael Porter's value chain analysis are unbundled and then reassembled into the dynamic business ecosystem portrayed in the figure below from the book, *The Death of 'e' and the Birth of the real New Economy*. Business activities and processes are realigned with real-time connections between and among a company's customers, suppliers, and trading partners.

As shown, primary and support business processes of a company are aligned around four realms of interwoven activities involving

- suppliers and suppliers' suppliers (direct procurement)
- operating resources suppliers (indirect procurement)
- core competency trading partners (value added activities), and
- customers and customers' customers (selling through private and public channels).



Historically, business models were linear. They involved tightly linked suppliers and trading partners and were made up of large sets of complex business processes. In large companies, supply chains were tied together with complex and expensive systems. As the monoliths that they are, such systems were difficult to build and maintain, and they couldn't adapt to the dynamics of markets being made possible by the Internet.

Such rigid supply chains must now become lightweight, fine grained, and flexible to fit ever-changing contexts. In the era of mass customization and personalization, a unique value chain may be needed for just a single customer and a single transaction. Others may serve multiple customers over long periods of time. These multiple value chains must be woven through the tapestry of the any-to-any connections of the Internet-enabled business ecosystem. It must be possible for them to be bundled, unbundled, and rebundled in response to changing market realities. They must allow a company to participate in multiple marketplaces or reach out directly and uniquely to "a market of one." *The successful company must be able to manage multiple, simultaneous value chains and all the business processes that are involved.*

Levi Strauss doesn't make jeans, Dell doesn't make computers. The best-run companies are no longer *sellers to their customers; they are buyers for their customers*, reaching out to networks of producers across the globe to deliver compelling value. So, who owns the end-to-end business processes that drive these value chains? Whose customer relationship management (CRM) system is to be used? The answers to these questions go beyond enterprise CRM to Value-Chain Relationship Management (V-CRM) and Customer Community Relationship Management (CCRM). When it comes to relationship management in the 21st century, it's not just "customers," it's "customer communities." It's not just a portal, it's portals. It's not just supply chains, it's business ecosystems. It's going beyond sales, marketing, and customer service delivered by a single enterprise, and on to outside-in processes such as inquiry-to-order from multiple channels and customer communities. Hmm, it's beginning to sound like the next generation of CRM will need to be managed in the Cloud. Ditto for product lifecycle management (PLM) where your CAD, supply chain, and contract management systems must go *outside the firewall* to reach design and production partners, as well as your customers in the new world of customer-driven innovation.

Thus, BPM itself could become BPM as a Service (BPMaaS). This trend could be similar to what client/server is to IT. A company would have choices over the best way to implement and manage Private, Public, and Collaborative process types, some being handled by industry-specific Business Process Utilities (BPUs). With the rise of Business Process Outsourcing (BPO), it's reasonable to expect the BPU to capture the economies of scale for commodity processes, e.g., human resources and multi-company processes such as V-CRM. As the business world continues to move toward mass customization, business processes could increasingly be accessed through BPUs offering the same core services, customized all the way down to the process instance, for multiple clients. Of course, core business processes will always be Private, as they represent the unique competitive advantage of a given company. Yet, Private doesn't necessarily mean a company has to have its own hardware and software infrastructure in-house. Private processes could be wrapped in a veil of powerful security mechanisms in the Cloud. "Situational business processes," whose unintended contexts may draw on a given company's core processes, just could become the norm; and they must be managed as diligently as any other mission-critical business processes.

We can safely conclude that cloud computing isn't just for the construction of virtual supercomputers for scientific and research purposes, but that it's also for dealing with the realities of today's value delivery systems, social networks, and complex business ecosystems (see also, Business Intelligence 2.0 in the Postscript). Already, cloud computing appears to be leveling the playing field for many business start-ups, avoiding the need for enterprise IT investment altogether. But as even the largest of companies begin to tiptoe to the edge of the new business ecosystem to conduct business and pursue the long tail, the need for BPMaaS will become more and more apparent. *As competition has evolved from company vs. company to supply chain vs. supply chain, and now on to choreographing networks of trading partners, the action is outside any one company's firewall; it's in the Cloud.*

Collaboration 2.0: Human Interaction Management and Bioteams. Most of today's BPM solutions can take care of 80% of the mechanistic, predetermined system-to-system and workflow process scenarios. Such capabilities are needed to help a company put its "house in order." However, when you consider collaborative activities and the fact that, as Xerox's former Chief Scientist John Seely Brown explains, "processes don't do work, people do," there's no doubt that what's now needed isn't more and more software for animating computers; it's software for animating human-to-human interaction processes, where work teams may be scattered across the globe.

