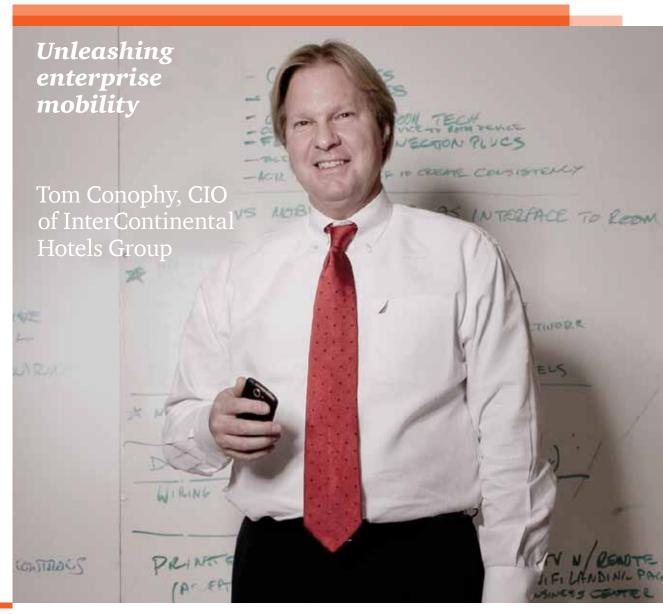
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Issue 1 2011 Handheld power for enterprise clout

20 Mobile tech from peril to promise

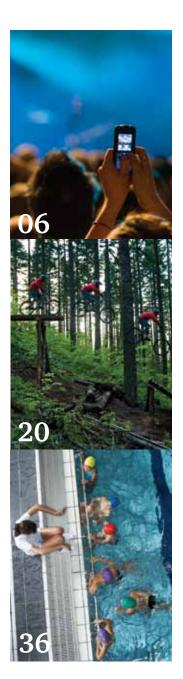
Wielding CIO mobile influence







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Subtext >

Cybernetic era A change in individuals caused by an information

system that is always present and accessible, in which the individuals and the system begin

to blend.

Autonomy, mastery, and purpose (AMP)

Dan Pink's list of intrinsic motivating factors for employees in the 21st century, which contrasts with extrinsic motivating factors such as financial

incentives that were more effective in the previous century.

Context-aware computing

Computing that benefits from human-assisted, sensor-rich mobile handhelds for timely location, personalization, and environmental input.

Client virtualization

On mobile devices, a runtime environment that mobile applications and their resources can operate in. In the case of thin-client virtualization, all the data resides on the server, and the mobile device

merely acts as a display.

Native app

An application developed to take advantage of the specific functionality and interfaces of a device's

operating system.

Message from the editor >

Tom DeGarmo, Principal & Technology Leader thomas.p.degarmo@us.pwc.com



To every thing there is a season. As this verse¹ poetically captures, matters that at one point in time seemed settled may at another time be open again for debate. When it comes to smart handhelds, this is one of those times.

Enterprises are accustomed to standardizing and controlling the devices their employees use. But the season is changing. The relationship of mobile devices to enterprises—more importantly, the relationship of mobile devices to individuals who also happen to be employees—is undergoing a fundamental transformation. More than any other factor, the rapid innovation in smart handhelds is responsible for this transformative development.

What does this new world look like? Some leading-edge companies are saying to new hires, "Bring your own smartphone; we'll support it." They're offering \$50 monthly subsidies and allowing employees to choose the data plan that works best for them. These companies say

they have figured out how to manage applications and information on employee-owned devices in a secure way.

How did we get here? And why would a company offer to support many different kinds of handhelds?

You might think this is just a case of being nice to Millennial employees (those born after 1980). If we don't let them have their way, we'll have to deal with a disgruntled staff, some say.

The reality is far more interesting. Yes, Millennials are likely to be "digital natives" who have strong, even obsessive, attachments to the handhelds of their own choosing. But a broader industry trend is in play. Smarthandheld users now have more choice and hold the power of the cloud in each device. And that makes all the difference. When technology converges the way it has in the desktop and laptop domain, the opportunities for innovative and creative new uses of the technology are diminished. It is quite rational to standardize, control, and buy in bulk. There's no upside to flexibility when choices and capabilities are limited.

In a world of divergent choices, new capabilities, and a more mobile-sensitive Web, control has a big downside. It kills innovation.

What makes today's divergence even more important, though, is its cybernetic quality. It's the commingling of the human adjustment to engaging with information everywhere, at any time, with anyone, and the rapid innovation in mobile computing devices. This issue of the *Technology Forecast* examines the underpinnings of these twin disruptions in the business world. It suggests that companies that are stuck in control mode are being penny-wise and pound-foolish. The opportunity here isn't just to give the digital natives the shiny new gizmo they've been craving. Smart handhelds imply more opportunities for enterprises than might be obvious at first glance.

The article, "Turning handheld power into enterprise clout," on page 06 explores how enterprises can turn what has been a consumer trend in smart handhelds to their advantage. The first step here is to understand how the workforce is changing. What digital natives are doing with their handhelds and the information cloud they tap into represents a different collaboration model—a more interactive and information-rich path to productivity. They depend on personalized access to a cloud of relevant information. Rather than bucking this trend, business should embrace it.

"Mobile technology's journey from peril to promise" on page 20 details the ways that security for smart handhelds is improving. As information becomes more pervasive and easily accessible, the potential to mix enterprise and personal information increases. Control over corporate data on mobile handhelds is a major concern, but security models to manage this data are already established, and mobile device management software and major operating systems are evolving to embrace and extend those models. Some of the more innovative enterprises have taken advantage of the security that already exists and, seeing the potential for process and productivity improvement, have committed themselves to in-house mobile application development. For them and for others, now is the time to explore the new process improvement paradigm that's emerging in smarthandheld applications.

"How to exert leadership on enterprise mobility" on page 36 establishes that, as a first step, CIOs need to acknowledge that employees have their own IT capabilities now. Whether by conveying an understanding of the device choice options to the rest of the C-suite, establishing new governance approaches, or formulating new business process models, CIOs have ample opportunity to lead, especially considering the new power of smart handhelds connected to the cloud. Otherwise, someone else will.

This issue also includes interviews with four executives at companies on the leading edge of smart-handheld management and mobile application development:

- Tom Conophy of InterContinental Hotels Group places smart-handheld trends in the context of an innovative IT culture he's established and led.
- Todd Schofield of Standard Chartered outlines the bank's strategy for supporting smart handhelds and building an application development organization to support that strategy.
- Srini Koushik of Nationwide describes how to begin supporting employee-owned smart handhelds and the value of "bring your own device" from an insurer's point of view.
- Mark Pesce of FutureSt Consulting paints a big-picture view of how organizations can face the challenges of personal IT, as well as a view of the leading mobile application development trends.

Please visit pwc.com/techforecast to find these articles and other issues of the *Technology Forecast* online. If you would like to receive future issues of this quarterly publication as a PDF attachment, you can sign up at pwc.com/techforecast/subscribe.

We welcome your feedback and your ideas for future research and analysis topics to cover.

Tom DeGarmo, Principal Technology Leader



Turning handheld power into enterprise clout

The smartphones, tablets, and other handheld devices your employees already own are productivity drivers. Seize the opportunity.

By Bo Parker and Alan Morrison

D7, a construction consulting firm in Southern California, threw its hat in the ring when it heard that Box.net, a cloud storage provider, was seeking a partner to test business applications on the Apple iPad. Before long, about 20 field workers at D7 were using smart tablets to diagnose quality assurance issues on-site; to relay audio, documents, and digital photos; and to store and share the material via Box.net.

By using this approach, D7 has accomplished something that had previously eluded it: digital workflow from customer sites. In the past, workflow involved paper documents "that weren't very usable," says Aaron Levie, CEO of cloud collaboration company Box.net. Joseph Daniels, D7 president, says tasks that took a week or longer can now be done the same day. "That's what people want. They want it now or yesterday," he says. With a mobile digital workflow, the D7 team eliminated a major bottleneck.¹

This modest example illustrates several trends related to enterprise mobility that PwC has identified for this issue of the *Technology Forecast*. Among them:

- By using smart handhelds and the cloud, employees can improve business processes in ways they couldn't before.
- Consumer-grade tablets, smartphones, and supporting technologies are more powerful than ever and are now becoming secure and reliable enough for enterprise use.
- Applications don't need to be sophisticated to produce immediate business results.
- With the help of mobility, the knowledge economy is expanding to include more traditional industries.

Enterprise mobility is clearly a growing resource for enterprise agility, giving organizations access not only to standard cell phone communications, but also to wideranging collaboration capabilities at low cost. Many of the newest mobile applications are relatively simple, but the collaboration they enable is at a higher, more complex level, because it cuts across organizational boundaries. Yet this new resource presents a challenge unfamiliar to business executives who are accustomed to controlling enterprise technology: how do you take advantage of an asset that most of your employees already have in their pockets?

¹ Ian Hamilton, "Construction firm tests iPads: Company pairs cloud software with Apple tablet to try to boost productivity," The Orange County Register, July 16, 2010, Factiva Document OCR0000020100717e67g0001h; Mike Schramm, "Box.net's 20 iPads arrive at D7 Consulting," The Unofficial Apple Weblog (TUAW), http://www.tuaw.com/2010/07/08/box-net-ipads-arrive-at-d7-consulting/; PwC interview with Box.net Co Aaron Levie, August 18, 2010; and "Box.net's iPad campaign: Real-world tests," Box.net YouTube video, http://www.youtube.com/watch?v=Y2QZmzFZ1UM, accessed October 7, 2010.

The answer to that question has many layers. It requires an understanding of what drives knowledge workers especially Millennials, those digital natives born after 1980—and of the implications for attracting and retaining talent. It involves innovative organizational change to manage the flat, sprawling network of individual nodes defined by workers and their devices. And it requires more imaginative uses of IT resources, sourced internally and externally, to move closer to where the action is—the edge of the enterprise—and to deliver application and information power that's been elusive until recently. This first article examines the business implications of these issues.

The article, "Mobile technology's journey from peril to promise," on page 20 examines the issues of application development, the limits of these devices in replacing PCs, and the security risks of handhelds—which turn out to be not as insurmountable as many say. The article, "How to exert leadership on enterprise mobility," on page 36 offers insight into governance and other risks.

At this stage of enterprise mobility, the biggest risk for many companies would be inaction.

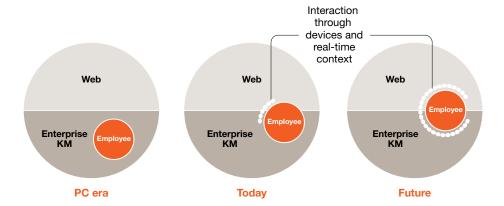
A phone in your pocket, or an enterprise IT asset?

Knowledge workers want nothing less than perpetual connection to the information they need, and today more of that information is increasingly accessible via handhelds. The smartest of these devices, as futurist and interactive media consultant Mark Pesce points out, offer the same power as a 1980s Cray supercomputer² and are optimized to work on wireless networks suited to high-volume data exchange. Smartphone subscribers account for more than 60 percent of US mobile application use and more than 55 percent of mobile Web browser use, according to comScore.3 Early adopters are using their phones to become an integrated part of the information landscape. This is the beginning of the realization of a cybernetic vision in which humans

As Figure 1 points out, traditional knowledge management hearkens back to an era in which the enterprise information system was all that was online. Employees had access to only internal IT resources. Now, in the era of the smart handheld, employees have anytime access to external resources. Not only that, but those resources change in response to an employee's input. As information in the cloud becomes more adaptive, the result will be a cybernetic system, a symbiosis, and an interworking of man and machine that's been theory for a long time but is now finally becoming reality.

The new smartphones and tablets take advantage of new classes of applications that allow easier use of knowledge and information sources on the public Web. The best of these applications can improve processes incrementally in areas such as field support and sales with the help of small, agile collaboration tools suited to the new handhelds. What has emerged is a form of cloud-based collaboration and file sharing that emphasizes ease of use rather than expansive feature sets.

Figure 1: The trend in cybernetic employees



Traditional approaches to knowledge management (KM) surround the employee with corporate information. Smart handhelds simplify access to external information and feed real-time context to the system. The system uses that input to filter what it retrieves for the employee.

The employee moves more to the edge in this scenario, straddling the boundary between internal and external information.

and their devices, wherever they are, are part of a more integrated whole.

See the interview with Mark Pesce on page 48.

See the line wew with mark rescs on page 4-d.
"Smartphone Subscribers Now Comprise Majority of Mobile Browser and Application Users in U.S.," comScore press release, October 1, 2010, http://www.comscore.com/Press_Events/Press_Releases/2010/10/Smartphone_Subscribers_Now_Comprise_Majority_of_Mobile_Browser_and_Application_Users_in_U.S, accessed October 5, 2010.

Few IT departments are currently in the decision loop for acquiring the mobile devices and applications for enterprise use. When IT departments are in the loop, they clear a path for sales forces and other knowledge workers to use leading-edge smartphones and tablets. "When the CEO shows up with an iPad, you [the CIO1 are forced to look at it whether you want to or not," says Larry Herrmann, manager of global IT customer support at DJO, a medical device manufacturer. Herrmann compares the current trend to what happened with BlackBerry devices in the mid-2000s. "We got our first BlackBerry devices about six or seven years ago, and the CEO at that time said there will never be more than 25. Now we've topped 900 globally."

Some IT organizations are building on recent technology improvements to refine efforts they had already started. "We are sought after by the business and are viewed as consultants," says Tom Conophy, CIO of InterContinental Hotels Group (IHG). "We profess the art of the possible." His team offered mobile applications in the past and is enthusiastic about capabilities that began to appear at the end of the decade. "IHG was one of the first companies to actually put out a mobile app that did booking, but it was pretty lame," he admits.

