

REAL WORLD CASE

1

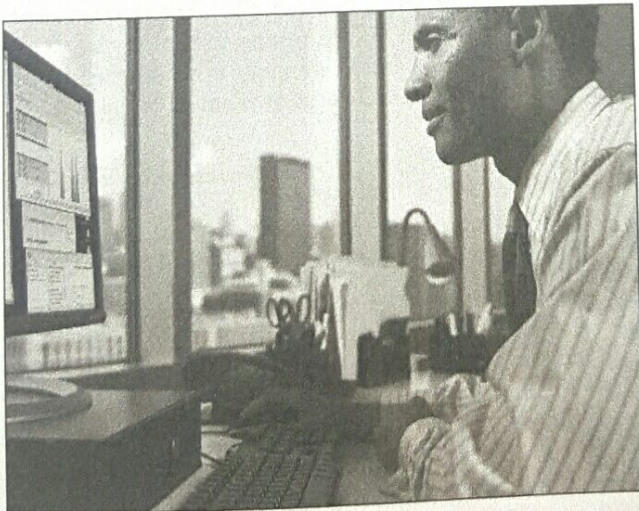
Microsoft, SiCortex, and Others: How Virtualization Helps Software Developers

Virtualization's big push to fame was arguably kick-started by VMware's Workstation product, which allowed individual users to run a bunch of operating systems (OS), versions, or instances (similar to multiple application windows) instead of having a one-at-a-time multi-boot environment. In many companies, virtualization arrived with developers first using the technology quietly to do testing and development, then introducing the virtualization tools to IT executives.

Although computer virtualization today fuels many production environments (e.g., servers, desktop infrastructures, and as a provisioning tool), virtualization is also used by a still-growing number of software developers. For starters, they use virtualization tools to provide a range of target environments for development and testing (such as different operating systems, OS versions, and browsers), and also to provision/reprovision configuration instances quickly and easily.

Mark Friedman, a senior software architect, works in Microsoft's Developer Division, where upwards of 3,000 people create Visual Studio and the .NET Framework. Friedman himself works mainly on the performance tools that ship with Microsoft's Visual Studio Team System. "About two-thirds of the people in my division are in development and testing—and most of these developers and testers are using system virtualization (via Microsoft's Hyper-V technology) as one of their key productivity tools," says Friedman, who is also a board director of The Computer Measurement Group.

FIGURE 12.1



Virtualization technology simplifies the life of software developers and testers.

One key advantage is virtualization's ability to set apart an unstable environment, which is something any developer expects in early phases of application design. As the Microsoft tools are developed, says Friedman, testing early versions may destabilize a developer's entire computing environment.

"That's the nature of the beast," he says. "Almost anything except the simplest desktop application can crash the system. I often tell my developers that if they aren't crashing the system regularly, they are not trying hard enough. We appreciate virtualization technologies, because they save time, and let our developers spend more of their time on the challenging stuff, not the mundane and extremely time-consuming aspects of prepping test environments."

Like other virtualization tools, Microsoft Hyper-V lets users "snapshot" the system at a "last-known good version." "We create a rollback that allows us to restore the system to that previous good state within minutes," Friedman says. "The alternative is having to re-image the computer or rebuild the environment, which can take hours," says Friedman. "This is a tremendous timesaver."

Friedman's group also makes extensive use of virtualization and virtual machine images in quality assurance (QA) testing. "Once you get past unit testing by the developers, we like to talk about the test matrix—what versions of the OS does it run on, for example," he says. "Then we need to test against both the 32-bit or 64-bit versions of each. Using Virtual Machine (VM) images is the fastest, cheapest, most flexible way to maintain a variety of testing environments. In our QA labs, we are doing this all the time; we do a lot of automated testing, so we stockpile these images as VMs, and point our test suite at them. It's invaluable. We save so much time you wouldn't believe it."

The ability to snapshot, and restore a working image within minutes, rather than wait hours for a rebuilt system, is particularly important. "You're often looking at bugs where you have to spend a day or two to set up the environment just to reproduce a bug. so the time you spend having to rebuild again and again—that's a time waster," says Friedman. "That is loss of productivity."

For example, when a bug causes a system crash, the developer has to work backward to identify the point where the system crashed. "People often initially set breakpoints too far into the process and the system crashes again. Since a developer can easily be crashing the system several times a day, being able to restore quickly and then re-run the debugging session while the problem is still fresh in their minds is a great benefit," Friedman says. "When you're troubleshooting a complicated bug, it's good to stay in that groove."