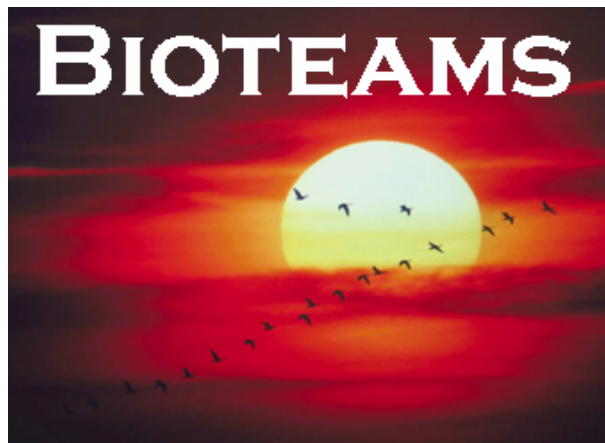
It's now time to shift the process spotlight onto those human-driven processes. That means fusing traditional collaboration and information tools (e.g., groupware, knowledge management, and workflow) and extending them with a complete theory of human work if we are to build systems that can support the way people actually work, versus treating them as cogs in an information machine. In a groundbreaking book, *Human Interactions: The Heart and Soul of Business Process Management*, Keith Harrison-Broninski wrote, "We must find a way of thinking about human-driven processes that allows controlled management of change – something that is innate in all interaction work, as human-driven work processes evolve continuously throughout their lifetime."

Human interaction management is orthogonal to BPM, requiring neither BPM nor SOA for implementation. On the other hand, HIM goes hand-in-glove with either or both, filling in the gap where goal-oriented human interactions are paramount. It's about "commitment processing" versus "information processing," where participants negotiate and commit to next steps, just the way real people work in the real world. A Human Interaction Management System (HIMS) can reduce the infoglut and overwhelming noise generated by the many Web 2.0 communications channels: blogs, wikis, IMs, et al. Who has time to read and reply to emails, much less consume all the new Web 2.0 media channels? So, in one way, a Web 2.0 HIMS is a Web 2.0 noise tamer, helping workers get their work done with others; call it the "work channel" if you like. Supported by

a HIMS, high performance teams can be formed, but new protocols and new team behaviors will be needed to optimize communications among team members that are more and more operating in virtual teams.

Got team? You'd better. To succeed in today's dynamic, technology-enabled environment, you must be able to function in and through teams. But, if we stick with our current "command-and-control" approach to teams, we will not be able to meet the growing needs of our customers and our communities in the high-change global economy. The discipline of *bioteaming* offers a vision of what successful teaming experiences look like in the interconnected world of the 21st century.

Ken Thompson's fascinating new book, *Bioteams: High Performance Teams Based on Nature's Best Designs*, reveals how business enterprises, supply chains, high-tech ventures, public sector organizations and not-for-profits are turning to nature's most successful designs to create agile, high performance teams.



High Performance Teams Based on Nature's Most Successful Designs

According to the distinguished Indiana University technology professor, Dr. Curtis Bonk, "This is the age of employee participation, multiple leaders and yet no leader, and prompt communication, as well as the technologies that make all this possible." Bonk's statement sets the stage for the natural attributes of bioteams that include

- *Collective Leadership*. Any group member can take the lead.
- *Instant Messaging*. Instant, whole-group, broadcast communications.
- *Ecosystems*. Small is Beautiful ... but Big is Powerful (e.g., collective intelligence).
- *Clustering*. Engaging many through the few.

We need new guidance for creating business networks, mobile workgroups, and virtual communities. Bioteaming offers first principles for building exceptionally agile, high performing teams based on a thorough examination of the underpinnings of nature's most successful groups. In short, Web 2.0 and the Cloud aren't so much about technology as they are about *a new platform for human interactions* that, in turn, requires new team behaviors. In a process-managed enterprise, command-and-control leadership gives way to connect-and-collaborate, where every member of a business team is a "leader." In a process-managed enterprise, leaders don't give commands; they transmit information, trusting the team members' competencies and gaining *accountability through transparency*. True leadership is about cooperation, not control. As in nature's teams, it's about acting on opportunities and *letting others lead the leader when they know best about getting stuff done*.

With the emergence of global Internet collaboration, social networks, and mobile communications, the very meaning of the word "team" has changed – changed utterly. Not only will we need software support, e.g., the HIMS, for taming the inherent chaos in this brave new Web 2.0 world, we'll need a change in behavior to replace command-and-control in our human interactions, in our teams.

Takeaway.

Just as GE's legendary CEO, Jack Welch, learned about the power of the Internet in the 1990s by watching his (now former) wife shopping online, consumers are out front of companies when it comes to using the Cloud and Web 2.0. Just think Google, Yahoo, eBay, Amazon, and Flickr – all with very sophisticated and powerful cloud infrastructures. On the other hand, it's been tough to convince the largest enterprises that the Cloud represents the next infrastructure, the next computing platform.