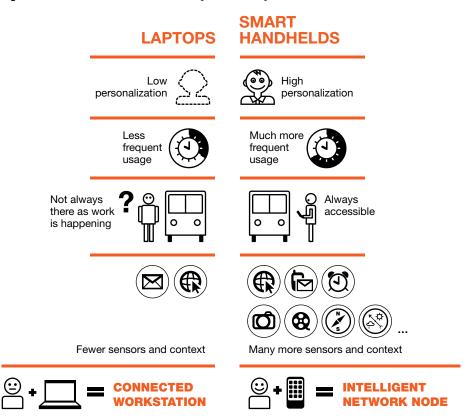
Conophy's point: The technology has only recently become enterprise ready. "The phones themselves were not that great, and the infrastructure was lacking," he says. "The rendering capabilities were not super." Conophy describes the current environment as "a perfect storm." After lagging for years, more of the capabilities IHG and others need have at last materialized.

Too often, though, IT is slow to capitalize on the mobility opportunity. And as a result, individual executives, business units, and employees do what they want with smart handhelds and the myriad mobile applications available in the cloud. The individual results may be useful, but a potentially powerful enterprise IT asset is not yet being tapped organization-wide.

Smart worker, smart device symbiosis

Mobile phones aren't just more powerful; broadband connectivity, 3-D sensors, and enhanced geolocation capability have turned the devices into intelligent, humanassisted network nodes on the public Web. (See Figure 2 for a comparison of network intelligence between laptops and smart handhelds.) The symbiosis mentioned earlier happens with the help of a constant flow between these nodes and the changing information in the cloud. Blend that capability with social networking, and you get an emerging form of large-scale, contextually aware mobile networking that many enterprises have dreamed of—the kind that research and development (R&D) labs such as the Palo Alto Research Center (PARC) are exploring.⁴

Figure 2: Smart handhelds enable cybernetic systems



Smart handhelds provide features that laptops do not, including quick, always-on access to applications and a multitude of sensors. The result is that a human with a smartphone or tablet becomes a de facto human-assisted network node—part of a cybernetic system and the overall information flow.

⁴ See a description of PARC's focus area "Context-aware computing & mobile interaction" at http://www.parc.com/ work/focus-area/context-awareness/, accessed October 27, 2010.

The art of the possible in enterprise mobility in the 2010s

What is an "intelligent network node" and why is it important to enterprise mobility? An intelligent node is basically Nova Spivack's "human as sensor" concept, with each human carrying and interacting on the Web via a smartphone filled with a Global Positioning System (GPS), sensors, a powerful processor, and lots of memory.* These nodes and the networking that connects them create the opportunity for applications to learn more about you and others in your business network in real time and provide more of the information you need in your context at the moment. For example, a salesman about to visit a prospect's headquarters office can learn about mutual friends and connections before walking in the door. Some of the main enablers for this kind of contextually aware computing include the following:

Better locating capability:

Smartphones and cellular networks that are GPS enabled are more precise about location these days. Together with other sensors and details about each person, applications will be able to make educated guesses about what information will be relevant.

More capable sensors: Smartphones already have sensors that detect motion. That's how Apple iPhone devices can have displays that respond to the device tilting, or games that take advantage of the phones' motion detection capabilities and build that into a user interface. New barometers in phones will add to motion detection and geolocating capabilities, making it possible for applications to learn what floor a person is on in a building, tell them someone they know is in a

meeting down the hall, or indicate what printer is closest to them.

Faster networking: 3G is finally commonplace, although the average speeds US users experience on mobile devices are sometimes as low as one-quarter of the average speeds advertised, according to the Federal Communications Commission (FCC). This implies downloads in less than optimal circumstances of 100 to 500 Kbps or lower. In the best conditions, users get from 1 to 1.5 Mbps in the United States. Network upgrades (to the Long-Term Evolution [LTE] standard, for example) promise improvements two or three times what users are experiencing with 3G. That's network throughput. On the data throughput side, back-end storage system speeds are improving substantially, with higher-speed solidstate storage becoming available and caching performed more cleverly now than ever. Overall, users experience better performance than they did three years ago, and they can expect an additional cycle of improvement to occur during this decade.

During the next three to five years, intense development activity and experimentation will continue. Look for lots of targeted applications intended to solve practical problems. The end result will be a different kind of application environment for enterprises—one where business units are more closely involved in development or even doing some development themselves, not to mention a rich but rather confusing and difficult-to-navigate application environment externally. The first few years will be a time to focus on the fundamentals and to capture what's most essential from an application perspective.

The problem for the enterprise is that adoption of this powerful but unfamiliar networking capability is happening on the consumer Web and then bleeding over into the enterprise. Enterprises are having difficulty deciding what to allow and what to curtail. They also need substantial organizational flexibility to take advantage of this new capability. Remnants of command-and-control or even carrot-and-stick approaches. which exist in many organizations, are not supportive of this capability. Because the idea of participating in the cloud is so compelling, many companies are conducting pilot projects and pondering what policies they might need to change, but they haven't gone much further. Others that have managed some degree of comfort in a somewhat more flexible organizational structure have embraced the new medium.

It's not just organizations that are changing; the individuals in them are changing, too, especially the younger, more adaptive generations. It's not news that the workforce has changed in response to technological improvements, but it's worth pondering what specific changes have resulted.

Take manufacturing as an example. Factory output per worker in industrialized countries has risen dramatically since the 1970s. This productivity boost is a primary factor behind factory employment declines.⁵

The need for fewer workers in industries that previously required more physical labor is one of the reasons today's economy is characterized as a knowledge economy. A significant share of that increased productivity is due to the improved ability to generate, retain, share, and—most importantly—leverage information. More workers will do

^{*} Nova Spivack, "Nowism," TTI Vanguard Shifts Happen conference, San Francisco, CA, February 23, 2010.

⁵ Jay Bryson and Tim Quinlan, What Really Drives Growth in the Industrial Sector? Wells Fargo Fixed Income Research, July 2010, https://www.wellsfargo.com/ downloads/pdf/com/research/special_reports/What ReallyDrivesGrowthintheIndustrialSector_ July2010.pdf, accessed October 5, 2010.

more knowledge work, even if their job category remains otherwise steady and stable.

Handhelds are becoming powerful at precisely the same time that the knowledge economy is becoming predominant. One implication: enterprises must make more room for the creative nature of a handheld-wielding workforce. This is especially true in an environment that requires enterprise agility.

Enterprise agility's demand for workforce creativity

The most knowledge-intensive segments of the workforce already understand the value of fostering creativity in this new environment. Standard Chartered, for instance, is setting up a mobile applications development unit that emulates a Silicon Valley startup, to the point that it is located in San Francisco's South of Market new media district and staffed by a small group of locals. Never mind that Standard Chartered is headquartered in London and most of its branches are in Asia, Africa, and the Middle East. Todd Schofield, who heads the unit, says the idea is "to stay very small and nimble, and be able to bring in new ideas, deliver quickly, and then move on to the next thing."6

The unit's approach reflects the way digital natives tend to operate and underscores why they are capable of contributing to enterprise agility. Because they are accustomed to the tools that allow agility, digital natives are more apt to iterate quickly and to continually refine their access to information via handhelds. And because they collaborate so readily on an ad hoc basis, they're accustomed to participating in change efforts—an aspect of their character that enterprises need to take greater advantage of.⁷

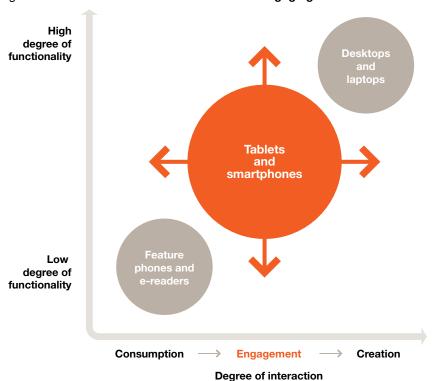
Several companies interviewed for this issue focus on smartphone and tablet innovation precisely *because* of the growing influence of digital natives. Their development groups exemplify how the workforce as a whole is changing in response to the need for accelerated innovation. IHG's Conophy has set up informal R&D groups to hash out ideas. "You have to give people outlets," he says. "They have their day jobs, and then they have their passions. The idea is to try to turn on some of those passions."

In job categories where workers traditionally have used their hands (construction trades, for example), the information component is increasing and more creative approaches are emerging. As construction tools and techniques

become more sophisticated (as in the D7 example) and the need for precision increases, more effort shifts to planning, measuring, calculating, resourcing, machine setup, maintenance, and quality control, where each worker now has management responsibility and autonomy over an important part of what can be, in essence, a small, ad hoc, on-site building factory.

That's because the iPad, the iPhone, Android-based handhelds, and similar devices have opened up a new category of interaction with digital content for companies such as D7. Before, that interaction essentially was limited to content creation (with a desktop or a laptop) or consumption (also with a laptop, but more recently with a smartphone or an e-reader). Now, a category for engagement has emerged. (See Figure 3.)

Figure 3: The role of new mobile handhelds in engaging with content



Content engagement splits the difference between creation (which requires a precise and elaborate interface, such as a mouse and keyboard) and consumption (which requires only a simple interface). Multi-touch and gesture interfaces on smart handhelds allow new ways to interact with the content, and that level of interaction should increase as developers become more familiar with the capabilities of these relatively new interfaces.

⁶ See the interview with Todd Schofield on page 32.
7 See Michael S. Hopkins, "The Digital Natives, and You," MIT Sloan Management Review, April 1, 2010, http://sloanreview.mit.edu/the-magazine/articles/2010/spring/51317/the-digital-natives-and-you/, accessed October 27, 2010.

⁸ See the interview with Tom Conophy on page 16.

Sun Life Financial Canada is close to rolling out a new application to run on the forthcoming Research In Motion (RIM) PlayBook tablet that could be described as an engagement application. In the past, Sun Life has used a paper-based approach to enroll participants in Sun Life retirement plans that employers offer to their employees. However, the employees of Sun Life's client companies have many options to choose from in the retirement plans, and paper forms have proven too complex for some employees to complete. The industry average for enrolling in retirement programs hovers between 50 and 60 percent. In companies where employees are not normally outfitted with laptops—oil services or manufacturing, for example enrollment by computer has not been effective. Security concerns surrounding employee information has also kept enrollment a paper process.

Thomas Reid, senior vice president for Group Retirement Services at Sun Life, heard about the ease of use and potential of the PlayBook, Working closely with RIM on prototype devices, Sun Life developed the first PlayBook enterprise application to support enrollment in the company's retirement products. Soon, retirement counselors will bring with them Sun Life-outfitted PlayBook tablets that are preloaded with the enrollment application. "By using engaging software to encourage enrollment while simplifying the complex investment choices facing employees. we expect much higher enrollment rates in retirement programs," Reid says. "Our research has pointed to enrollment rates as high as 90 percent. When we recently told our 50 top clients about this, they were thrilled and are eagerly anticipating the rollout of the PlayBook app in their organizations."

The latest handhelds are squarely in the middle of engagement, but they have the ability to expand outward. Although large numbers of smart devices probably will not replace PCs soon, in some cases, tablets already do substitute for laptops—for some doctors, for example. (See the article, "Mobile technology's journey from peril to promise," on page 20.)

Construction is just one industry example. Car dealerships, insurance companies, and hospitals, among many others, are all poised to incorporate more tablets into their workflow. This trend is consistent with how mobile workflow is becoming more information rich and has ramifications for how business leaders choose to manage.

All of the fastest-growing job categories over the next decade will have a heavy information component. judging by information from the U.S. Bureau of Labor Statistics. (See Table 1.) Today's skilled jobs are already information rich: tomorrow's jobs will be more so considering the power of collaboration using mobile devices and the cloud. The two job sectors the Bureau of Labor Statistics predicts to grow fastest are professional (including science, engineering, law, and teaching) and services (including healthcare workers, firefighters, detectives, and cooks). Each will feel the impact of the emerging Web-based collaboration environment that the networked intelligent nodes noted in the sidebar will enable.

Table 1: US employment by major occupational group, 2008 and projected 2018

	Employme	nt, millions	
	2008	2018	% change 2008-2018
Professional and related	31	36	+16.8
Service	30	34	+13.8
Construction and extraction	8	9	+13.0
Management, business, and financial	16	17	+10.6
Office and administrative support	24	26	+7.6
Installation, maintenance, and repair	6	6	+7.6
Sales and related	16	17	+6.2
Transportation and material moving	10	10	+4.0
Farming, fishing, and forestry	1	1	-0.9
Production	10	10	-3.5
Total	151	166	+10.1

Source: U.S. Bureau of Labor Statistics, 2009. See "Employment Projections: Occupational employment and job openings data and worker characteristics" at http://www.bls.gov/emp/ep_table_106.htm, accessed October 6, 2010.

Empowering the knowledgedriven workforce

What should business leaders do to empower digital natives and others so they can succeed in the knowledgedriven workplaces of the 21st century? The first thing is to remove obstacles to motivation, including limitations on access to tools and networks that knowledge workers need. In general, knowledge workers are not as motivated by traditional reward systems as by an environment that ensures their autonomy and ability to make a creative impact. Knowledge workers are also motivated by the opportunity to develop their talent. It's primarily talent that creates career security today—jobs and companies come and go.

Business leaders also need to recognize that digital natives are the most engaged knowledge workers online, more so than knowledge workers as a whole. Digital natives need autonomy and creative channels that extend outside the enterprise. The extended, virtual organization they work within is a patchwork quilt of internal and external resources.

Take the example of a new sales executive who uses his personal smartphone for work. He's accustomed to using Foursquare and other social media to find opportunities to meet prospective clients and build personal relationships with them. He depends on the consumer applications his friends and acquaintances are using. That phone is part and parcel of his workspace. He creates value with it in significant ways that his managers may not recognize and do not directly measure.