Virtualization is a great boon to iterative testing, developers say. "We have lots of test systems for use by our developers—each of which needs its own x86 control system. Rather than get a lot of PCs, even whatever's cheapest, we're using virtualization to create VMs which then 'attach' to the

484 • Module IV / Development Processes

external cluster boards,” says Adam Moskowitz, senior software engineer at SiCortex, which builds and sells a range of energy-efficient computers.

A primary benefit of virtualizing the control systems, says Moskowitz, is ease of testing. “Want an experimental system? Clone a standard VM and away you go,” he says. The toolset is also valuable because of its ease of configuration; developers can build a VM with the latest software once, then clone it as many times as needed.

Mike Brescia, who works for a company making real-time environmental data recording, and retrieval, says, “In addition to offering its system as a virtual appliance, our company’s developers use virtualization to put up different test environments, e.g. Windows and Linux, on fewer hardware boxes.” Cloning a clean computer system for testing purposes is much easier than copying a disk image and using Clonezilla, Brescia says. “Running VM does not require tearing down and wiping a complete system; we only need to be careful not to overload resources on the host machine,” adds Brescia.

The 15 Web developers at design and marketing firm Eli Kirk have to cater to a number of Web browsers and operating systems, says Connor Boyack, Eli Kirk’s senior web developer, who uses Parallels version 4 on Mac OS X Leopard, and runs VMs of Windows XP, OpenSUSE 11, and Windows 7 Beta.

“Creating functional and aesthetically identical sites requires a great deal of browser testing, which makes virtualization a must,” says Boyack. “Virtualization allows me to use multiple operating systems and multiple browsers all collaboratively and seamlessly.”

There’s a huge advantage in the ability to test a dozen different scenarios simultaneously to ensure a consistent user experience, agrees Nick Gauthier, a developer at SmartLogic Solutions. “Another advantage is being able to boot up a specific version and browser when a client has a complaint. We no longer have to say ‘Well, I don’t run that browser, I’m on Linux,’ now we can say, ‘One moment please. Ah, I see the problem and I’m fixing it now.’”

“We use virtualization to test our software on the platforms and applications we support (for QA), and to replicate customer environments when there are customer issues for support,” says Eric Floehr, CTO at 3X Systems, a start-up that developed and sells a remote backup appliance. “Virtualization

allows us to quickly bring up and tear down environments, and allows us to do so with a minimum amount of physical hardware.” The ability to test against a large number of platforms and environments with a minimum of capital outlay is especially important in a small start-up company. Plus, “It greatly improves the quality and reliability of our product,” adds Floehr.

There are, developers acknowledge, parts of the process where virtualization can’t help.

“One area where virtualization doesn’t help is in stress testing our product, which is a network-based backup appliance,” notes 3X’s Floehr. “While we could test 10 simultaneous clients virtually, it isn’t a true stress test because the 10 clients are only going through, say, four physical CPUs and two NICs, which are constraints that would not exist if they were 10 physical clients in the real world.”

“For load testing or scaling, you have to run on the raw hardware, the physical machine,” says Microsoft’s Mark Friedman. “Performance characteristics, unless you expect to deploy on a VM, are very different. And the same applies to the state of the art for performance measurements; you can’t trust the [Physical Machines] you get on a VM currently.” Although, Friedman notes, over time he expects this to be fixed.

Also, says Friedman, the para-virtualization approach used by the virtualization industry can and does change some underlying aspects of the OS, notably the OS drivers.

“So if you have a dependency on specific drivers or hardware environment, that will be impacted. For example, there’s a virtual NIC, and there’s a specific driver. The driver is ‘virtualization-aware.’ You have to understand that if you need testing against a native set of drivers, you won’t see that within a VM. So this impacts people doing driver development, but not web developers, etc.”

Despite those quibbles, virtualization already gives developers real benefits. “Virtualization makes our developers more productive once they learn to work with the technology,” says Microsoft’s Friedman. “It allows them to spend more of their time in coding, testing and debugging. It eliminates a lot of time and delay spent in set-up and preparation, which isn’t where we want them to be spending the bulk of their time.”

Source: Adapted from Daniel Dern, “How Virtualization Improves Software Development,” *CIO.com*, February 11, 2009.

