Advancing Productivity Where Complexity and Urgency Collide:

A Framework For Disaster Recovery Testing

By Eric Jackson

CREATING BUSINESS VALUE IS THE ULTIMATE GOAL OF INVESTMENT IN NEW IT technologies. This article offers vital recommendations to both IT vendors and IT users on how to ensure that the value gained is not overwhelmed by the growing cost of managing these technologies.

Advances in computing and networking technology have given rise to significant increases in productivity, as well as new products, new businesses, and new business models. These same advances have also fueled an explosion in complexity in an environment where IT-based processes are increasingly urgent and critical. More than just a problem to be solved, this collision of complexity and urgency represents a new way of the world, a new environment that must be managed in new ways. Both vendors and users of information technologies must make adjustments. On the vendor side, in addition to the perennial task of quality improvement, a new emphasis is required on automation tailored to applications and on integrated testing and validation. On the user side, the best way to manage the difficult interplay of complexity and urgency is for management and IT organizations to continue to explicitly tie IT investment to the business value it provides.

THE COLLISION OF COMPLEXITY AND URGENCY

In the early days of any new technological era, speculation and even fantasy thrive. Remember the paperless office? Or the regiments of robots freeing us all from drudgery of every kind? How about the imminent disappearance of brick-and-mortar businesses? All of these speculations have turned out to be wrong in one way or another. Nevertheless, the reality of the changes brought about by computing and networking technologies has been no less astonishing and fantastic. Over the past decade or so, IT advances have fueled an explosion in business productivity. The impact on the top line has been equally dramatic—many new kinds of businesses, new kinds of products and entirely new ways of doing business have appeared as a result of the tremendous rate of innovation in networking and computing infrastructure and software.

The accelerating push toward open, non-proprietary systems that can inter-operate through standards-based protocols has only accelerated the trend. The ability to mix and match best-of-breed technologies or to build effective lower-cost solutions has been a boon to business, allowing the implementation of new technologies in ways that align with business goals and achieve good returns on investment.

These same advances in information technology and tremendous increase in flexibility have also fueled an explosion in complexity. The flexibility of open systems means that many new combinations of hardware and software systems become possible, with myriad new potential interactions among them and between them and the business processes they support. Information technology has exploded in space as well. Once the domain of a few specialists in the data center that carried out a few critical, but narrow tasks, today computing and networking technologies directly touch every individual in the organization and support almost every major and minor function. IT components are now distributed throughout the enterprise, from an expanded data center to individual departments and offices to branch locations and even to individual employees using mobile technologies. The result: a large, diverse, strongly interacting system of distributed technologies that create tremendous management complexity at the same time that they free business to achieve new levels of productivity.

To make the difficulties more acute, this complexity is growing within an environment of increasing urgency because of the ever more critical nature of business IT systems. Recent years have given us all a heightened awareness of the risks of both natural disasters and human malfeasance. Pressures are rising from the need to comply with regulations like HIPAA and Sarbanes-Oxley. Add in relentless competitive pressures and there is an ever-increasing drive for higher availability, greater robustness, and faster reactions. Business simply cannot afford for IT systems, and more importantly, the business processes built on them, to be unavailable or not working properly. Downtime and malfunction can cost from thousands to millions of dollars per hour, and can wreak havoc with a company's core business processes, potentially even threatening the viability of the company.

This collision of complexity and urgency has lead to what might be considered a crisis in the management of IT systems. "Crisis" is not the appropriate term, however. What is happening in information technology is not a crisis, not an acute problem to be solved. Rather, it is the new way of the world, a new environment that must be managed in new ways. It is an environment that requires both users and vendors of information technology products and systems to make adjustments.

A QUESTION OF QUALITY?

What is the responsibility of IT solution vendors? Are there specific things that they need to be doing to address the situation? A common and seemingly obvious answer to this question is that IT vendors

should focus on improving quality, especially in software. Improved quality alone, however, will not solve the problem, for two reasons.

The first is that we already know how to dramatically improve the quality of software: slow down development, introduce rigorous controls on software development and thorough, in-depth and rigorous testing. The problem with this cure is that it may be worse than the disease. Not only does it slow the pace of innovation, but the complex and resource-greedy processes involved largely exclude small, agile companies with very limited cash and personnel from participating in the game. Yet these are the very companies that play the greatest role in driving innovation. Certainly there are improvements to be made, but the benefit they bring must be balanced against the cost of carrying them out.

The second reason is simply that, even if we were to significantly raise the level of quality, we would not fix the problem. The complexity of modern IT systems arises not because of quality problems in individual components, but because of the interactions of all the components and systems within the environment. When software and hardware systems must interact or interoperate with hundreds or thousands of other systems, most of them impossible to know in advance, the range of variables that must be taken into account far exceeds that which can reasonably be tested. As the work on chaotic systems has shown, tremendously complex behavior can arise out of very simple interactions of a large number of perfectly simple systems.

Improving our ability to manage the complexity of modern IT environments requires a different approach. I suggest that there are two elements on which IT vendors should focus. The first is automation. The second is integrated online validation and testing.