As pointed out in the article "Embracing unpredictability" (*Technology Forecast* 2010, Issue 1, pages 6–10), organizations are complex systems that create value in two ways: incremental and fundamental innovation. Incremental innovation can benefit from a conventionally managed approach, but fundamental innovation demands that organizations protect and nurture the unpredictable, creative effects of complex interactions that increasingly take place on informal networks made possible by smart handheld devices.

In an earlier era, 3M's Post-it notes became a success after an engineer in one group suggested the note application for what started as an adhesive invented by an engineer in a different group. Without a culture that fostered the freedom to invent and collaborate in what constituted a marketplace of ideas, 3M would have missed an opportunity that turned out to be crucial to its long-term success.

With the Post-it note innovation, the 3M engineers demonstrated in the 20th century what Dan Pink calls a 21st-century style of motivation.9 Instead of using carrots and sticks, leaders of the most-effective knowledge enterprises motivate by allowing autonomy and by encouraging mastery and purpose (AMP). This was true for 3M then, and it is more so for all in this new era. Business executives who foster mobile handheld freedom will encourage employees to reach out through their own networks to innovate and get things done, and in the process reinforce an enterprise's support of Pink's AMP principles.

Pink's studies, and those of others, suggest strongly that research has proven something that businesses haven't taken consistent advantage of yet: the better way to motivate helps employees to achieve three personal goals:

- **Autonomy**—The urge to direct our own lives
- **Mastery**—The desire to get better and better at something that matters
- Purpose—The yearning to do what we do in the service of something larger than ourselves¹⁰

Pink elaborates on the previous work of others, of course. For example, in 2007, author Gary Hamel addressed the issue of developing an innovative, creative corporate culture to attract talent. ¹¹ Culture is at the core of the issue Pink addresses, and culture certainly has been the focus of executive concern generally. Companies that already embrace these values will have a far easier time with enterprise mobility than others.

[&]quot;Dan Pink on the surprising science of motivation," TEDGlobal 2009, July 2009, http://ca.ted.com/talks/dan_ pink_on_motivation.html, accessed November 19, 2010.

¹⁰ Ibid.

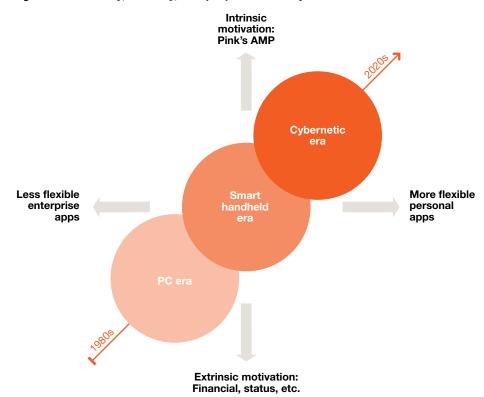
¹¹ Gary Hamel, *The future of management* (Boston: Harvard Business School Press, 2007), p. 182.

From Pink's standpoint, a broader compensation model is central to effective cultural change. Enterprises should pay employees fairly, but enterprises also need to understand that what drives many knowledge workers goes beyond monetary compensation. A work environment that fosters self-actualization (psychologist Abraham Maslow's term for AMP) can ensure effectiveness and solid results. In contrast, the carrot-and-stick method may have worked well during the industrial age, when consistent output from laborintensive mass-production lines was more important than agility. But it's not well suited for the current age, when rapid knowledge creation and its application provide the competitive advantage necessary for agility. Even more knowledge sharing in the future implies a greater need for AMP-style motivation, particularly in the cybernetic era, as Figure 4 illustrates.

Conclusion: 21st-century work as cybernetic craft

Consider what AMP implies for the 21st-century workforce armed with smart handhelds. Digital natives, as Kim Woodward, vice president of corporate marketing at Citrix Systems, points out, "aren't used to being as constrained as older generations were." They assume the ability to reach out to other geographical areas for talent. When it's possible with the help of virtualization to do work on any device in any location, the recruitment model opens up. Mobile device freedom is emblematic of this open recruitment model, not to mention a direct recruitment tool.

Figure 4: Autonomy, mastery, and purpose as today's motivators



The way work will get done in the cybernetic era will depend heavily on rapid and frequent knowledge sharing. That kind of knowledge-intensive environment, as Dan Pink notes, implies an even larger demand inside enterprises for AMP motivators. Work styles will be more individualized than ever. Enterprises will have even more porous boundaries, as more teams are created or disassembled and as employees behave more like independent contractors.

"A couple of banks that we talked to said it's actually a recruiting tactic for them. They can tell fresh graduates that they are hiring, 'You can bring in whatever device you want and we will support it," says Srinivas Krishnamurti, senior director for mobile solutions at VMware.

With these new capabilities, work is becoming more of a craft again. Businesses are enjoying a renewed ability to craft solutions for the challenges they face, tapping a larger percentage of their employees, now that application development and mashups are easier.

"In the past, you had the one-size-fitsall sort of mentality. Now companies are starting to break down services so that they can access almost all of their capability through an application store," says systems engineer Ed. Jimison of Intel.

Futurist and interactive media consultant Mark Pesce¹² underscores the fact that application development is becoming simpler, which empowers business units and allows IT to play the role of craft master training the apprentice. "When you get tools like Titanium (for the iPhone) or App

¹² See the interview with Mark Pesce on page 48.

Inventor (for Android), you significantly decrease the barriers to entry," Pesce says. "Over the next 10 years, those tools are going to become more pervasive, the quality will go up, and the ease of use will go up."

In essence, work itself has changed because what constitutes the workforce is more a blend of individual and social networks mediated by highly personalized devices, bound together by software. The work itself has become more cybernetic. This cybernetic capability offers enterprises a built-in feedback-response loop of the kind that Gap recently discovered when it launched a new brand identity and had to react to a negative response on Facebook.

The Gap example suggests an opportunity for companies to solicit feedback publicly on initial ideas, which will reduce the risk inherent in high-cost initiatives such as a brand update. Particularly when it comes to consumer goods and services, the customer community is a much more frequent and active participant in enterprise workflow. The youngest generations in the workforce can help executives anticipate and respond to this kind of change. The rise of the smartphone ecosystem and its challenge to IT traditions of companyissued standard devices and companydictated controls over applications must be understood in this context.

Smartphones extend IT to the edge of the enterprise because they are mobile, and they are always with the employee when the important work is happening. But the most significant "edge of the enterprise" is the individual employee, seeking the autonomy to contribute to enterprise goals through mastery of everchanging knowledge and processes. Increasingly this is happening through personalized mobile devices.

Resistance to the organizational flexibility that enterprise mobility requires and IT prohibition of device use will inhibit the value-creating variability, because they reduce autonomy, self-directed mastery, and commitment to enterprise purpose.

"Over the next 10 years, [application development] tools are going to become more pervasive, the quality will go up, and the ease of use will go up." — Mark Pesce of FutureSt Consulting

Getting to your best mobile strategy

Tom Conophy of InterContinental Hotels Group describes the importance of a sound cultural and management foundation for mobile innovation.

PwC: You have been doing some really interesting things with IHG. How did you get started?

TC: I've been in technology for 30 years now. I was approached by the chairman of the board to consider IHG about four and a half years ago. The company was going through a significant transformation of its core brands as well as its corporate structure. It had been without a technical leader for a few years, and the chairman and the new CEO wanted to reestablish IHG as a leader. So I was brought on board to help drive a technical direction and an overall strategy for the company as it relates to technology.

With that mandate, we embarked on a back-end refinement of all our core systems. We have a booking engine that does between \$20 and \$25 billion a year in revenue. We have a Web suite of tools—a Web complex that books about \$4 billion in revenue per year. A logical extension for all of that was into the mobile space.

What's at the core of your mobile strategy?

When I came on board at IHG, the technical community was pretty demoralized. They were disenfranchised, and the business really didn't view them as value-add. I knew this all coming in, because the chairman told me what was going on. So I not only started to establish myself with the business teams, but also started to form the core of what is now a pretty powerful technical group.

We've established a little bit of entrepreneurial fever by changing the cultural attitude. We got rid of some of the Luddites, brought in some new blood, and just changed things around.

We have built up an enterprise computing platform following an SOA [service-oriented architecture] model, and the services that we've created have enabled us to turn on some great mobile applications rapidly.

If you don't have the back-end capabilities, it's hard to have a fairly intuitive device that somebody can use as a small pane of glass to look through to what that back end can display. You are not going to type a novel on the phone, but we do book almost \$3 million a month now on mobile phones. We expect it to be toward \$5 million by the end of the year. This time next year, I'd be shocked if bookings are not over \$10 million a month.



Tom Conophy has been CIO at InterContinental Hotels Group (IHG) since 2006. Before joining IHG, he was executive vice president and CTO of Starwood Resorts. In this interview, Conophy debunks the notion that too many CIOs have their hands tied when it comes to innovation, and he uses the example of the mobile applications evolution to make his point.

So what did you do to get to that point?

We had a mobile app out there for a long time. IHG was one of the first companies to put out a mobile app for booking, but it was pretty lame. It didn't do too much. We recognized that the device had a nontraditional browser, and so we changed the format and would send out appropriately rendered screens for the phones. It had usage, but not very much. I think we might have been lucky to break \$200,000 a month in bookings, not very much.

The early adopters tolerated an environment that didn't work that well because the phones themselves were not that great and the infrastructure was lacking. The rendering capabilities were not super.

Then the perfect storm scenario happened. You had a higher adoption of smartphones. You had better resolution, better capabilities. You had the advent of 3G and better networking, and then the applications themselves became much more intelligent. So we first revitalized our mobile offering, which was the standard mobile booking application.

We gave it an overhaul from a lookand-feel point of view, streamlined the booking process to make it simpler, and leveraged inferencing capabilities—we knew data about you based on your phone, so we would not need to ask you mundane questions as part of a booking process. From a human factors point of view, we ate our own dog food, so to speak, and we were critical of each other relative to how it worked.

We targeted it for loyalty members first. That helped significantly. That was October 2009. We went from \$200,000 a month in bookings to \$1 million, and that was due to people using it on iPhone and BlackBerry devices. It wasn't a specific iPhone app yet.

Then we built an iPhone app and released in May 2010. Right away, it was well adopted by the traveling public. It was rated very highly—we

were downloading 4,000 apps a day or something like that. The ratings were very high, and we then surpassed the earlier players that had products out there already. Ours was rated higher because we took the time to make it pretty intelligent in terms of richness of capability without necessarily making the user interface complicated.

We translated some of the learnings from our overhaul of our mobile apps in general into the iPhone apps. And we took feedback from our early adopters. We reached out and asked them what's working or what's not working, and what would you like it to do? We had people internal to the business using it. We would set it up in lunchrooms and have people play and give us feedback on the spot. That's not super sophisticated or scientific, but it tends to work pretty well.

"We recognized that the device had a nontraditional browser, and so we changed the format and would send out appropriately rendered screens for the phones."

And this is all in-house development?

Yes, all in-house development. We had a small team of guys who were really deep into it, and so we just turned them loose and then did a lot of whiteboarding. I have a humanfactors passion. I'd come in and we'd project all of the wireframes onto large whiteboards and just basically rip them apart. But it was healthy; the culture supports that. It's not uncommon to be critical and at the same time make suggestions. It's a very collegial, very collaborative environment—one that might not work well at all corporations, but it works well within the technical community that we have established inside of IHG.

I have about 800 employees across the globe. I've always been a strong believer that you have to give people outlets. They have their day jobs, and then they have their passions. The idea is to try to turn on some of those passions. So we've established these labs, and we let anybody with reasonable ideas come in. I have two rules. One, don't burn down the hotel, and two, don't electrocute the guest. It's all based on giving knowledge workers the freedom to experiment and then giving them the tools and the resources to make that happen.

It sounds like you are tapping into the increased ability to interact with the guest in some form or fashion. And as the guest gains an online presence, you can tap into that online presence more and more, and extract the information you need to respond to the guest's personal needs.

Exactly. We have the ability now to send alerts and things like that through the application itself. The standard mobile app is still humming on nicely, and the iPhone app has done fairly well. I think it's done great, relative to our sector and our

competitors. It is the leader by far. That one is equally well received and getting a lot of presence, and that's helped to kick our bookings to \$3 million a month and climbing. The adoption has been extremely high. I have some guys in the group working on another twist for the latest cut of the new Android 10.

We are looking at how to extend beyond booking. Think about a concierge in your pocket. Say it doesn't matter if you are booking or not. If you are part of our family and you have a need, for whatever it might be, our concierge services help with ideas for places to go, and the app links to Yelp and other services that people use more frequently now.

We're trying to make sure that IHG has a small position there in terms of your mind share, and it's not just about, "I have a business trip and I need to think about where I'm going to stay in Prague." The concierge for IHG can maybe answer this hotel choice question for us and then send the message that way.

We are also doing some things with instant messaging. Instant messaging has more than 350 million daily users, and we are thinking, "Why not enable a very simplified booking process through instant messaging as opposed to a traditional Web site or some other navigation?" It's just another nontraditional access method. With template-based booking, you can turn that thing into a template, and then vou can instant message it very simply with just a couple of parameters, such as a new date, as long as the system knows your profile and preferences behind the scenes. It takes all that into account, does the searches, puts together some potential itineraries, and comes back and says, would you like option one or two or three?

Your interaction with your phone or through some other form of access should be as simple as asking an assistant to get you to Seattle on Thursday, and the assistant runs away and does all the stuff.

If mobile devices become dominant by 2012, are we entering a world of ubiquitous docking stations at some point?

For most executives and most business types, it's about quick access to information. There may be producers of that data, and they may be sitting in centers in the Philippines or India or wherever else cranking out systems support capabilities. But the executives are more knowledge workers, and they are taking data in small bites and small formats or dashboards. With the use of color and graphics, you can translate lots and lots of information, and you can set up filters to avoid needing to zip through a lot of stuff.

