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Model Driven Architecture:
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New Dimensions in Business Applications

In my last installment of MDA Journal[1], I discussed the new dimensions of cloud computing and mobile devices that present opportunities and challenges for enterprise-class business applications. These are not the only new dimensions that impact business applications, offering new value but entailing increased complexity.

Cloud-Mobility Recap

The advent of cloud computing is lowering a key barrier to entry for business ventures by reducing direct software costs and avoiding the complications of installing the software and maintaining the computing infrastructure on which it operates. Consequently, new specialized business models that focus on a particular function within a value chain will emerge that were not previously viable.

Mobile computing is expanding the traditionally small percentage of a company's employees who use enterprise software, by connecting people who work on the shop floor or in field operations.

On the other hand, cloud and mobile computing increases complexity, because there are many inter- and intra-business scenarios that require business applications to coordinate among cloud-based, mobile device-based, and on-premise software components.

Sensors and Machines that Communicate

There is an emerging "internet of things" in which RFID tags track the movement of physical objects, and machines, such as manufacturing equipment, consumer appliances, utility meters, and vehicles, are equipped with sensors and wireless communication facilities.

RFID sensors provide businesses with real-time data about the location of items as they move through supply chains, presenting unprecedented opportunities to analyze and correct

[1] "Business Applications in the Cloud-Mobility Era," MDA Journal, BPTrends, September 2010

bottlenecks in supply chains, and to control fraud, theft, and terrorism. Enterprise class business applications are gradually integrating these new capabilities.

When your refrigerator senses that a belt needs replacing and communicates that to the appropriate node in the value chain, and you receive a notification that your dealer can make a service call next week to replace the part, all of the parties to these expanded application facilities obtain clear benefits. However, it means that business applications now have to coordinate not just among on-premise, cloud-based, and mobile-based components, but also have to manage sensor data and messages generated to address what the sensors detect. Thus, the new abilities cause a marked increase in the complexity of the coordination.

Furthermore, sensors are among the factors causing order-of-magnitude increases in the sheer quantity of data that applications have to manage. The amount of digital data worldwide grew approximately 60 percent between 2008 and 2009.[2] When the sensor sends a photo of the refrigerator part that seems to be having a problem, instead of just sending a simple message, the impact on network bandwidth and on static storage capacity grows by yet another order of magnitude.

Linked Data

Another surge starting to hit business applications is the Linked Open Data movement, which seeks to give people the ability to link related data together that wasn't previously connected, using technology that underpins the Semantic Web.[3] As this movement takes hold, business users will expect that their enterprise applications support this kind of linking.

Imagine that you are using your ERP system to manage payments to vendors. While investigating a particularly large pending payment, you go out on the Web and find the vendor's payment discount policy. You establish a link between the vendor record in the ERP system and that resource on the Web. The next time you or a colleague is managing a payment for that vendor, the link is available.

Now imagine this kind of scenario playing out in the large. An obvious impact is a further increase in the data load, because the links are yet another kind of data on the cusp of a volume explosion. A less apparent consequence is the complexity of managing the scope of the link. Is the link something that any employee can see? Is it interesting only to a subset of employees and thus would represent nothing more than clutter to others? Is the link confidential in some sense, requiring access restrictions? Enterprise class business applications have to address these questions. Despite the popular "Linked Open Data" tag line, the links cannot always be open in the enterprise context.

Social Computing

Another emerging dimension for business applications is social, collaborative computing. Taking our payment scenario a step further, if you have an issue with the payment amount or due date, you may need to communicate with your counterpart in the vendor's back office, which raises new issues for business applications.

The upcoming generation of business users, who are growing up with social computing being integral to their way of life, will expect the application to offer something beyond the possibility of picking up the phone and calling the vendor. They will expect collaboration capabilities to be built into the application so that you and your counterpart can share data and documents, open the conversation up to other colleagues where necessary, share links that you've established using data linking facilities, use Twitter-like facilities to alert relevant personnel, and so on.

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[2] "The Digital Universe Decade – Are You Ready?," EMC-sponsored IDC study, http://www.emc.com/collateral/demos/microsites/idc-digital-universe/iview.htm

[3] "Linked Data - Connect Distributed Data across the Web," http://linkeddata.org

Factoring social computing into enterprise class applications introduces questions of scope and security similar to those that linked data introduce. Some intelligence about who may be relevant to or interested in a particular collaboration will be a big help to the business user, who otherwise could be overwhelmed with all kinds of irrelevant contact.