CASE STUDY QUESTIONS

1. How does virtualization work? In your own words, describe what you understand about the virtualization process as depicted in the case.
2. In software development and testing, where does virtualization help, and where does it not help? Why?
3. What are the business benefits of implementing virtualization technologies in software development? Classify them into those that enhance the effectiveness and the efficiency of the development and testing process.

REAL WORLD ACTIVITIES

1. Go online and research other users of virtualization technology (backup and disaster recovery being one of those). How do those differ from the ones described in the case? How are they similar? Prepare a report to summarize your findings.
2. If virtualization technology were to eventually allow end users to run any environment of their choice in the same device, does that mean the choice of computing platform (desktop, notebook, smartphone; Windows, Linux, Mac OS) becomes irrelevant? Break into small groups to discuss this issue.

504 • Module IV / Development Processes

REAL WORLD
CASE

2

JetBlue Airways, WestJet Airlines,
and Others: The Difficult Path to
Software Upgrades

Few things in the airline business are more daunting than upgrading to a new reservations system. Do it well and customers are none the wiser; mess it up and a carrier risks losing customers and tarnishing its brand. Discount carriers JetBlue Airways Corp. and WestJet Airlines Ltd. both recently switched reservations systems. The differing outcomes are a reminder of how the implementation of new technology can be just as crucial as the technology itself.

Despite months of planning, when WestJet flipped the switch on its new system, its Web site crashed repeatedly and its call center was overwhelmed. It took months to resolve all the issues. JetBlue, which later upgraded to the same software, smoothed its transition by building a backup Web site and hiring 500 temporary call-center workers.

Reservations are at the heart of a customer's relationship with an airline. So messing with the reservations system "is certainly not for the faint of heart," says Rick Zeni, a vice president of JetBlue who led the Forest Hills, N.Y., carrier through its transition.

Both WestJet and JetBlue previously used a system designed for start-up airlines with simpler needs. As the carriers grew, they needed more processing power to deal with increasing numbers of customers.

FIGURE 12.17



Major software upgrades can become make-or-break scenarios for companies today.

Source: © Ryan McVay/Getty Images.

They also wanted additional functions, such as the ability to link their prices and seat inventories to other airlines with whom they might wish to cooperate.

After studying alternatives, WestJet and JetBlue independently selected a system offered by Sabre Holdings Corp., a provider of such technology to 300 airlines and owner of Travelocity and other online travel agencies. JetBlue says the new system cost about \$40 million, including \$25 million in capital spending and \$15 million in one-time operating expenses. WestJet did not disclose its costs.

The system sells seats and collects passenger payments but it also controls much of the passenger experience: shopping on the airline's Web site; interacting with reservation agents; using airport kiosks; selecting seats; checking bags; boarding at the gate; rebooking and getting refunds for cancellations. "It has a very big circle of influence and has to integrate with other systems in the airline," says Steve Clamptt, an executive at Sabre Airline Solutions division. "It's as visible a technology upgrade as in almost any industry."

WestJet, which has 88 planes and is Canada's second-largest airline, switched to Sabre in October 2009 after it had shifted to a lighter winter schedule and canceled some flights. A big challenge was the overnight transition of 840,000 files—transactions of customers who already had purchased flights—from WestJet's old reservations server in Calgary to Sabre's servers in Tulsa, Oklahoma. It didn't go well, says Bob Cummings, WestJet's executive vice president of marketing and sales, because the migration required WestJet agents to go through complex steps to process the data.

Making matters worse, WestJet didn't reduce the number of passengers on the flights operating after the cutover, nor did it tell customers of its upgrade plans until the day of the switch. "We didn't want to telegraph dates so a competitor would put on a big fare sale," Mr. Cummings says. WestJet's customer loyalty scores tumbled as a result of long waits and booking difficulties. The airline sent apology letters, offered flight credits to some customers, and a month later bolstered its call center with temporary staffers in India.

"We were in pretty good shape in mid-January from a service perspective," Mr. Cummings says. "But this is a three- to six-month recovery process." He says WestJet remains enthusiastic about the new system's potential, which will allow the airline to fulfill its plans to begin cooperating with U.S. and international airlines.

JetBlue, which has 151 aircraft, had the benefit of observing WestJet's transition, at WestJet's invitation. JetBlue decided to make its switch on a Friday night because Saturday traffic tends to be low. It trimmed its schedule that January weekend and sold abnormally low numbers of seats on remaining flights. With WestJet's crashing Web site in mind, JetBlue developed a backup site that it used twice for a few hours.