Our viewpoint is that the smartphone will evolve to a hybrid between it and a tablet of some kind. We are looking at these Droid tablets. They may be too big to put into a coat pocket, but they are going to be smaller than the laptops that people have today and there's going to be a certain form factor that people will settle on. This is because finger sizes are the way they are, and eyesight is what it is. Unless you issue monocles with your devices, you can't expect corporate computing to be done only on small-glass devices.

If you take the average size laptop and maybe take that to three-quarter size or maybe even smaller, that's what we think people will end up using. The traditional desktop is for all intents and purposes gone in most companies. We think people will use a personally owned device, and with it they will have access to corporate content that most likely will be shifted into the cloud.

Several of the CIOs we have talked to over the years say they're not able to do what you are doing. You really focus squarely on R&D [research and development] and the leading edge. They say, well, we have to keep the lights on and we need to X, Y, and Z, and just those things consume all our time and budget.

Those guys just don't get it. Whenever someone like that talks like that, the CEO should automatically just fire them. They are not doing their job. Within the last four years, I have reduced my overall operating cost by 20 percent, but yet we probably do 200 percent more than we ever have. We do something called Fuel for Fire. We create operating efficiencies and savings that turn around and enable us to put more monies toward investments. I carve out what we call a CIO fund, and I pitch it whenever I submit my budget. It's about a million dollars a year now. I have earned it through our track records. Remember, when I came to the company, the place was a shambles, and we were able to turn around the whole mind-set.

The gulags [IHG's development labs] don't cost me jack. We just took a couple of big conference rooms and changed them. I have done things like bring in free soda, juices, and water. This is not rocket science. We renamed all the meeting rooms after mathematicians and scientists. We put in stress-relieving rooms, where other things can be dealt with, foosball tables.... That doesn't sound like a lot, but it is a big corporation. You have to establish the environment, but that doesn't cost very much money.

"What I call 'traditional CIOs' usually came out of the data center world. They just don't have what I call the killer instinct, and they certainly don't have a software-centric background. Every time I come across a CIO like that, I can tell you exactly how they came up in the organization."

What I call "traditional CIOs" usually came out of the data center world. They just don't have what I call the killer instinct, and they certainly don't have a software-centric background. Every time I come across a CIO like that, I can tell you exactly how they came up in the organization. Those that are really out there firing on all pistons have tended to come out of the software side. The rest either don't know how to do it, or they are so risk averse they would never, ever risk their position by even attempting to do it, and they have established the culture of losing, frankly.

IHG is forward looking, but as of today, you still issue enterpriseowned devices, correct?

Today we issue a BlackBerry, and then we have a series of laptops. By the first quarter of 2011, our goal is that you can have what we call a CP, a corporate phone, or an individual phone. And regardless of which way you go, you will sign a document that says that should you move, IHG will blank the device and all corporate information will be scrubbed.

But personal information would remain.

That's right. We really don't want to cross that line. So we're focused right now only on our corporate information, working through our legal teams to make sure we have all of our bases covered. The bottom line is that we want to communicate to the staff, "Here's what we are doing, and here's what this all means." And then if they opt in, that's great. If they don't, they can just get a standard corporate-issue device they get today and be happy about it.



Mobile technology's journey from peril to promise

App-centric handhelds are maturing rapidly, and the path to secure adoption is more straightforward than it may seem.

By Galen Gruman

Given the passion for mobile computing among users and the tech industry, it is easy to get swept up in the excitement and see mobile as the solution for everything. It's also not hard to write off the technology as a fad that will run its course. We're betting the first camp is more on target, given the rapid adoption of mobile technology by business users and consumers with fervor reminiscent of the early PC days.

In conversations with CIOs and other IT leaders, PwC sees a sea change in attitude toward mobile devices. Once viewed as an oddity to be kept at arm's length, they're now seen as a platform for enterprise value through their existing functions and ones not yet invented.

The key reason for this change in attitude? The new generation of devices, represented by the Apple iPhone and handhelds that use Google's Android operating system, is evolving from a messaging platform into an application platform, making the devices more versatile for business needs—that is, more like a PC. So much so that Standard Chartered recently switched to the applications-oriented iPhone.

As the mind-set shifts from "containing the newfangled devices" to "getting business value from them," enterprises

are discovering they're not yet familiar enough with the technologies they need to understand and exploit. This article sorts them out.

There are also shifts in the interaction between businesses and their employees and customers that will affect the design and management of mobile enterprise applications. This shift involves the acceptance—even the embrace—of a certain amount of device heterogeneity; that is, employees and customers use their preferred tools and businesses seek to exploit the special characteristics of the more popular devices while providing a baseline of enablement for the others.

Heterogeneity extends to each individual device, which due to its personal nature will mix personal and business data and functionality, and will require a different management mentality by IT. Technologies now under development may ease efforts to support this heterogeneity.

The big issue has been control: Can the business ensure information security in mobile devices if they are used for both business and personal matters? This is a real concern, especially because the platforms igniting the most passion— Apple's iOS and Google's Android operating system—have been slow to provide control mechanisms. Recent changes to both indicate the control issue will be resolved in the next year or two. As control issues are resolved, IT will be able to focus on value-creating efforts, exploiting the emerging mobile technologies along the way.

Solving the control requirement with new technologies

When businesses began to use BlackBerry devices (and later Windows Mobile, Nokia Symbian, and Palm OS devices), IT realized the need to secure the messaging and server access they provided. Management tools similar to those used for PCs were soon available, along with on-device capabilities such as at-rest and in-motion data encryption, remote management, and policy-based administration.

Because the focus was messaging, mail servers were the main conduit between the device and the data center, which simplified the deployment and management effort. Mail servers also tapped into Active Directory and other policymanagement servers, allowing IT to extend those services to mobile usage.

Most companies viewed mobile devices as messaging clients and standardized on the BlackBerry, giving themselves just one platform to manage. Some companies used the ability of Windows Mobile to run specially built applications, such as for field forces, and added that platform as the standard for certain classes of users. Microsoft made it easy to do so by extending its widely deployed Windows Server applications to manage these devices.

This situation remained stable until about 2007, when the debut of the iPhone redefined mobile computing to encompass more than messaging and field force applications. It first skewed toward personal use, with its tie to the Apple iTunes service, but users quickly

"The iPhone changed the whole world, because all of a sudden the people within the enterprise were demanding that the iPhone be used. And then it became the CFO's job or the CIO's job to say yes, rather than to say no." — David Goldschlag of McAfee

began to use it for business e-mail if they weren't restricted from doing so.

Now enterprises are taking the next step.

"Everybody wants to tell their employees, 'You don't have to carry a corporate phone and a personal phone," says David Goldschlag, vice president of mobile technology at McAfee. "The iPhone changed the whole world, because all of a sudden the people within the enterprise were demanding that the iPhone be used. And then it became the CFO's job or the CIO's job to say yes, rather than to say no."

Security was the stumbling block. Apple was slow to add enterprise-class security capabilities, but it did so in the summer of 2010, providing operating system—level services and application programming interfaces (APIs) that let the mobile management vendors—AirWatch, BoxTone, Good Technology, MobileIron, Symantec, the Afaria unit of SAP Sybase, Tangoe, Trust Digital, and Zenprise, among others—deliver management tools similar to those for BlackBerry and Windows Mobile.

Four of the six major platforms can now be managed to the standards of most businesses; in order from most capable to least, they are BlackBerry, Apple iOS, Windows Mobile, and Nokia Symbian. Although, as Forrester Research has noted, Google has not yet focused on security management, and there are tools to give IT assurance over Android devices—such as NitroDesk

TouchDown and Good Technology's Good applications for Exchange messaging, and the forthcoming IBM Lotus Notes Traveler for Notes messaging. Google is likely to develop competitive management and security capabilities soon. Microsoft's new Windows Phone 7 does not yet have such third-party tools to fill in some of its security deficiencies, but Microsoft has said it will enhance its security capabilities in 2011. For enterprises that have the highest security requirements—such as the Pentagon— BlackBerry and Windows Mobile are the two options, due to their militarygrade encryption and support for two-factor device-based authentication.

Another shift easing the control burden is broad adoption of the Microsoft Exchange ActiveSync (EAS) protocol for managing and enforcing device permissions. Microsoft's devices and servers support it, of course, but so do Apple's devices and mail clients, Google's corporate Gmail service, and, to lesser extents, the Google Android, Hewlett-Packard/Palm webOS, Microsoft Windows Phone 7, and Nokia Symbian operating systems. IBM's Lotus Notes recently adopted EAS, and Novell has released a beta mobile server add-on based on EAS for GroupWise. This near-universal adoption of EAS should allow consistent policy definition and management for IT. The "Mobile device management products" sidebar compares the mobile device management options-EAS and otherwise—the main vendors have made available.

Mobile device management products

As smartphones and tablets become commonplace, and as employees make the case to bring various kinds of devices into the workplace, IT faces the challenge of managing access, usage, and security across multiple mobile devices. To address that need. many vendors have developed mobile device management (MDM) tools that provide a central console to manage multiple devices over the air with a

common set of policies, ensuring consistent policy enforcement and providing auditing capabilities as well. Common capabilities include remote wipe and lock, password enforcement, device encryption enforcement, restricted access to designated virtual private networks (VPNs) and Wi-Fi networks, and remote policy installation.

These tools use one of two approaches, and sometimes both: they use policy profiles, typically based on the widely used Microsoft Exchange ActiveSync (EAS) protocol, and they use a client application on each supported device to provide the managed, secured workspace and additional policies. Those that support the BlackBerry work with Research In Motion's own tool, BlackBerry Enterprise Server (BES).

MDM support by operating system and specific capabilities

Operating system supported

Product/vendor	Android	BlackBerry	ios	Symbian	webOS	Windows Mobile	Specific capabilities
AirWatch AirWatch	0	0	0			0	Provides content-filtering policies, data-roaming policies, and allows (on iOS 4) selective wiping of business data (leaving personal data intact for employee-owned devices)
BoxTone BoxTone	0	0	0			0	Provides tools for troubleshooting user devices, user self-registration, and asset tracking (including carriers used)
Good for Enterprise and Good for Government Good Technology	0		0	0		0	Permits control over application installation, allows (on iOS 4) selective wiping of business data (leaving personal data intact for employee-owned devices), and can be set to allow only specific device/operating-system combinations
Trust Digital EMM McAfee	0		0	0	0	0	Provides tools for troubleshooting user devices and user self-registration
MobileIron Server MobileIron	0	0	0	0	0	0	Permits control over application installation, allows (on iOS 4) selective wiping of business data (leaving personal data intact for employee-owned devices), and provides telecom expense management capabilities
Afaria SAP Sybase	0	0	0	0		0	Provides control over application installation, lets IT set up an internal "app store," and permits asset tracking of mobile devices
Mobile Management Symantec	0	0	0			0	Provides application update management, asset management, and endpoint security capabilities such as anti-malware

Source: InfoWorld, 2010

Differential management supports mixed devices

The July 2010 release of Apple iOS 4 (for iPhone, iPod touch, and iPad) also untied iOS management from the natively supported mail server (POP, IMAP, Microsoft Exchange, Google Gmail, and Apple MobileMe), so devices could be managed according to user sign-on—for example, in a hospital where devices are shared but e-mail accounts are not necessarily issued to users.

iOS 4 also introduced differential management in which applications and data are tagged so each server owns whatever it provisions. Thus, on an iOS device that had corporate and personal assets, the corporate server could reach into the device and lock, restrict, or delete the assets it provisioned, leaving other assets untouched. BlackBerry OS 6, released in August 2010, brings the same approach to Research In Motion's newest smartphones. Mobile management vendor MobileIron says the operating system for Google's Android is likely to have similar capabilities in the next year or so.

Even without differential management at the asset level, most smartphone operating systems use the concept of sandboxing, in which applications have private space for their data. Thus, the applications can control access to that data by other applications, and management tools can apply greater controls to such applications than the operating system might provide. This is the case in Google Android, which currently has no on-device encryption and does not have a management API outside of support for a limited set of EAS policies. But individual applications, such as Notes Traveler and

TouchDown, can encrypt their sandboxes and allow themselves to be managed by IT-controlled servers (Lotus Domino and Microsoft Exchange, respectively).

The differential management approach pioneered by iOS and BlackBerry OS is a major step in ensuring security and compliance and it's more than a corporate laptop or home PC can do today. Although technologies such as client virtualization were proposed in 2006 to give PCs the same level of safe business/personal dual use, they haven't been productized. Mobile's much more intense personal nature and corporate IT's concerns have pushed mobile ahead of desktop in this area. Table 1 compares specific security and management capabilities by operating system.