Sustainability

The sustainability dimension presents yet another opportunity and complication for enterprise software. More and more companies are finding it necessary to take into account the sustainability of their practices from the standpoint of environmental impact and ethics. To some extent, direct bottom-line considerations drive this trend; after all, if you use dramatically less energy, materials, water, and so on, your costs go down. Indirect pressure on the bottom line ensues when a prospective customer's procurement process includes an evaluation of the sustainability of the vendor's products and operations, which is happening with increasing frequency.

Enterprise software can address sustainability by leveraging some of the other new capabilities, such as tracking the movement of goods to make the carbon impact of the supply chain transparent, or using tracking to verify the pedigree of pharmaceuticals in order to avoid the social cost of accelerating microbial drug resistance.

Moreover, sustainability concerns bring a whole new world of data to the fore. For example, what happens when a machine reaches the end of its productive life? Is the machine buried in a landfill? Is it broken down into parts that are then reused, and, if so, is a part reused multiple times or is the recycling just a relatively short delay until the part ends up in a landfill in the next cycle?[4] Answering these questions requires more tracking and, therefore, generates more data.

Enterprise application developers cannot afford to ignore the sustainability issues while they factor in the other new dimensions, because customers increasingly will demand to see the sustainability dimension. Governmental legislation and regulation will also require the new level of transparency, as society refuses to allow companies to externalize environmental and social costs. Thus, we can count on the new world of sustainability data adding to the overall data explosion.

Managing and Making Sense of Massive Data Volumes

Industry is starting to come to grips with the implications of the data explosion. There has to be a way to store, retrieve, analyze, and secure such enormous amounts of data.

On the computer hardware front, advances in producing cheap and expandable mass data storage appliances offers hope that we will be able to physically store all this data. The plunging cost of putting large amounts of main memory in computers makes it possible to crunch large quantities of data amazingly quickly in order to view it from many different angles upon demand.

But business application developers cannot simply rely on the hardware advances. They have to design their applications to truly exploit the new hardware capabilities. A large amount of the data underlying business applications today duplicates other data by putting various data together in pre-processed combinations and extractions so that it can be quickly processed when transactions happen or rapidly displayed in business intelligence dashboards when needed. With the mass growth of data volumes, such practices will not scale, because the huge data volumes, when duplicated many times over, become astronomically large; instead, applications will need to take advantage of the fact that the combining and extraction can be speedily executed on the fly because of the large amount of main computer memory available.

Security is a large topic in its own right, but suffice it to say that application developers will not be able to disregard security issues because security facilities are built into underlying computing

[4] For an in-depth treatment of these cycling nuances, see the book *Cradle to Cradle: Remaking the Way We Make Things*, William McDonough and Michael Braungart, North Point Press, 2002.

infrastructures. They will have to think through how enterprise applications integrate sensor data and social computing and linking facilities, so that the security infrastructure does its job where needed and relaxes it where the situation demands it.

Applications will also have to learn to make sense of the data, beyond the immediate purpose for which the data was created. An application may know exactly what it means when the refrigerator sends a message that the belt is worn, because it is pre-programmed to know that. However, it is quite another thing to get a handle on overall patterns of breakdowns, service calls, customer satisfaction, and so on by analyzing myriad forms of structured and unstructured data, including structured service records, public tweets by customers, internal communication among repair management personnel, and so on. Companies that excel at such sense making will have a competitive advantage, and enterprise applications that help them with it will overtake those that do not. Necessity will drive improvements in semantic technologies that extract meaning – with varying levels of confidence – from the mass of data.

Conclusion

Enterprise software has come in waves over the years. The first wave introduced mainframe applications that rested on the business premise that automating certain routine operations could power a large company to new levels of productivity and efficiency. The next wave of client-server applications allowed a broader range of companies to automate their non-core processes so they could be free to focus on their core competency.

The new wave rests technically on a far more diverse range of components linked together by the Internet, including on-premise systems, cloud-based systems, mobile-devices, and sensors, over which business applications integrate back offices, field operations, machines, transportation networks, and social networks, about which society demands increasing transparency and security.

It's a tall order, and a fantastic opportunity.

David Frankel has over 30 years of experience in the software industry as a technical strategist, architect, and programmer. He is recognized as a pioneer and international authority on the subject of model-driven systems. He has published two books and dozens of trade press articles, and has co-authored a number of industry standards.

David is a member of SAP's Technology Strategy team, which is part of the CTO's Technology and Innovation Platform organization. He focuses on standards for the financial services sector and for model-driven systems.

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