JetBlue also contracted for 500 outside reservations agents. After the switch, in which 900,000 passenger records were moved to Tulsa from Minneapolis, JetBlue routed basic calls to

the temporary workers, leaving its own call staff to tackle more complex tasks. The extra agents stayed in place for two months, “one of the wisest investments we made,” Zeni says.

There were still glitches. Call wait times increased, and not all of the airport kiosks and ticket printers came online right away. JetBlue still must add some booking functions in the future. But having Sabre, says JetBlue CEO Dave Barger, was an important factor in the airline’s recent decision to co-operate on some routes in and out of Boston and New York with AMR Corp.’s American Airlines.

The word “upgrade” has long been a virtual bogeyman for SAP customers, given the historical pain, time, and cost of moving to a new version of the vendor’s ERP software. For some time, SAP has been trying to entice users onto the modern ECC 6.0 through its “enhancement pack” program, which promises to let users add new features without the pain of a full technical upgrade. Customers can’t take advantage of the packs until they move to 6.0.

For legacy customers who don’t yet wish to upgrade, this means an increase in cost for vendor support, a jump to a third-party maintenance provider—which has its own uncertainties, given ongoing high-profile lawsuits—or a decision to go with no paid support at all. The pack strategy is therefore crucial for SAP, which needs to preserve lucrative maintenance revenue while making life easier on customers and stemming defections to other options, particularly SaaS (software as a service) applications, where upgrades are handled by the vendor.

SAP’s strategy with the packs “makes a lot of sense,” says Tim Ferguson, CIO at Northern Kentucky University. “Relatively speaking, compared to previous ways that SAP did this, they’re very easy to install.” NKU has served as a beta tester for the packs, which helped the school influence SAP to add key features it desired.

While NKU’s core SAP functions for billing, payroll, and other areas are fairly stable, the systems that touch students each day must evolve regularly, Ferguson says. One of the packs provided a new Web service that allows students to register for classes through their iPhones, for example. “The students that are coming out this generation, they expect different types of services. We have to change to meet those needs,” says Ferguson.

SAP’s pack strategy is apparently pleasing some customers. But it still involves some work. “I’ve mostly heard good things,” says Jon Reed, an independent analyst who closely

tracks SAP. “But they’re not quite as painless as SAP’s marketing sometimes presented it.”

System testing remains a crucial factor, Reed says. “Things break during an on-premise implementation and there’s a preferred method of handling that, including sand-boxing and testing, so when you pull that lever there are no problems. Customers still need to anticipate how it might break their system.”

But SourceGas, a U.S. natural gas utility, had only one issue when installing the enhancement packs, specifically a problem with the “flexible real estate” functionality in SAP, says Michael Catterall, director of enterprise solutions. The company uses that module to manage information regarding the many property easements and rights-of-way it maintains for its infrastructure around the country.

“When we brought up enhancement pack 4, because of how we had it configured, we kind of broke it a little bit,” he says.

SourceGas plans to “keep watching the enhancement packs as they are coming out,” Catterall says. “First, we’re looking at where we can improve and get more out of modules we put in.”

Meanwhile, there is the substantial task of getting to ECC 6.0 in the first place.

Upgrade expenses can amount to 50 to 85 percent of the original implementation costs, with the price tag varying, depending on factors like the number of integration points and customizations, according to analyst Ray Wang, partner with Altimeter Group.

“Ultimately, upgrading makes sense for R/3 customers who are still committed to SAP and want new functionality provided in the packs,” says Wang. But those customers potentially have other options these days, in the form of third-party maintenance from companies such as Rimini Street, as well as SaaS applications. Meanwhile, on-demand products from vendors such as Workday, which makes human-resources software, and CRM (customer relationship management) specialist Salesforce.com are being used by some legacy SAP customers, who are finding that integrating them back to the core ERP system isn’t overly difficult, Wang says.

Source: Adapted from Susan Carey, “Two Paths to Software Upgrade,” *Wall Street Journal*, April 13, 2010; and Chris Kanaracus, “SAP Users: Upgrading Has Its Benefits,” *CIO.com*, April 9, 2010.