Table 1: Mobile security and management capabilities compared

Capability	Apple iOS 3.x, 4.x	Google Android 2.x	Hewlett- Packard webOS 1.x, 2.0	Microsoft Windows Mobile 6.x	Microsoft Windows Phone 7	Nokia Symbian 2.x, 3.x⁵	RIM BlackBerry 5.x, 6.x
On-device encryption	Yes			Yes	No	Yes ⁶	Yes
Over-the-air data encryption	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Complex passwords	Yes		Yes	Yes	No	Yes	Yes
Enforce password policies	Yes ¹	EAS (2.2 only, requires PIN only)	EAS	TPS, EAS	EAS	TPS, EAS	BES
Support VPNs	Yes	Yes	Yes (2.0 only)	Yes	No	Yes	Yes
Disable camera	Yes ¹			TPS, EAS			BES
Restrict/block application stores	Yes ¹			TPS, EAS			BES
Restrict/block wireless LANs	Yes ¹			TPS, EAS			BES
Remote lockout	Yes ¹	TPS (2.2 only) EAS (2.2 only)	EAS	TPS, EAS	EAS		BES
Remote wipe	Yes ¹	TPS (2.2 only) EAS (2.2 only)	EAS	TPS, EAS	EAS	TPS, EAS	BES
Selective wipe of business applications and data only	TPS (4.x only)						BES (6.x only)
Enforce and manage policies	TPS (4.x only) EAS	EAS (2.2 only)	EAS	TPS, EAS	EAS	TPS, EAS	BES
EAS policies supported	14	9 (2.2 only) ²	5	29 ³	7	Not available	None ⁴
Manage over the air	TPS (4.x only) EAS	TPS EAS (2.2 only)	EAS	TPS, EAS	EAS	TPS, EAS	BES
Second-factor authentication (RSA SecurID)				Some device models			Some device models

EAS = via Microsoft Exchange ActiveSync

BES = via BlackBerry Enterprise Server 5.x

Source: InfoWorld, 2010

TPS = via third-party server

¹ Via choice of Apple iPhone Configuration Utility (no over-the-air confirmation or auditing), EAS, and 3PS

² Some third-party e-mail client applications support additional EAS policies within those applications only

³ Exchange Server Enterprise license is required for support of all 29 EAS policies, lower-tier licenses support 15 EAS policies

⁴BES supports more than 400 policies of its own

⁵ Select Nokia Eseries and Nseries devices only

⁶ Storage cards not encrypted

Virtualization for enhanced security and app delivery

Vendors are working on virtualization technology to let enterprises partition business assets from personal ones on the same smart device. These approaches could also enable IT to deliver single-application instances to multiple mobile operating systems rather than re-creating the application for every supported device.

There are many virtualization approaches, but for mobile vendors the focus is on client virtualization (VMware), thin clients (Citrix Systems), and hypervisors (Open Kernel Labs). These approaches separate applications and their data at a deep level on the device, so that barriers are harder to breach than with sandboxing and source tagging.

Client virtualization creates a runtime environment for applications and their resources—similar to Adobe AIR, Adobe Flash, Microsoft Silverlight, and Oracle Java, which can run applications on Windows, Mac OS X, and sometimes Linux. Thus, users don't need to switch from one environment to another as they did in early desktop virtualization products. Instead, they can launch an application that happens to run in its own virtual environment, using the host operating system's user interface and shared services.

Client virtualization could be used to develop VMware applications that run natively on iOS, BlackBerry, Android, and Windows Phone 7 (assuming operating system vendors and wireless carriers permit it), so IT would need to create just one version of the application, says Srinivas
Krishnamurti, VMware's senior
director for mobile solutions. Client
virtualization also could be used to
run native applications in their own
environment. Doing so would isolate
their data and services from other
applications and services on the
device, thus providing a high level of
security and data protection, he says.

The thin-client approach runs the application using the data from a server: the mobile device is just the screen and input medium for the computing performed in the data center. Data and application components may be temporarily loaded to the mobile device in a cache for processing efficiency, but they are never stored beyond the session. Thin-client applications are already widely used in financial services and other industries that require a strong separation and protection of resources. Typically, Windows applications are run remotely from a desktop PC that never stores the information being used. Citrix is hearing from such firms that they want to extend the use of thin clients to iPad tablets and the coming set of new tablets, says Kim Woodward, vice president of corporate marketing at Citrix.

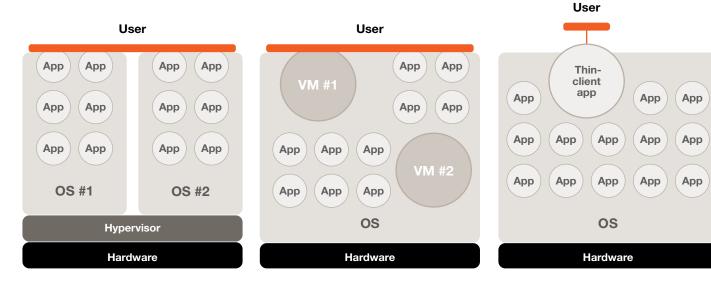
The flaw with the thin-client approach is that most applications are designed for desktop screens and are difficult to use on a smartphone. That's why Citrix reports most of its mobile usage is on a tablet, the iPad, a trend it expects will accelerate when other tablets begin to appear in 2011, Woodward says.

Web-based applications can more easily auto-reconfigure to fit the user interface of a smartphone, because dynamic HTML, JavaScript, and related technologies provide for such contextual interfaces. As previously noted, such applications and their data are not as fully separated from the rest of the device as a thin-client session is.

The mobile hypervisor approach is similar to client virtualization, except that it doesn't run on a host operating system; it runs underneath the host operating system, communicating directly with the device hardware. That approach offers the greatest possible separation of resources, because the guest operating systems and the applications that run on them are isolated from each other—and from the host operating system and its applications. Figure 1 illustrates the main differences between the three types of mobile device virtualization.

Users don't need to switch from one environment to another as they did in early desktop virtualization products. Instead, they can launch an application that happens to run in its own virtual environment.

Figure 1: Three types of mobile device virtualization



Mobile hypervisor (Type 1)

A hypervisor sits directly on top of the hardware, allowing multiple virtualized operating systems to run above it. This is also known as "bare-metal" virtualization.

Virtual machine (Type 2)

In Type 2–style virtualization, virtual machines run within a host operating system. In essence, they virtualize the host OS, not the hardware directly.

Thin client

A thin client relies on the server for storage and computation. It merely acts as a display, or a "pane of glass," for the end user to see what the back end serves up.

The virtualization types can be used in a variety of combinations.

Open Kernel Labs notes that Motorola has shipped the Evoke, which runs the Binary Runtime Environment for Wireless (BREW) and Linux cell phone operating systems simultaneously. Users see a unified interface because the Open Kernel Labs technology allows the device maker to integrate user interface (UI) elements, deciding at a granular level the degree of separation across the operating systems, notes Steve Subar, the company's CEO. Like client virtualization, the hypervisor approach could be used to run multiple operating systems, multiple instances of the same operating system, or a combination of the two on the same device.

All three vendors say current smartphones have the processing power and memory to support these technologies. But they're not yet implemented because mobile operating system makers are deciding to what extent they want to support alien operating systems and whether they want to add the extra layer. PCs don't have this level of internal safeguard, so adding it to mobile has not proven urgent.

Of the three approaches, the thin client most likely will soon be widely available for segregating applications from the mobile device's other applications and data; the Citrix Receiver thin-client application is already popular among mobile users, the company reports.

The path to broad adoption of the other forms of virtualization is less obvious. As the next section explains, Web-based applications can provide similar universality without the overhead of virtualization. It's also not certain that mobile platform providers will support the VMware or Open Kernel approaches; today, for example, Apple prohibits the use of non-native runtimes such as Adobe AIR and Flash and Oracle Java on its iOS.

Extending corporate apps to the mobile environment

Virtualization could help IT tap legacy applications and create new "write once, run all" applications for a heterogeneous environment, but there's a simpler approach in many instances: Web-based applications, including cloud applications. Using Web-based applications has several advantages.

First, they require no new technology on the mobile device: the browsers all support HTML and JavaScript.

Second, IT can adapt many Web applications created for desktop users, including front ends to enterprise resource planning (ERP), human resources (HR), order-entry, and other enterprise applications. The user interfaces will require redesign to fit the mobile screen and to accommodate the touch interface's lack of fine input positioning of the cursor. Using existing dynamic HTML techniques, IT could establish automated layout re-rendering on the basis of device detection, so IT would need to support only one core application rather than develop several versions. Differences among mobile browsers will require custom exceptions in the HTML and JavaScript code—much as the case for various versions of Internet Explorer, Firefox, Chrome, and Safari desktop browsers.

The supporting infrastructure is improving rapidly, as solid-state storage, processing, compression, and bandwidth improvements make Web applications richer. These advances, plus advances in virtualization and user-interface mapping between mobile devices and desktop-oriented server applications, also make the use of thin-client computing—such as through Citrix, Microsoft, or Wyse terminal services—more attractive where the Web application approach is ill suited.

"It would be my preference as a developer that we will do this all in HTML5, and everything is going to be much more Web-based across all these platforms." —Aaron Levie of Box.net

The networking infrastructure also is improving and can support the need most Web applications have for continuous network connectivity. Wi-Fi networks are increasingly available in public and private buildings, and 3G and emerging 4G cellular technologies are approaching availability and speeds that reliably fill most gaps between Wi-Fi networks. The issue of not having reliable connectivity is fast receding. On the provisioning side, highercapacity servers and storage media for general uses, such as thin-client access, and specialized uses, such as video streaming, allow the back-end infrastructure to handle provisioning to hundreds of millions of data-capable mobile devices already deployed.

Third, in many instances, IT can avoid native application development on multiple mobile platforms by using the draft HTML5 specification, which Apple, Google, Hewlett-Packard/Palm, Nokia, and Research In Motion have adopted in their mobile browsers. Microsoft has not joined the HTML5 bandwagon, but says it will add HTML5 support to its new Windows Phone 7 operating system at some point.

The local storage facility in HTML5 can help Web applications continue to function even when disconnected from the Internet, at least using the data cached on the device before the connection is broken. HTML5 also supports location data, which lets Web applications tap into one of mobile devices' key information streams.

Although HTML5 is several years from final status and ratification, major components are already implemented in most popular mobile and desktop browsers, providing an opportunity for IT to test and use the capabilities over time. Box.net CEO Aaron Levie summarizes the ideal scenario: "It would be my preference as a developer that we will do this all in HTML5, and everything is going to be much more Web-based across all these platforms."

HTML5 is not a prerequisite for capable Web applications. Today's mobile Web applications typically use the HTML4 specification and add-on technologies such as JavaScript, but HTML5's adoption will allow developers to offer applications with additional capabilities and richer user experiences.

Futurist and interactive media consultant Mark Pesce figures that 90 percent of mobile application development could take place in HTML. "HTML is your low-hanging fruit," he says. "So you'll think about how to farm out your 10 percent to a tiny little app that's not going to take much development time to deploy, but does just this one thing that you can't do in HTML5." Figure 2 considers that scenario, associating application types with the kind of development needed for that type. According to those such as Pesce who are close to the topic, HTML5 methods can cover the vast majority of application needs.

Figure 2: Enterprise mobile application development circa 2012

Common smart handheld services	Texting, Bluetooth, Wi-Fi, camera, accelerometer			
Mass-consumption applications	HTML5 only	Content applications (news, books, video) airline boarding passes, cloud storage		
Employee horizontal applications	HTML5 only	Common corporate applications such as ERP, CRM, MRP, cloud-based office productivity tools		
Competitive applications	HTML5 + native SDKs	Mobile payments with device-based authentication navigation, visual analytics		
Device-dependent applications	Native SDKs	Games, environmental monitoring applications, chemical analysis tools		
	Mark Pesce estimates that 90 percent of mobile applications developed during the forecast period could be handled by HTML5. Only the remaining 10 percent need be native to the device.			

Current and future HTML technologies are likely to be used by vendors of software as a service. Salesforce.com, SAP, Netflix, Box.net, and others have already created mobile applications with such technologies. So IT can likely extend any cloud service effort to include mobile users.

Other Web-style application approaches include client environments such as Adobe AIR, Adobe Flash, Microsoft Silverlight, and Oracle Java. However, these clients are not universally supported. And none of these clients has facilities for re-rendering the user interface automatically for the client device, so such applications will require significant redevelopment for mobile, even if the underlying process logic can be used. (The user-interface issue is less acute on tablets, due their larger screen sizes.)

But screen size is not the only user interface mismatch. These client technologies as yet do not support the rich gesturing capabilities of smartphones and tablets. As a result, interactivity generally consists of mouse-style actions, which usually are more limited than gestures and require more precise motions than finger-based gestures allow.

Thus, PwC does not expect such clients to be a significant mechanism for providing multiplatform applications, at least not until they better handle the gesture approach of mobile interfaces. Adobe Systems has said it is working to revise Flash to support such standards, whereas Microsoft has built such capabilities into Silverlight for Windows Phone 7 but not for the desktop version of Silverlight that would play on a Web site.

As an interim step, IT can use such clients to make existing applications available to compatible mobile devices. After all, mobile users are familiar with using regular Web sites on their devices and adjust their expectations accordingly; the same principle applies to using Flash or other client applications.

Web-style applications are particularly suited for information consumption and for lightweight content creation and transactions, what PwC calls "engagement"—the same kinds of use cases for which Web and cloud services make sense. Because mobile devices are best suited for such information consumption and engagement, we expect most businesses to focus on these Web-based application development and delivery technologies to support most mobile users.

The new breed of mobile applications

HTML5 and client environments are useful for porting existing services to mobile devices and for enabling content-consumption and engagement applications, but they are less useful with mobile-specific attributes. One reason for this is that each mobile operating system has unique functional and/or interface capabilities that the more generic Web technologies can't take advantage of. Another is that existing technologies don't have mechanisms to handle common sensor data from the devices—such as acceleration, spatial orientation, ambient light levels, and proximity detection—that could be used for new classes of services and applications.

Thus, developers will also need to create native applications on mobile platforms that users or customers favor. That support means more than simply having a "skinned" Web application for the devices. Users form strong allegiances to the way their smartphones work, and they expect the key applications they use to follow the same approaches and tap into what they consider special about the devices. "A native mobile app should provide a user experience that is difficult or impossible to provide via the Web," says Pesce of FutureSt Consulting.

To go native means to honor each platform's user experience even if it means providing different functionality, says Srini Koushik, CTO of Nationwide. In some cases, such as Apple iOS, the operating system creator enforces adherence to such standards, while in others, the creators promulgate but do not enforce design guidelines. "There's a lot of benefit to that, especially when you get into the customer market, where people use technology but they don't want to worry about the details

"A native mobile app should provide a user experience that is difficult or impossible to provide via the Web." —Mark Pesce of FutureSt Consulting

of technology," Koushik says. "When I started working with my application developers to put out mobile apps on these devices, a key question was, 'How do I make sure that the experience—and the customer's perception of Nationwide—is a good one?"