As Sun Microsystems' CEO, Jonathan Schwartz blogged, “. . . I'm sure George Westinghouse was confounded by the Chief Electricity Officers of the time that resisted buying power from a grid, rather than building their own internal utilities.” He goes on to write, “We learned a lot, but mainly that most enterprises today define On Demand computing as hosting – they want to give their computers, software, networking, and storage to a third party, and rent them back for a fixed price. But that'd be like an electricity company collecting generators and unique power requirements, and trying to build a grid out of them. That's not a business we're in (nor one in which technology plays much of a role – it's all about managing real estate and call centers, as far as we can tell). Grids are all about standardization and transparency – and building economies of scale.”

Schwartz isn't too concerned about early adoption by large enterprises, “Rumor has it there's a good business in the long tail. My view – most computing will be purchased by that tail. There are, after all, far more small financial institutions than large. The same applies to movie studios, pharmaceutical companies, academic institutions, and nearly every other industry on earth. I'm very comfortable betting on the value in volume – and the willingness of those smaller firms to change culture, process, and lifestyle to get a competitive advantage through network services.” As with most new paradigms, such as open source, cloud computing may start at the edges of enterprises and slowly be absorbed into more and more functions.

My very first experience touching a PC – I'm guessing around 1971 and way before “real” PCs were developed – was a Datapoint 2200, the device that also led to the development of the first 8-bit microprocessors, and whose specifications led to the creation of the Intel 8008 single chip microprocessor. Now, not so many years later, I'm waiting for the specification from OMG's Business Process Management Initiative, or whoever, that will make it possible to put business process management in the Cloud – with Web 2.0 simplicity. The time is ripe.

Over time, cloud computing could help IT managers dramatically reduce the complexities and costs of managing scale-out IT infrastructures in the Web 2.0 era, and could also help manage the complexities of scale-out inter-enterprise business process management – including requisite real-time petabyte-scale *business intelligence, business rules via *intelligent agents, inter-enterprise business process modeling, *complex event processing, and human interaction management (* see Postscript).

Old-line CIOs will certainly cling to their in-house infrastructures, claiming *security* as the major concern (and don't forget compliance: SOX, HIPAA, GLBA, FFIEC, PCI, COBIT, et al.). Of course, security is and always will be a major concern, even for in-house located systems, though one that can be overcome in the Cloud. For every major technology shift, commensurate new management controls and auditing procedures are needed, as I explained in my last BPTrends column, “EDP Audit and Control Redux.” So, watch for FWaaS (firewalls) and SVPNaaS (secure virtual private networks).



Meanwhile, the forward thinking CIO will no doubt put his/her head in the clouds, and change his/her title to CPO, Chief Process Officer, for it's agile business processes that companies want to manage, not technology infrastructures. And, no, it's not one size fits all; it'll likely be a combination of SaaS, In-house, and Cloud infrastructures. But it will be a new paradigm, surely, as the PC was a new paradigm to mighty-mainframe IBM in days gone by. So here's a word of warning to those who have shrugged off Web 2.0 and the Cloud as its platform, "Do so at your own peril, even though where all this will end up is still up in the air." Let the dot connecting begin.

P.S. Did I mention Web 3.0? Stay tuned, for the Cloud and Web 2.0 just could represent the knee of an *exponential growth* curve for the business Internet.

Technology Postscript on Web 2.0.

Making the user experience complex is easy. Making the user experience easy is complex. For example, using Google is easy, building Hadoop was hard. Much of the literature on Web 2.0 seems to imply a lesser and lesser role for IT specialists and other technologists due to end-user ease of use. Not so. If we look behind the Web 2.0 curtain, we can see some heavy lifting that only technology professionals and computer scientists are prepared to undertake. So let's take a quick peek at just two challenges: Business Intelligence 2.0 and Business Rules 2.0.

Business Intelligence 2.0: Complex Event Processing. Much like accounting, business intelligence (BI) to date is pretty much backward looking. Much like counting Web page hits, BI often consists of one-dimensional metrics, e.g., a scorekeeper. In the era of, let's call it Web 1.0, the big metric was page views. Page views are rendered as quaint in the Web2.0 era eyeball wars. What counts now are the number of connections in social networks, the number of messages being sent, and the time spent on a particular site. It gets complicated pretty quickly when you consider that analytics and decision support must now operate in real-time (in time enough to make a difference, in time to *act*). Acquiring the right information and continuous analytics, in real-time in the Web 2.0 Cloud, is the next challenge for BI, especially as we move from "data mining" to "blog mining" for valuable business information. It comes down to how can you go beyond a Google search, and sift through the mountain of Internet *chatter* to figure out what's really going on in your industry, and who's saying what about your company's products and services. In short, there's a need for a Web 2.0 dashboard.