CASE STUDY QUESTIONS

1. In the case, both airlines upgraded to the same application but approached the upgrade process differently. What were those differences, and how much impact did they have on the outcome of the project?
2. What precautions did the organizations in the case take to prevent software upgrade problems? To what extent do you believe those helped?
3. SAP customers have the choice between upgrading to the most recent version of the application suite or integrating third-party products into their existing infrastructure. What are the advantages and disadvantages of each alternative?

REAL WORLD ACTIVITIES

1. Why are ERP upgrades so complex and expensive? What role does ERP customization, if any, play in this process? Go online and research other examples discussing ERP upgrades. Can you discern a pattern in what seems to be the major cost drivers of the upgrade process?
2. Place yourself in the position of a WestJet or JetBlue customer while the upgrading was being implemented. What, if anything, would you have done differently had the companies told you that a major software upgrade would be happening soon? Should they have told you? Break into small groups with your classmates and discuss these questions.

522 • Module IV / Development Processes

REAL WORLD
CASE

3

PayPal: Going Global All Languages at a Time

When you're a global company that keeps expanding into new countries, how do you keep all of your consumer sites updated in the local language—without spending a ton of time and money?

PayPal realized five years ago that if it didn't solve this problem it would hinder the e-commerce payment company's ability to grow, says Matthew Mengerink, the company's vice president of core technologies; his IT responsibilities include PayPal's architecture and payment system infrastructure. Today, PayPal has re-architected the software code for its site to allow simultaneous refreshes for 15 locales ranging from France to Poland. In the development community, they call this unusual achievement "polylingual simultaneous shipping" or "SimShip."

"This is a big problem that's been around a long time," says Ron Rogowski, a principal analyst for Forrester Research, who specializes in globalization issues. "For the most part, companies really do a poor job localizing content," he says, noting that technology solutions in this area aren't plentiful, and companies also must conquer organizational battles over who controls what content. "Companies would like to manage their translations better," Rogowski says, "to realize internal and external cost savings. But the real benefit is the potential for revenue growth, the ability to roll into markets quickly."

That ability today translates into a large portion of PayPal's bottom line: For PayPal, international business now represents 44 percent of net revenue, which was \$582 million for the first quarter of 2008, a 32 percent increase year-over-year. As of late 2007, PayPal handled about \$1,806 in payment volume per second; the company's re-architected code played a key role in this increase.

PayPal, now part of online auction giant eBay, had to go global to support customer desire, Mengerink says. People outside of the United States were demanding that eBay let them use PayPal (the primary purchase mechanism on eBay) and that PayPal be presented to them as seamlessly as it had been presented in English, he says. The company had to do more than present a stilted translation of English into, say, French or German, he adds.

"Imagine you're going into a bank and you want to speak French," Mengerink says. "The teller can speak French. But that's not enough. You want to feel you're in France. You want to see the French flag on the wall. Especially in the banking industry, it was very important to express something that people trust in such a way that it is natural and native for them," he says.

Traditionally, companies solve the localization issue by working with third-party translation companies, whose staffers convert an English-based site into multiple languages, says Mengerink. The problem: "If you can't send them the smallest amount of text, it gets fantastically expensive," Mengerink says. "Here at PayPal you have a full site experi-

ence, you have to translate it, and we're an Internet company; we update the site every six weeks. How do you not slow the company down with the process of translation?"

PayPal's decision to custom-develop a solution is unusual and interesting. Few software vendors compete in the translation tools arena. Also, many companies can't even overcome the organizational hurdles related to translation. "There's a whole organizational issue that has to be looked at who's in charge of what," says Rogowski.

For example, he notes, a consumer electronics company may not even have similar-looking content, never mind identical content, on Web sites in multiple countries. "A lot of times Web content springs up without any plan for centralization," he says. "Before your company can translate all of its sites efficiently, you may get embroiled in organizational messes," Rogowski warns, which is why some companies are tackling the problem silo by silo.

Not PayPal. Five years ago, Mengerink and a team of localization experts inside of IT began their project to fix the problem in a very centralized way. Often, Mengerink says, companies facing this problem try to cut and paste code, and then translate it into different languages; this can lead to trouble because it's not simple to keep compressing and unifying the code. "It's far easier to manipulate text than code, he says.

PayPal decided that it had to re-architect its code to accommodate the language localization issue—purely for reasons of business speed. He says, "If you get the architecture right, you can get into new countries faster." No commercial tools existed that fit the bill, Mengerink says, so all the development was done in-house with a small IT team; PayPal will not disclose the exact size of the team or the cost metrics.