PwC sees two additional rationales for developing native mobile applications:

- People have their mobile devices in situations where they don't have their PCs, creating the opportunity to apply technology in new domains for employees. partners, and customers. Current examples include scanning bar codes of products to look up more information or check pricing elsewhere, providing maintenance staff current status on work requests when they're in the field, and acting as remote controls for Wi-Fi-enabled devices such as TVs, building automation systems, and security cameras.
- Mobile devices have built-in sensors—cameras, microphones, location detectors, accelerometers, ambient light sensors, compasses, and proximity sensors—that provide the opportunity to tap into contextual information for new types of applications. Current examples include pedometers that calculate energy use, routing tools to direct drivers to their destinations based on current conditions, and visual heart-rate monitoring. Sensors can be added via near-field wireless networking for continual blood pressure and glucose monitoring.

Early adopters already see advantages in such novel uses. For example, InterContinental Hotels Group (IHG). which manages 45,000 hotels globally, has provisioned iPad tablets to concierges so they can help clients get information or book reservations anywhere quickly, and not be tied to a kiosk while doing so. Another IHG application allows guests to book and manage their hotel accounts while on the go, increasing mobile bookings by 500 percent in less than a year, says CIO Tom Conophy. And IHG is testing an application that uses the smartphone's speaker to emit an audio code to unlock a guest-room door, so guests don't even need to check in to get a key.

Conophy says IHG is using different devices for different purposes, based on fit for the job for internal applications and customer demand for external ones, which in turn requires a more flexible planning and deployment process than has been typical.

Nationwide has also deployed several mobile applications. A popular one for its agents lets them take photos of an accident site and upload them to the claims management system, which speeds claims processing, says Koushik.

Standard Chartered is now investigating what applications would benefit its staff. "We don't want to create an app just because it's neat; we want it to be something that will add value to the bank and make people's lives easier," says Todd Schofield, who leads a mobile development unit for the bank. His unit is looking at the use of location-based services to tell what's going on in an office or a city, and at the bar-code-reading feature of the iPhone for asset-management tracking of PCs and to track bar-coded paperwork.

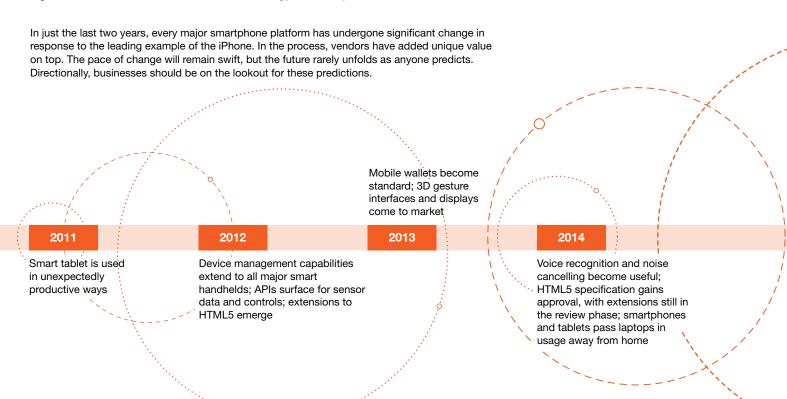
In some cases, multiplatform software development environments, such as the one by the Eclipse Foundation and commercial products from Appcelerator and Rhomobile, will ease the development of multiple native versions of an application. But PwC believes that the richest applications will need to be developed on the native development tools provided by each mobile operating system creator. Even today, a mix of applications exists depending on the degree of desired nativeness, and PwC sees no reason why that fact will change.

Conclusion

The rise of mobile device usage by employees and customers has the potential to introduce transformative capabilities into business, but at a cost of accepting platform heterogeneity and sharing ownership of devices with employees.

Although the current stable of mobile operating systems is daunting, PwC expects the number of viable platforms will shrink to a manageable four to six, and most companies could focus on perhaps three.

Figure 3: Milestones on the mobile technology road map



Still, that reality will mean being more focused on application functionality, rather than trying to deliver Swiss army knife–style "do it all" applications. And it will require knowing when using a common technology such as HTML5 is a workable approach versus creating native applications for your target platforms.

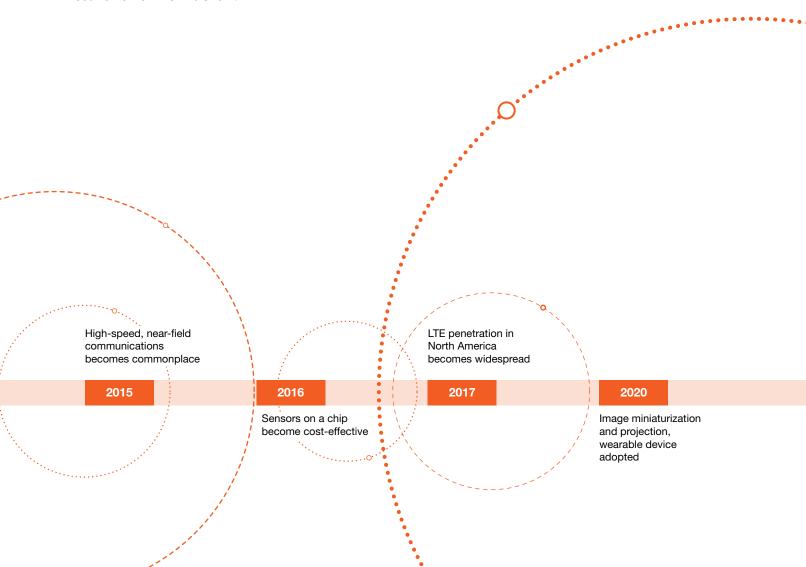
The heterogeneity of mobile devices and the rapid change in enabling technologies such as HTML5 mean that companies will need to rethink how they adopt and deploy them. Application development and platform adoption time frames need to be flexible and short.

Applications—both client and back end—need to be modifiable to take advantage of new mobile capabilities as they appear, without massive reprogramming.

User interface expertise will become critical, because mobile devices are fundamentally different from PCs on this score. Also, because users and platform developers are still figuring out what works best, best practices are unclear, requiring more ongoing attention on UI issues than is typical for corporate application development.

Above all, experimentation is important because users are just starting to figure out what they can do with these versatile devices that are always at hand, and technologists keep inventing additional capabilities. PwC does not expect this opportunity-providing instability to settle down for some time yet. In fact, as the timeline in Figure 3 points out, the series of developments we anticipate over the next decade will likely provide plenty of opportunity, not to mention instability.

Unleashing enterprise mobility



Blending work and life on smartphones

Todd Schofield of Standard Chartered makes enterprise application platforms from consumer smartphones.

PwC: What's your role currently at Standard Chartered, and what were you doing before you came to the company?

TS: I've been with Standard Chartered for a couple of years now. I moved into a new role about a year ago to do a transition to the iPhone. I also recently relocated from Singapore to the San Francisco Bay Area to set up a small innovation technology office for Standard Chartered. Our plan is to tap the Silicon Valley and the San Francisco Bay Area resources that can really help ensure that we deliver very rich content.

Before taking on this role, I was in charge of the client systems at Standard Chartered—all of the various platforms that have to do with end users. This included our 80,000 desktops and laptop PCs, BlackBerry devices, Active Directory, e-mail, and SharePoint.

What's the scope of your conversion plan to the iPhone platform?

We are geared up to continue to produce iPhone apps and iPad apps, and we also will look at other platforms for both internal and external use. This includes our customers for the retail bank, which we call our consumer bank, as well as our wholesale bank and what kind of value we can help add there.

What's the strategy behind the plan?

We want to be more application driven than e-mail driven, which is why we chose to convert to 8,000 iPhones. We want to move from an e-mail-centric device to an application-centric device that also does e-mail.

What we are really after is how we can do business more effectively with an application-centric platform. In our case, the bank is buying each iPhone, and so it's considered a corporate device—not something the individual owns. The bank owns the iPhone and the data plan for it. And we are building the infrastructure to be able to support that. We have already written our own internal suite of applications for the iPhone, and those are being rolled out now to our iPhone users.

What have you been doing to implement the plan?

This is uncharted territory in terms of device controls; we've made some decisions to see that essential controls are put in place. For example, we are not allowing users to install iTunes on their work computers, although we are encouraging people to install it on their home computers.



Todd Schofield is the global head of enterprise mobility at Standard Chartered, a bank headquartered in London with 1,700 branches in 70 countries. In this interview, Schofield outlines the bank's innovative approach to standardizing on an application-centric smartphone platform, and he describes how smart handhelds have opened new vistas for enterprise applications.

That means when they want to upgrade the OS [operating system] or add a patch, they will need to do it from their home PC. We don't allow them to install it on their work PC because we don't want to give admin rights to everyone or open ourselves up to bandwidth utilization issues. Even though only 8,000 people will have iPhones, we expect that number to grow to between 13,000 and 15,000 by the end of 2010. We don't want these users' media libraries to live on corporate PCs.

That being said, we have been positioning the iPhone as a blended work/life device. We encourage people to load apps that they like or find useful, as well as the Standard Chartered applets that we can push and pull to their screens.

This model moves away somewhat from the traditional controls approach that we have for our PCs. For the iPhone, we don't have the same kind of visibility because it's not connecting to the corporate network in the way a Windows PC is. The user is responsible for upgrading the OS on their own home computer's iTunes. That's a bit of a mind shift.

"We encourage people to load apps that they like or find useful, as well as the Standard Chartered applets that we can push and pull to their screens."

So we are moving away from traditional extremely tight control. But from another viewpoint, we also need to maintain control. We need to make sure that development standards are adhered to, that hardware standards are adhered to. that there's compatibility with our Exchange systems, VPN [virtual private network] systems, or the interface back into our enterprise systems. All that stuff can be very delicate. If people were trying to use all sorts of different devices, we'd spend so much time and effort just trying to make it work — that's one reason for standardizing on the iPhone.

How did you come to a decision to offer the iPhone and support it this way?

This was the brainchild of Jan Verplancke, who is our CIO. Jan was very interested in moving to a more dynamic platform. He wants to see how can we move to this next phase? How can we move to a new stage?

How can we do things better? How can we do things differently? We have some very good support from Peter Sands, who is the CEO of the bank that Jan directly reports to. Peter really buys into this vision also, as far as wanting us to be a technology-driven organization as opposed to just a technology-supported organization.

He sees the iPhone as having the potential and the capability as well as the critical mass in the consumer world to be able to make that transition to overlap into that enterprise base. He doesn't expect this to ever become a fully corporate device. He understands that this is a consumer device, but it is something that is strong enough now to be used in the enterprise world.

The traditional laptop with a VPN and message-centric mobile devices become very limiting. When salespeople, for example, need to update sales files, they wind up doing that long after the fact through their laptops. If we can offer instant access through an iPhone, then updating sales files is something that we can make easy. We can do a whole variety of things both with stuff that we write internally as well as third-party apps.

The other piece of this—which some organizations see as a negative, but we see as a positive—is the Apple SDK [software development kit]. To many people, that means Apple has the control and you can't deviate from what they do. We see that as a positive thing rather than something that's limiting.

We want applications that are going to be written in a very standard way using the SDK and that are going to be there for more consistency and more reliability. If we do something that's a bit more open source, then it winds up in the different flavors of open source and can wind up being nonstandard. But because Apple is so focused and tightly controlled on the way that development works for this platform, we think it will allow us to provide better applications to our users and will allow us ultimately to provide better service to our customers.

You're responding to a mix of different demands, both internal and external, yes?

Definitely. We expect to start to get more ideas from the staff, and that's where we think a lot of the great ideas will come from. The staff is on the front lines, looking at what the possibilities are as people become more familiar with the iPhone platform and what it can do.

For instance, we could use locationbased services to tell what's going on in an office or in a city, or use the bar-code-reading feature to do asset management tracking of our PCs or paperwork that's bar coded as it flows through our systems.

And as we are doing that, we are looking to see where we can add value. We don't want to create an app just because it's neat. We want it to be something that will add value to the bank and make people's lives easier.

In this issue of the *Technology Forecast*, we're contrasting content creation and content consumption. There is an emerging category in the middle we call engagement—interacting with the content to some extent, say on an iPad, but not doing something as involved as building spreadsheets. Can we talk a bit about that third category?

An example of "engagement" might be the acronym directory app we've created that's available through the iPhone. So if I see "CB" [for commercial bank] all over the place, when I go to that commercial bank. and I look it up, I discover that CB actually means consumer bank, and so I can add that definition for CB. We've done that for a little iPhone applet now. Also, if I try to look up wholesale bank for "WB" and it's not there. I can add in "WB," and that abbreviation in turn will show up on everyone's iPhone. It becomes a collaborative effort and something that is a bit more like a wiki, so that we can collaborate and share information. We definitely wanted apps for folks to be able to consume content, but we also want the ability for our people to add value and add content, because that's where we think that the space needs to go.

What best practices or innovations have you developed to roll out the iPhone environment?

A lot of it links to back to the security. For example, we use unique digital certificates for access to the VPN, as well as to the wireless itself. If I'm an iPhone user, a certificate is generated for me in a configuration profile, and I then put it on my iPhone. It will install only on my iPhone. If something happens to my phone, we can revoke access to that certificate immediately. We can remote-wipe the phone.

Another new thing we're doing is that we are not blocking any content from the iPhone that we do block from the PCs, and this is because the folks who have iPhones are, generally speaking, the folks who are working like crazy. We don't want to disrupt what they are doing. We want them to be able to take full advantage of the device in both their personal lives as well as their work life. We are using this as a benefit for employees, so they can take care of some of their personal things as well as take care of their work things, all through one device.

We expect and require users to be professional and follow the rules. But we also need to change the control mind-set in which we are accustomed to being in full control, with PCs and the networks locked down. We have to break ourselves of that mentality. Instead, we trust our users and assume that they will behave responsibly.