The quants, the super-number crunchers, are in great demand. Jeff Bezos started as a quant working on Wall Street. Gary Loveman, CEO of Harrah's Entertainment Inc., has a Ph.D. in quantitative economics from MIT. Reed Hastings at Netflix Inc. was a math teacher. Hal Varian, Chief Economist at Google and former the Dean of the School of Information Management at UC Berkeley, was one of the earliest quants at Google, and now one of many. My coauthor of *The Real-Time Enterprise*, Joseph Bellini, is now CEO of Symphony Marketing Solutions whose ambition is to be the gold standard for developing both market and customer level insights.

The quants are moving from Wall Street to Madison Avenue where they are helping their companies identify their most profitable customers; accelerate product innovation; optimize supply chains and pricing; and identify the true drivers of business performance.

SAP and Oracle paid a combined \$10B for Business Objects and Hyperion to get into the BI game. And IBM announced its \$5B acquisition of Cognos in November 2007.

In addition to all this BI action in the industry, let's not forget complex event processing. As described in the landmark book on complex event processing (CEP), *The Power of Events*, by Stanford professor, David Luckham, some CEP messages may not even carry business data swapped between applications. Instead, they contain information about low-level events that, when aggregated into patterns, can reveal high-level business intelligence. Luckham asserts that low-level events that occur in "the cloud" of network-based business interactions can yield valuable business intelligence. By using complex event processing for business intelligence, CEP can close the loop between BI and the business process management system that, in turn, can act on the business intelligence. As companies extend BPM outside their walls and on to the complex business ecosystem across the value chain, the value of CEP becomes an obvious lynchpin for business intelligence and real-time process analytics.

Business Rules 2.0: Intelligent Agents. Without policies and constraints to govern who can change what rules under what circumstances, any business would fall into chaos. Hence, the rise and widespread adoption of business rules engines (BREs). To manage the inherent complexity in inter-enterprise or value-chain business processes, smart companies will demand ever smarter processes that go far beyond today's typical business rules engines. But "smart" doesn't mean some Orwellian thinking machine, it means intelligent agent technology, also known as *distributed artificial intelligence* (DAI). Just consider "who can change what rules under what circumstances" in the figure in the section, *BPM Suites 2.0: Business Process Utilities* that shows that "your company" must maintain multiple value chains to offer the mass customization now being demanded by your customers.

What's an agent? Backing away from technology for a moment, the everyday term, agent, provides a starting definition: "one who acts for, or in the place of, another." A software agent is a software package that carries out tasks for others autonomously, without being controlled by its master once the tasks have been delegated. The "others" may be human users, business processes, workflows, or applications. A basic software agent stands on three pillars, three essential properties – autonomy, reactivity, and communication ability. The notion of autonomy means that an agent exercises exclusive control over its own actions and state. Reactivity means sensing or perceiving change in their environment and responding. And, even the most basic software agents have the ability to communicate with other entities – human users, other software agents, or objects. Add to this definition the ability to plan and set goals, to maintain belief models (their own and other agents' beliefs), to reason about the actions of itself and other agents (including humans), and the ability to improve its knowledge and performance through learning – you then have the core ingredients of an "intelligent agent." An intelligent agent represents a distinct category of software that incorporates local knowledge about its own and other agents' tasks and resources, allowing it to operate autonomously or as a part of a community of co-operative problem solvers (including human users), each agent having its own roles and responsibilities.

Agents can be integrated into BPM frameworks that contain specific problem-solving functions, data, and control. Intelligent agents support a natural merging of BPM and knowledge-based technologies. Intelligent agents can facilitate the incorporation of reasoning capabilities (e.g., encapsulation of business rules within agents). They permit the inclusion of learning and self improvement capabilities at both infrastructure (adaptive routing) and application (adaptive user interfaces) levels. Intelligent user interfaces (supporting task-centered user interfaces, intelligent assistance to end-users, and business rules management) can be a boon to productivity in a complex world of multi-company business processes. With the complexity of tasks inherent in multi-company business processes, we will certainly need a little help from our knowledgeable

friends, intelligent agents. With companies and their software being disassembled as services (e.g., SaaS) and reassembled to provide unique value to unique customers, and with suppliers and trading partner resources often scattered across the globe, it's intuitively obvious that new "chaos busters" are in order. Thus, we can expect to see the continuing evolution from policy manuals, to business rules engines, to intelligent agent technology in the Cloud.