"There's this notion of a country code and a language code," Mengerink says. "Your software has to understand two things: *What country am I in and what language is being read?* This is extremely important because there are countries outside the United States where customers cannot imagine not having multiple languages, Canada, for example. The first thing we said is put both codes everywhere," Mengerink says. Then his developers had to create a code base with much more flexibility than the original; it had to convince the software, for instance, that strings of information such as e-mail addresses, customer support phone numbers, and time of day would change depending on the country code.

The second key to the project's success for PayPal: Ghassan Haddad, PayPal's director of localization, and the development team created a tool that color codes text in the software code base to note newly added strings of text that will need translating. "People just program as if it's in English, Mengerink says. "At the same time, the software extracts the new pieces." Then PayPal can send only the new pieces, instead of whole paragraphs, to the translation house. "This can take 5, 10 days depending on the size of the

release," Mengerink says. "Then off we go to the races, releasing simultaneously in all locales."

So what's the next challenge for Mengerink and his developer team at PayPal? "We got very good at managing content with engineering," he says. "Now the question is, how we put that content management in the hands of business. They want to change it themselves without an intermediary. The business folks are saying 'we respect you but pretty please can we do it ourselves?' That's a challenge, he says, given that the development toolset will continue to grow.

By the way, PayPal isn't looking to license the technology it developed. "Our tools are built for PayPal, Mengerink says. "We're encouraging others to build it for themselves." Although his team worked primarily in HTML, the programming language is not the important choice, he says. "Think about the methodology. That's a really critical part. We built custom tools and they literally change every six months. This is a nascent industry. When you start looking at the publishing tools and content tools, most are appropriate for preview and publish," he says.

That's a simpler model than what PayPal does, for example, frequently linking new content with new features, he notes. "There was a lot of fear, a lot of people saying, 'Why aren't we being industry standard?' Leverage what you can, but you have to be good at creating your own tools. In the beginning, there was a lot of healthy skepticism, even internally,"

Mengerink says. "Some of your execs and developers will note that their last company tried to do simultaneous shipping and failed," he says. "Some people in the developer community still don't think it's possible," he adds. "Once it was done, we saw that it's not just manageable, it's a core advantage."

The sooner your company can start working on a SimShip project, the better: "Once you get too big, you can't afford the interrupt to the cycle," he notes.

"Very early on, you have to create the generic structures for the code," he says. "Build every next thing correct."

What's the bottom line for PayPal from Mengerink's team's work? "Today, we have 15 languages, 17 currencies, 190 markets," he says. "Our code base has grown a lot. All of the new code is being built using the right structure. You have to build internationalized." PayPal's re-architected code base now keeps e-commerce humming as the company continues to expand: PayPal's net total payment volume for 2007, the total value of transactions, was \$47 billion, a gain of 33 percent over the previous year.

To put that in context, PayPal's net total payment volume for fourth quarter 2007, \$14 billion, represented almost 12 percent of U.S. e-commerce, and almost 8 percent of global e-commerce.

Source: Adapted from Laurianne McLaughlin, "How PayPal Keeps E-Commerce Humming in 15 Languages at Once," *CIO Magazine*, March 14, 2008.

CASE STUDY QUESTIONS

1. One of the challenges that PayPal faces now that it has managed to overcome the polylingual obstacle is finding the best way to put this functionality in the hands of the business, so that they do not have to go through IT each time. How do you balance this need for responsiveness and flexibility versus IT's need to keep some degree of control to make sure everything keeps working with everything else? Provide some recommendations to managers who find themselves in this situation.
2. PayPal opted to deviate from industry standards and build its own custom technology that would better suit its needs. When is it a good idea for companies to take this alternative? What issues factor into that decision. Provide a discussion and some examples.
3. Although the new system has been quite successful, PayPal has chosen not to license this technology to others, forgoing a potentially important revenue stream given the lack of good solutions to this problem. Why do you think PayPal chose not to sell this technology? Do you really think this can be made into a strategic advantage over their competitors? How easy would it be for their competitors to imitate this accomplishment?