One of the principles that Jan is really after is that we don't want to punish the 99.9 percent of people who behave for the 0.1 percent of people who misbehave. We would rather deal with that 0.1 percent appropriately. and we have the normal policies you would expect about being a responsible corporate user and representing the bank in a professional manner—all this is part of an employment contract. But as offenders come along, we will certainly deal with them in the appropriate way. We really try to make sure that we are empowering users to do more in both their personal life as well as their professional life.

You are investing a good deal of money in this. What do you think the payoffs are going to be? How did you convince management to make these extensive investments? There must have been some expectation of a return. What do you think that return is going to be?

A lot of the return in the long run is going to be about employee efficiency and effectiveness—how they can be more proactive, have better and faster access to information, and can hold these unlimited possibilities in the palm of their hands wherever they happen to be in the world.

We don't know what limits we will hit with the iPhone or iPad. We see it as kind of limitless. We could push it in so many different ways.

"A lot of the return in the long run is going to be about employee efficiency and effectiveness how they can be more proactive, have better and faster access to information, and can hold these unlimited possibilities in the palm of their hands wherever they happen to be in the world."



How to exert leadership on enterprise mobility

CIOs need to acknowledge that the IT capabilities of employees' own smartphones threaten the status quo.

By Bud Mathaisel

Enterprise mobility isn't happening the way we thought it might. We assumed the IT department would be in the driver's seat, executing a carefully mapped plan to take the enterprise where it wants to go. That scenario isn't entirely absent, but in many cases IT is slow to capitalize on the opportunity. When IT does not provide solutions, impatient business unit managers turn to the myriad opportunities outside, including services offered in the cloud by third parties.

Executives embrace powerful new mobile technology from third parties and ask employees to use it. Or employees themselves seize the opportunity and do what they want with handhelds and mobile applications available for download. Rather than following a carefully mapped plan, enterprise mobility is going viral.

CIOs can't just watch and wait this time. Mobile technology is unlike the earlier technologies adopted independent of IT. With the personal computer, the Internet, and others, the CIO had some level of confidence that the chickens would come home to roost—inevitably, the CIO did gain control at some later stage. Enterprise mobility is different because the applications in use are likely to be in the cloud, professionally written and run. As Figure 1 underscores,

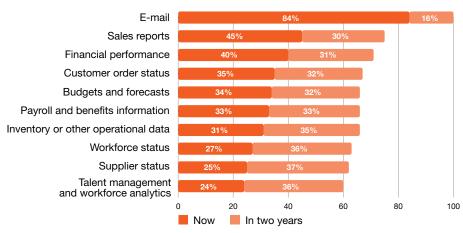
the next two years promise substantially more access to corporate information through the use of smart handhelds. There might be no independent trial within the enterprise, nothing for the CIO to eventually take over and make robust for everyone. To stay engaged, the CIO must influence mobility from the start.

Influence this time around begins with acknowledging the new power of personal IT. "The CIO has to come to terms with the fact that everyone's walking around with significant IT capabilities," says futurist and interactive media consultant Mark Pesce.

As noted in the PwC white paper *The situational CIO*,¹ it is a given that a CIO must balance the multiple and sometimes conflicting demands of providing information access and IT services to the organization. Now, because individuals are bringing their own IT assets and infrastructure with them, the CIO and the IT team need a strategy for managing this phenomenon, including how to choose and what to enable.

¹ See http://www.pwc.com/us/en/technology-innovation-center/cio-operations-strategy-sourcing-budget.ihtml.

Figure 1: Corporate information types accessible via smart handhelds



Based on a survey of 1,004 director-level and above respondents at companies of all sizes

Source: Bloomberg Businessweek Research Services, 2010

Through research, PwC has identified several best practices any enterprise mobility strategy should include:

- Enable grassroots research and development (R&D) capabilities
- Understand device choice options
- Assess the payback potential
- Establish new governance approaches
- Formulate new business process models
- Provide new infrastructure and skills

Enable grassroots R&D capabilities

Don't expect or insist that IT is the only wellspring of ideas. Although IT may have already identified some mobility opportunities, it is likely that new applications will be developed from the ideas and initiatives of employees. Sponsor internal R&D activities for mobility across the whole organization, not just in IT.

This cross-functional approach has at least two benefits:

- Because many employees are knowledge workers, they will have insights, experiences, and passions you can leverage.
- When you give people an official enterprise channel for their ideas, word gets around and you help make your organization a place where more people, especially Millennials (those born after 1980), will want to work.

Some organizations have sponsored innovation prizes to encourage idea generation and sharing, but the setup and management of that process can be tricky and could work against those who are most inspired to share their ideas. It is likely that many mobility ideas will come from the younger workforce—the Millennials—but it is inappropriate to be exclusive.

Tom Conophy, CIO of InterContinental Hotels Group (IHG), encourages an enterprise-wide approach: "I sponsor R&D-type activities across my team. I have about 800 employees across the globe, most of them knowledge

workers and computer scientists. I've always been a strong believer that you have to give people outlets. They have their day jobs, and then they have their passions. The idea is to try to turn on some of those passions. So we've established these labs, which we call gulags, and we let anybody with reasonable ideas come in."²

Unlike any previous IT initiative sponsored by headquarters, mobile devices are ubiquitous and designed to provide independence. Some CIOs have invented a few things in their digital labs, but other CIOs are sourcing ideas from end users. For example, Standard Chartered is investing in a special applications development environment in San Francisco's media district, South of Market.

"We plan to have our San Francisco entity stay very small and nimble, and be able to bring in new ideas, deliver quickly, and then move on to the next thing," says Todd Schofield, head of a new mobile development unit at Standard Chartered. His strategy is influenced by the creative environment associated with the South of Market neighborhood in San Francisco. However, great inspirations can come from anywhere, and the best advice to CIOs is to give knowledge workers the tools and the resources to make mobility work well.

The CIO needs to ensure that the R&D teams adhere to development and hardware standards, especially for the interfaces among enterprise systems. As CIO, the other important contribution is to put the infrastructure in place to enable the R&D, including wireless access, security, help desks, and so forth, as discussed in the article, "Turning handheld power into enterprise clout," on page 06.

² See the interview with Tom Conophy on page 16.

Understand device choice options

Providing IT devices to end users is nothing new, but mobile devices create a dilemma for organizations: to provide a standard device to every user, or to accept users choosing their own—known as "bring your own device" (BYOD). The first option gives IT the kind of control it is accustomed to having over enterprise technology assets, while BYOD embraces the personal empowerment that has helped make these devices so powerful in the first place.

PwC research suggests that limited BYOD will become the rule more than the exception, in part for reasons expounded in the article, "Turning handheld power into enterprise clout," on page 06. For some organizations, BYOD is perfectly appropriate right now; for example, when the organization is quite diverse or in a stage of experimenting. In other cases, the diffuse nature of BYOD might require the CIO to spread the applications and infrastructure teams too thinly.

It is true that the shift from an enterprise choice to an individual user choice adds a great deal of complexity, and the shift could result in a patchwork of devices with varying capabilities. For some organizations, this is no issue and actually supports the broader move to create a more employee-empowered culture. For others, it is a problem for two reasons: security and applications integration.³

For security reasons, limited choice might be appropriate in areas where a high degree of rigor and consistency are required, such as in regulated environments, finance, protected data, and physical safety. At least for now, some organizations are limiting the choice of device, operating

system, and applications in these circumstances. It is wise to apply this restriction sparingly and to let BYOD be the default. Providing the devices at no cost to selected end users is a helpful catalyst to reduce clutter and ensure focus on a mobility strategy. A variation on BYOD that might be best for many enterprises is to limit employee choice to a few of the more popular consumer devices that can be more easily integrated and supported, ensuring a first-class approach to that support.

Applications integration is another argument for providing every user with the same device, or at least limiting the choices. "We previously had message-centric devices and we are converting those to iPhones," Schofield says. "The intent is to be a more application-driven company rather than an e-mail-driven one. We want to move from an e-mail-centric device to an application-centric device that also does e-mail."

To enable this conversion, Standard Chartered is launching an enterprise applications store roughly equivalent to the Apple App Store, from which applications can be downloaded that fit the specific purpose and parameters of Standard Chartered.

Assess the payback potential

CIOs usually have an investment payback mind-set. Because enterprise mobility is relatively early in its adoption cycle, many organizations approach the investment as either a means for cost reduction or for improved personal productivity. Although the justification may be quantifiable, many organizations take as a matter of faith that their mobility investments and initiatives will produce a payback.

Cost reduction could come from two approaches, depending on the organization. One path reduces the number of devices to a manageable few and provides complete help desk, security, and support for those fewer devices. Another path exploits the fact that many mobile applications and data could reside in the cloud and leverages cost-effective economies of scale in the cloud.

Whether an organization achieves improved productivity depends on the organization and the nature of its business. For a consumer-oriented business, the opportunity to reach out to end customers through applications that they would want is considered an eventual benefit. For other organizations, enabling mobility is a way to attract and keep the best and brightest of younger workers.

Standard Chartered is counting on improved productivity through benefits to employees. "A lot of the return in the long run is going to be about employee efficiency and effectiveness," Schofield says. "We really want decision making to be able to happen faster. As everyone knows, e-mail is a horrible form of communication."

PwC research suggests that, for the foreseeable future, enterprise mobility devices will be used in addition to the PC. However, as more computing activity occurs on mobile devices and more applications are based in the cloud, PCs may be used less often, allowing enterprises to keep employees on older models longer. It is also likely that companies will eventually be able to invest in a set of wireless peripherals, including full-size keyboards and computer screens that would allow the mobile device to become the "hub" in a docking-as-you-need-to approach for desktop computing chores, giving employees even greater flexibility.

³ See the interview with Srini Koushik on page 44.

Establish new governance approaches

Even more than with previous technologies, mobility is about people and their use of the device, which can be a very personal matter. The IT organization often underestimates the cultural change needed to employ technology, and this challenge is especially true for a technology with roots in the personal domain. The wise CIO will seize this opportunity to establish a culture around mobility.

Current best practices suggest establishing a culture appropriate for this stage of evolution—a culture that aligns with the reality of the workforce today. Right now, excessive controls could stifle the creativity needed for enterprise mobility. Early adopters are—by nature—likely to be among the most creative users, and you don't want to squelch them. The "feel" of this culture is about experimentation and early adoption, but with important boundaries. Balancing the two will take persistent leadership and frequent, open communications.

The PwC white paper *The value-creating CIO* makes the case for balanced controls in situations such as enterprise mobility. Establish basic rules of behavior, but not too restrictive, given this early stage. The rules of behavior for IT professionals may not need to change, but because the value-creating team now expands to include many non-IT professionals, the rules of behavior must accommodate the broader base. For this broader base, the rules of behavior could include:

- Continue to strictly follow the enterprise security policy (updated for mobility)
- Avoid any potential embarrassment, especially given the potential for social networks to be a source of embarrassment

- Minimize the use of company time to do this work
- Share what you learn

Perhaps most usage policies reflect the enterprise's awareness of data privacy and other legal matters. But the more that mobile devices are used for both personal and business applications, the more diligence CIOs, legal counsels, and human resource executives will need to exert over unresolved legal standards. The realm of data privacy, particularly regarding mobile devices, has not been fully resolved by the courts.⁴

Rules that are too restrictive could be a problem for new employees, presumably hired because of their accomplishments in previous jobs. But what if those results were aided and abetted by a mobile device and a number of applications that—under your policy—the new hire can't use? You run the risk of "cutting off half of the value that you are hiring the person for," notes Srinivas Krishnamurti, senior director for mobile solutions at VMware.

Celebrate the creative ideas and breakthroughs of those who produce useful results. PwC's *The situational CIO* white paper emphasizes that communication is an essential skill and a crucial part of the CIO's job. This is especially important in mobility because of its very broad range of participants.

While specific approaches to fostering the right culture will depend on the organization, the digital labs referenced earlier can be a convenient and visible way to organize mobility initiatives. It is important also to reach outside the enterprise to customers and business partners.

Some organizations address the customer side through focus groups and structured marketing initiatives around mobility. Others approach this less formally through social networks, monitoring what customers say about the company and do on their own. Mobility is a great opportunity to connect with the customer base, especially if your customers are among early mobility adopters. Establish and publish the code of conduct for the enterprise and for those who connect to the enterprise. much as you already have done with privacy and security standards.

Mobility is also a great opportunity to leverage partner ideas and buy-in. In the same way some lean manufacturing organizations encourage partners to contribute to the design of products or improvements in distribution, collaboration could work well when creating mobility applications. This collaboration could be especially important in industries that have unique security requirements or regulations that affect everyone in the ecosystem.

The Health Insurance Portability and Accountability Act (HIPAA) and the Health Information Technology for Economic and Clinical Health Act (HITECH) "forced us into data encryption for our remote sales force," says Larry Herrmann, manager of global IT customer support at DJO, a medical device manufacturer.

Most IT organizations have worked diligently to secure their wired networks and data to meet regulatory and compliance standards. Mobility will challenge the traditional approach to imposing security standards on end users. Because they consider these devices their property rather than a corporate asset, end users will likely balk at the centralized

⁴ The closest the US Supreme Court has come is its unanimous decision in Ontario vs. Quon, in June 2010, involving the privacy of the personal use of an employer-issued digital pager. For many reasons, not least of which is the majority opinion stating the ruling was narrowly based on the particulars of the case, the issue of data privacy in mobile devices still appears to be wide open. For more on the case, see http://www.supremecourt.gov/opinions/09pdf/08-1332.pdf and http://www.nytimes.com/2010/06/18/us/18scotus.html, accessed November 2, 2010.

controls now available and appropriate for devices containing corporate and client information. CIOs should begin the education process early, since there is benefit to early cooperation and buy-in from users and business partners.