AUTOMATION

When the actual or potential interactions of a system with its environment significantly exceed the ability of a human to remember or manage easily, it is time to consider automating the process. The primary purpose of this automation is not to increase productivity, although that may be a beneficial side-effect. The fundamental goal is to reduce the overall complexity of the environment by reducing the number of different interactions that the human engineer must manage directly. On the surface, this seems a fairly obvious statement, but it is important to consider its consequences in more detail.

If all that is required is the ability to "program" a sequence of steps that a human might carry out, little is needed beyond support for powerful macros or scripting languages, or the development of general tools for workflow automation. Such tools are, of course, of great value, but they are an inadequate response. Indeed, they only exacerbate the problem, introducing additional variables and potential interactions into the system.

The kind of automation required is less about programming steps and more about tailoring software to the particular environment and use to which it is to be applied. At the highest level, the focus must be on business processes, the processes that the technologies are intended to support and enable. At the technology level, this translates to applications. In other words, it is important that automation be application-aware and application-specific.

A recent *Computer Technology Review* article on managed availability echoes this theme (CTR, 11/2004, p. 29). As shown in the figure, technologies for high and continuous availability require worrying about more than just data—they require worrying about and actively managing the application that uses the data. Thus, supporting continuous availability for an Oracle-based transaction-processing system is different from supporting the same availability for a company's communications built on Microsoft Exchange. They may be built on nearly identical technologies, but at the highest level, and indeed the level at which automation is most critical, they must diverge.

Another way to look at this is to consider the difference between technologies and tools, on the one hand, and solutions on the other. General technologies and tools are valuable and important in enabling solutions, but they themselves are not solutions and, by their nature, can easily contribute to complexity rather than reduce it. It is vital that IT vendors take the next step by integrating tools and technologies into real solutions built to support business-critical applications.

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INTEGRATED ONLINE VALIDATION AND TESTING

To repeat the point above, most of the complexity in today's IT environment is generated by the myriad interactions of different applications and infrastructure components. Unfortunately, it is often impossible for vendors to exhaustively test all potential interactions within the operating environment. Standards to govern interactions can sometimes help, but they cannot eliminate the problem—to do so they would have to restrict interactions so rigidly as to eliminate any real flexibility—a price that is much too high.

There is hope in a different approach, however. While it may be impossible to test all possible interactions before a product is shipped, it is certainly possible to integrate validation and testing functions that can be used in the actual operating environment. There are two approaches that IT vendors may use to achieve this.

The first is assumption validation. Whenever an IT component interacts with other components, it does so on the basis of certain assumptions. For example, it must assume that it is able to connect, that communication protocols are shared, and that it has the proper authority. It also probably makes assumptions about the state of the other system, for example, that certain processes are running or runnable, or that it has access to certain data. In many cases, individual assumptions may be validated at the point where they are relevant, but there is significant value in listing and verifying as a group the entire set of assumptions relevant to common or critical actions. Such validations should be carried out immediately prior to attempting an action, and may also be performed proactively at periodic intervals in advance.

In the end, of course, the only way to truly verify that a system works is to see it work—it must actually be tested. Thus, the second major effort required of IT vendors is the integration of support for all levels of testing, from individual components to the entire system. In this case it is even more emphatically true that integrated testing must be appli-

cation-oriented. Consider a high availability solution for a database, say Microsoft SQL, in which a geographically remote backup server is established to take over the function of the production server in the event of a disaster leading to loss of the entire primary site. It is not enough to verify that the bits and bytes at the two sites are the same. To ensure that the backup server and site are able to carry out their functions, it is necessary to test that the data are valid, that the application is correctly functioning, and that the failover works as designed. Testing these capabilities without integrated support from the vendor is typically quite disruptive and, hence, very expensive and difficult.

In other words, testing capability—in the operating environment—should be considered an integral part of any IT product that has significant interaction with and dependency on its environment.

THE RESPONSIBILITY OF MANAGEMENT AND IT ORGANIZATIONS

This paper has focused on what IT vendors must do to address growing management complexity in enterprise IT environments. They cannot do it by themselves, however. There is a parallel responsibility for users and purchasers of IT to support vendors' efforts by ensuring that they are actually accomplishing the task. How? Primarily by continuing to explicitly tie enterprise investment in IT to the business value it provides. This means tracking the real costs of IT infrastructure, including management and testing, and tracking real returns, including the cost savings and productivity gains from products that implement improvements like those discussed here. Just as the demands of IT users drove a shift toward open systems for more flexible and cost-effective solutions, so too is pressure from the IT user community critical in ensuring that vendors continue to help create value in an increasingly complex and urgent business environment.

Eric Jackson has nearly 20 years experience in the development and commercialization of advanced software technology.

Jackson is currently co-founder and CEO of Class VI Software, which provides software tools for new venture risk mitigation. In 2004 and 2005, he served as XOsoft's vice president responsible for product strategy and management. Prior to that, he was a co-founder of Ibrix, a high-performance file system company. He also founded and continues as president of DeepWeave, an advisory company providing services for technology commercialization, business strategy, and strategic product development.

Mr. Jackson is the inventor of several new technologies, including the Ibrix distributed file system and innovative techniques for automated computer chip design optimization. He has made significant contributions in a variety of fields, including distributed storage and file systems, automated computer chip design, high performance parallel computing, and the simulation and understanding of turbulent flow phenomena. He has numerous publications in scientific journals, including Nature, Physical Review, Physical Review Letters, and Proceedings of the Royal Society of London.