REAL WORLD ACTIVITIES

1. Choose two or three companies with global operations that interest you and visit their Web sites for countries other than the United States. Even if you are not familiar with the language, do the Web sites have the same look and feel of the U.S. site? In which ways are they similar, and in which ways are they different? If you did not know, would you have guessed it was the same company? Prepare a presentation with screenshots to share your findings with the rest of the class.
2. Although PayPal opted for a centralized approach to keep consistency across Web site appearance and content, other companies let both of these vary for each of the countries in which they operate. When would you use one or the other approach? Would it depend on the company, products offered, markets, countries, or on another factor? Break into small groups with your classmates to discuss these issues.

REAL WORLD CASE

4

Queen's Medical Center, National Public Radio, Worldspan, and Others: Your IT Project Has Been Backlogged

Everyone at The Queen's Medical Center in Honolulu wants some shiny new piece of technology. Doctors and nurses who have seen a new pharmacy management system demonstrated at a recent conference think the hospital should have it. An administrator wants his department to have PDAs for wireless access to e-mail. Someone else wants a hospitalwide dietary management system but doesn't have the budget to fund it. All of these people want CIO and vice president of IT Ken Kudla to get it all for them.

Yet before he even thinks about eking new systems out of his \$13 million annual operating budget, Kudla has to contend with the 30 projects he has going on right now. He's in the middle of upgrading the hospital's network and deploying an antispam management system. He's due to replace the seven different systems that make up his hospital information system. Meanwhile, he's trying to finish a document imaging project begun back in 2002, for which funding has been scarce. "CIOs are being bombarded," he says. "There's a pent-up demand for things."

Kudla isn't alone. According to "The State of the CIO 2006," an annual survey by CIO Magazine, demand for IT is back with a vengeance. It's almost like the late 1990s, except that what's missing now is the money, staff, and late-night takeout to deal with today's demand. In turn, the requests for IT projects are piling up. CIOs say that managing this application backlog is the number-one barrier to their job effectiveness today, regardless of industry or company size.

How CIOs manage this burgeoning demand has a direct impact on whether or not business leaders view IT as responsive to their needs. "Any CIO who sets an expectation that something will get done—and it doesn't—will be committing career suicide," says Bob Holstein, CIO at National Public Radio. The challenge for CIOs, then, is to ensure that projects already in the queue are aligned with ever-changing business priorities, to manage business-side expectations, and to control new sources of application demand from today's more sophisticated users. "One way you can interpret this problem is that users have a lot more appreciation of what's possible," says Holstein, "Or that the technology world has moved very quickly, and those business units want more, and they want it faster."

Whatever the source of the application backlog, CIOs should follow this cardinal rule. Don't complain; nobody—especially your CEO—likes a whiner. "I tell my staff, 'You can't be a victim,'" says Susan Powers, CIO of Worldspan. "I don't accept the victim mentality."

To some extent, backlogs have always been around because users have always cried for the latest applications. Ten years ago, during the Internet buildout, everyone got what they wanted. Then Y2K put the brakes on many less-critical projects. "Perhaps that started some of the backlog," Kudla says. Then came the dot.com bust, 9/11, and bad times for many companies.

Still, application demand remained. There may have been less development during the years when companies were focused on survival and keeping costs down, but users "still had their wish lists," says Stephen Rood, CIO of Strategic Technology, an IT consulting firm that advises small and midsize companies. Now, those needs are out in the open again, fueling CIOs' concerns about project backlogs.

How one defines and deals with any backlog boils down to two factors: the source of the demand and the project's stage of development. Holstein identifies two different types of backlogs: a backlog of desire (applications that users are yearning for) and a backlog of commitment (projects that are approved but not started). CIOs need to pay attention to both. If internal customers can't get an IT project on a CIO's radar screen, "they perceive there's a backlog because the IT shop can't do what they want," Holstein says.

When projects have been promised but not delivered, he says, "expectations have been set and not fulfilled." It may be that an IT organization hasn't planned properly, or that managers aren't tracking projects well, or that developers are taking time to assess the ins and outs of a project. Whatever the reason, users have not gotten what they were promised.

One way to look at the backlog is to consider the whole spectrum of projects that IT is currently working on but has not finished, in addition to the ones ready to go. Powers has a list of 100 projects at Worldspan that have funding and that IT has started. Outside the top 100 are projects that are on deck. "When you finish [project] three, you bring in [project] 101," she explains. If she doesn't have the right staff with the right skills available for the next project on the list, she may skip to another. "We tend to have a backlog of about one year's worth of work. But because we prioritize every two weeks, some items never make it to the active list," Powers says.

No matter how good CIOs are at keeping a grip on their backlog, ever-shifting business priorities always threaten to shake up the IT agenda. One of the toughest tasks for CIOs is to align the jumble of projects vying for resources with the company's strategic needs. In a fast-paced business climate, new projects—especially those that come from the top floor—scream for attention. "They can also come about quite innocently," Holstein says, due to external factors that cause the business climate to shift. "What was a top priority becomes priority number 10."

A major contributor to the application backlog has been compliance-related projects, such as investments for Sarbanes-Oxley and HIPAA regulations. IT has to complete those projects by set dates, and in many cases, these infrastructure projects require substantial IT resources. Invariably, notes Holstein, implementing compliance projects pushes others farther down the to-do list. At Worldspan, Powers says, compliance-related projects trumped even a project that aimed to improve how the company prioritizes its IT projects.

The backlog generated by a new corporate agenda is worse for the CIO, who has to scramble to execute a decision she wasn't consulted about. Rood has seen it happen: A CEO and COO decide that they want a CRM system. When the CEO tells the CIO about it, the CIO is clueless as to why the project is necessary. The new project sends the IT department scrambling to jump-start the CRM project and pushes everything else to the side. "That will upset what the priorities are in terms of technology needs for the entire organization," observes Rood.

At The Queen's Medical Center, Kudla wages a constant battle to ensure that all of his constituents know that every IT project has to be in sync with the center's strategic initiatives. As a member of the senior management team, he considers it his most important task to make sure his peers are aware of and agree to the center's priorities. Everyone, from senior executives on down, should know that a pharmacy management system is important for the hospital; they should also understand that rolling out the wireless PDAs for e-mail is "low on my food chain."

Rood, who's been in the IT field for 26 years, says he learned this lesson early in his career. "When you're new, everyone wants to shake your hand, welcome you on board, take you out to lunch, and at the end of the day you've got 50 things from everyone to do," he recalls. "It all adds up to a backlog, and then you're going to be crying to the CEO: 'I can't do this.'" At that point, he says, CIOs either have to

take the hit and not deliver what they promised (which could get them fired), "enter a crash mode, where they push their staff to the point of exhaustion to complete a project," or spend extra on contract labor to meet a deadline. "In any case, it becomes a no-win situation," he says.

Powers gets around the problem of not wanting to say no by sending the message that IT is a resource to be managed like any other; her organization can do anything given enough time and money. Then the onus is on users to justify and manage their requests through Worldspan's project justification process.

Kudla of The Queen's Medical Center expects that once he upgrades the hospital's seven major systems, new demand will surface. "Once the system is stabilized and users realize the potential of the new system, I anticipate a demand for new functionality," he says.

Kudla anticipates requests for, among other things, automating the capture of data from patient monitors and expansion of wireless access on the hospital campus. In other words, the application backlog isn't a problem one solves, it's a condition one lives with as technology matures and expands into new areas of the business, enabling growth and greater efficiency.

"Of course, working harder and more funding help," concludes Worldspan's Powers.

Source: Adapted from Thomas Wailgum, "The Number-One Problem of CIOs: The Project Backlog," *CIO Magazine*, December 11, 2007.

CASE STUDY QUESTIONS

1. The case notes that a changing environment or business priorities can render an ongoing project obsolete even before it has been completed. What alternatives do CIOs who find themselves in this situation have with respect to dealing with the troubled project? Would you go ahead and finish it, or scrap it altogether? How would you justify either position?
2. Do you agree with the statement: "Application backlog is not a problem one solves; it's a condition one lives with"? Why or why not? To the extent that it is true, how can IT executives manage things differently to make this situation more approachable? Provide some specific suggestions.
3. Susan Powers at Worldspan says she addresses the backlog problem by positioning her IT organization as a resource that should be used and managed in the most effective manner, like any other resource a company may have. What do you think of this approach? Is IT really like any other resource?
4. In which way is IT different from other areas of a company like marketing or finance?

REAL WORLD ACTIVITIES

1. Go online and search the Internet to discover how typical the experiences reported in the case are for other companies in different industries. How are the ones you discover addressing these issues? How similar or different are those strategies with the ones discussed in the case? Prepare a report to summarize your findings.
2. Which of the following strategies do you think IT executives should adopt to improve their current situation: reject new projects, attempt to increase staff and funding, prioritize often, or all of the above? Break into small groups with your classmates to discuss these and other strategies you may have thought of; compare and contrast advantages and disadvantages of each.