Formulate new business process models

Those who have adopted business process reengineering as a continuing endeavor will find mobility to be another opportunity to rethink workflow, touches, and information exchanges. The fundamentals of business process reengineering, postulated in the early 1990s by Tom Davenport, Michael Hammer, and others, are perhaps even more relevant with mobility because one of the fundamentals is to start with the customer experience and work backward to envision how the customer experience might be improved.

Tom Conophy of IHG observes that "a perfect storm" of new capabilities is converging. The example of D7 Consulting described in the article, "Turning handheld power into enterprise clout," on page 06 underscores how nagging process bottlenecks finally can be alleviated with the help of the current generation of smartphones and tablets.

In contrast with an R&D effort. which is more about sourcing product line innovation, business process improvement implies a strategic focus on any potential enablers of that improvement, as Figure 2 illustrates. Procurement of the devices, by contrast with the other two activities, would seem to be straightforward. The value a CIO adds will come from considering each of these elements in conjunction with the others. Much depends on a holistic approach to the

resources that are available—not just what the enterprise owns or can procure, but a broad view of the capabilities employees bring with them, and how those capabilities can lead to IT as a "competitive differentiator," in the words of Srini Koushik, CTO of Nationwide.

The CIO's leadership of mobility entails simultaneous focus in co-dependent areas:

- Redesigning business processes; customer-facing processes are a first priority
- Establishing R&D centers for in-house development of leading applications
- Reducing procurement barriers to device adoption; this is clear CIO leadership territory

Provide new infrastructure and skills

Mobility requires some new skills in the organization and changes to the basic infrastructure. Even when ideas and applications are developed in a grassroots lab, the CIO and IT organization will be responsible for integrating the innovations into the IT infrastructure. While the specifics will vary by organization and its legacy, some important new elements must be addressed.

There are two fundamental integration issues for enterprise mobility. The first is browser capability or enabling the mobile device for the same screens that appear on the laptop or desktop. The second is to use the capabilities native to the device to augment previous applications or new ones. Under the CIO's leadership, the technology plans for each must be inherent in IT

Figure 2: CIO focus for mobility

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Strategy		Actions	Focus
		Redesign business processes	Customer facing
Sourcing and orchestration		R&D centers	In-house development
IT operations		Prepare	Buy devices
		infrastructure	Buy devices

The CIO's leadership of mobility entails simultaneous focus in co-dependent areas:

- Redesigning business processes; customer-facing processes are a first priority
- Establishing R&D centers for in-house development of leading applications
- Reducing procurement barriers to device adoption; this is clear CIO leadership territory and could be part of the R&D effort described in the article

strategy and budgets. Knowledge of the emergent technologies is essential to develop a coherent plan; developing or hiring those with that knowledge is the CIO's responsibility.

Specific skill sets, of course, are important. Because HTML5 is likely to be crucial to mobility, it would be wise to have at least a few people in your IT organization acquire or update those skills. This is also a time for CIOs to update their portfolio of vendors. The IT organization needs to lead in researching, identifying, and contracting with providers that will be the future suppliers of choice.

A related challenge is modification at the front end to integrate devices with enterprise applications and data in the current architecture. Many of the executives interviewed for this issue of the *Technology Forecast* suggested they would handle this integration through the cloud, provisioned internally or externally. Mobility could become the

tipping point that encourages the use of cloud services.

Another critical issue is mobility security, which requires a rigorous approach to asset management. For example, to know which devices are being used by whom and to be able to update the information, IT must monitor device activity and manage the contents of the devices. As Figure 3 illustrates, the current generation of smartphones makes good use of the security model that evolved during the e-mail messaging generation.

Technology has followed a cyclical pattern three times with enterprise mobility. Each time, the technology arrives and enterprise adoption lags while the enterprise voices security concerns. Then vendors address the concerns. In the case of thirdgeneration application-centric phones, good security is becoming available and should be broadly adopted soon.

During interviews with PwC, many CIOs indicated that a major enabling factor to mobility is the ability to wipe devices of content if they are lost or stolen, which most smartphone platforms now support. The IT organization needs to choose the tools to do that and be able to respond immediately when it is required. (The article, "Mobile technology's journey from peril to promise," on page 20 explores the security issue in greater depth.)

IT leaders have two new security approaches to mobile devices:

- The capability to restrict mobile device information and network access; devices configured with a unique IP address have a distinct ID.
- The capability to remotely wipe and completely clear any device lost, stolen, or compromised.

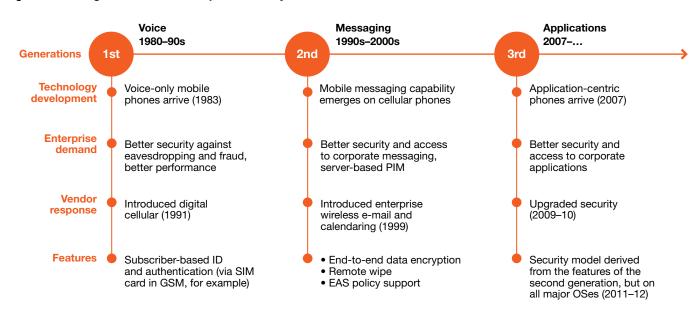


Figure 3: Three generations of enterprise mobility

Technology has followed a cyclical pattern three times with enterprise mobility. Each time, the technology arrives and enterprise adoption lags while the enterprise voices security concerns. Then vendors address the concerns. In the case of third-generation application-centric phones, good security is becoming available and should be broadly adopted soon. "Mobile technology's journey from peril to promise" on page 20 considers the security prospects for smart handhelds in more detail.

So, while enterprises can allow some flexibility in the choice of devices, any device must comply with the security standards. As Todd Schofield of Standard Chartered states, "We use unique digital certificates for access to the VPN [virtual private network] as well as to the wireless itself. Based on the unique serial number of my iPhone, a certificate is generated for me that restricts access to data and applications."

The cost of wireless communications will be another challenge. Many cell phone users have experienced the nasty surprise of an unexpectedly large phone bill. That problem was eventually addressed through fixed-price plans and by negotiating attractive rates from carriers. PwC research indicates awareness of this issue and some early discussion with telecommunications carriers, which are offering no new programs yet.

"Telecom is going to be an issue for all of us. We see that the unlimited is going away," Herrmann says. The best approach may be to begin service contract discussions with carriers now and to ensure that users have access to their usage costs. In the meantime, to provide a direct incentive for cost control, many companies are reimbursing employees a fixed or capped rate for smartphone communications usage.

Besides working with carriers, some enterprises are preparing internal facilities to accommodate a broader use of wireless within the enterprise, which can help control costs. "We are building Wi-Fi networks in our major

"We use unique digital certificates for access to the VPN as well as to the wireless itself. Based on the unique serial number of my iPhone, a certificate is generated for me that restricts access to data and applications." —Todd Schofield of Standard Chartered

offices, so that if I got to Hong Kong or London or Shanghai, or wherever, my iPhone will see that [a wireless network is available] and it will transfer me from roaming on a 3G network. It will move me over and make my data connection go through wireless Internet, so now I'm not roaming anymore," Schofield says.

Another big challenge is to provision more robust input and output capabilities than are possible with the mobile device itself; for example, the ability to input or output large amounts of data, especially from spreadsheets and presentations. This challenge relates to the wireless telecommunications challenge, but is internal to the enterprise.

Apple enabled wireless printing capability for the iPhone and iPad in its iOS 4.2 update in November 2010. More such features are coming from mobile vendors themselves, although the internal IT organization can do a great deal to prepare and enable this capability by choosing display and printing facilities that work wirelessly. Once this input/output piece is addressed, the "mobile mainframe" is in the hands of the users.

Conclusion: The mobility imperative

Timing may differ by organization, but eventually mobility will play a significant part of any enterprise information services—both internally to the organization and externally to customers. Some people see the opportunity to create a specialty position: chief information mobility officer.

In some organizations, CIOs have decided to free themselves from their current responsibilities and focus on enterprise mobility and new IT strategies. To a CIO, mobility at this stage can be frustrating. It may seem a contradiction to lower costs and improve security and controls while simultaneously encouraging the innovation mobility can provide. In one organization, the CIO named himself the chief technology officer and appointed someone else to be the CIO. Patience and a balanced control approach would be the main attributes of the IT leader of mobility, because the rewards will come.

The CIO has an opportunity to lead; otherwise, someone else will. Enterprise mobility is either the next CIO leadership opportunity, or the next missed opportunity.

Anticipating the next phase of enterprise mobility

Srini Koushik of Nationwide thinks out loud about how handhelds are influencing enterprise computing overall.

PwC: What's your role at Nationwide?

SK: I have what you would consider the traditional CTO functions of R&D introduction of new technology into the company, governance over the enterprise architecture, and architecture in general. My functions also encompass information risk management, which includes security and compliance. Then there's shared services and shared applications, which include applications such as Nationwide.com. My team consists of about 1,400 people.

What's notable about Nationwide from an IT perspective?

From an IT standpoint, the cool thing about working at Nationwide is that—from the board downward—they absolutely recognize IT as a differentiator. We are probably more heavily in-sourced than most of our competitors. Over the past eight years, we have needed to get very good at managing and supporting our shared infrastructure and introducing new technologies.

We know about your mobile applications on the customer side, but we're also curious about other kinds of applications you've developed. What sort of mobile workforce do you support?

We were the first insurance company to come out with an app on the iPhone. That was primarily aimed at our insureds, our policyholders. Over the last year and a half that we have offered the application, we have enhanced the features to do a lot more things such as paying bills and other capabilities. That app was very focused on B2C [business to consumer].

The B2B [business to business] component of our mobile strategy is all about how we enable our exclusive agents, suppliers, and wholesalers. We provide tools for lookup and sales effectiveness. We have a mobile app that many of our agents use—they can take a picture of a car, for example, and they can upload it and store it on our cloud storage through their BlackBerry.



Srini Koushik is senior vice president, CTO, and CIO of shared applications at Nationwide. He previously held three other executive roles at Nationwide in the area of IT over the span of eight years. Before Nationwide, Koushik was CTO of business innovation services at IBM Global Services.

In this interview, Koushik ponders the state of mobile security, sheds light on Nationwide's broad mobile constituency, and considers where new interface modes may open new application opportunities. From a workforce standpoint, our claims operation is a pretty big operation. Claims has always been at the forefront when it comes to using emerging technology, so that workforce is always going to be at the top of our list internally. We are increasingly trying to make capabilities available to our associates, primarily to employee-owned devices.

How did you start with employeeowned devices?

When I was a consultant at IBM a few years ago, we used to talk about pervasive anytime, anywhere access. It's taken a few years, but it's getting there. We started to look at the variability in the marketplace. How much and how far do we want to go with supporting the devices? The iPhone and the iOS operating system we definitely have to pick up, and also enable support for Android. We are still evaluating whether we want to do BlackBerry or Windows Mobile 7 as a platform.

The remote management capabilities of these devices are important. When somebody loses a device, the ability to do a remote wipe is important. As a financial services company that's very highly regulated, it is absolutely important that we try—to the extent possible—to avoid putting data on a device. We have seen a lot of progress in that space. One of the big things that has really helped us, especially in the last eight months, is desktop virtualization.

With virtualized desktops and on-demand applications, all of your data stays on our servers and you just access it from a screen. That allows us to truly jump into this base and start enabling. We have a carefully thought-through pilot that allows individuals to bring in their own devices. We are giving them access to our core applications via personally owned devices.

Today we have support for people who can bring their laptops and their own device, whether it's a Mac or any PC. Some people also bring iPad tablets. A variety of Android tablets and smartphones are in. With a selected set of individuals who have a variety of these devices, we are working with these technologies to determine what the experience looks like. What are some of the challenges we will need to overcome before a large-scale roll-up?

We have about 100 people on the pilot, including the CEO. It's going very well. Initially, it was just access to e-mail and calendar. Then the pilot provided a virtual desktop where users could bring up different content and review it. We gradually started giving them different capabilities. We're trying to establish what types of users need what types of functions. From that we can establish a support model. We absolutely think that in the next 18 months, our entire desktop and client computing environment is going to change significantly because of this.

"I believe that the days of the keyboard and mouse might be gone. You will get to a point where you flip the monitor and make it horizontal to the table surface, and then the interface behaves more like a multi-touch interface."

How are you dealing with Android being a bit behind security-wise?

Good [Good Technology] fundamentally allows us to put a protected space on the device. It allows us to secure and encrypt the data access. But it's not entirely what we need it to be. We've been pretty careful to not dive in head first. We did the Good pilot. Even though we were happy with those results, we thought maybe an even better way to do the pilot is first to provide just a virtual desktop instance. For us to do that, we need to make sure that things like the SSL VPN [Secure Sockets Laver virtual private network capabilities are strong enough.

Once the security issues get resolved, what do you think the implications will be of different interface modes that might be possible on an iPhone or the iPad, for example, versus a Windows PC or Mac? Any idea what direction that might be headed in?

Right now, it's all driven by an event-driven interface, primarily through a mouse and keyboard. Once you embrace a different interface mode, you can rethink how much data you want people to type in. If you look at most apps that are getting rolled out on an iPhone or that type of device, you really don't have to use the keyboard as much.

And then the mouse starts becoming less necessary, so what do you use the mouse for? If you need to click on a precise spot, a mouse is pretty useful. But if it's a multi-touch interface, and I can now start using one finger to do something, or two fingers to do something else, that becomes powerful. This is what most of the iPad devices look like. I think it starts challenging the way we build user interfaces.

When it comes to claims application design, what would the front end look like? How would you build that same Web-based app as a native app, so that when the claims adjuster is walking through a house after a hurricane to establish the damages, how do they use the multi-touch and the GPS to start pulling in specific coordinates? Can they use the device to measure the size of the hole on the roof? Can they use a device like this to make the job easier?

I've been proven wrong several times in the past, but I believe that the days of the keyboard and mouse might be gone. You will get to a point where you flip the monitor and make it horizontal to the table surface, and then the interface behaves more like a multi-touch interface.

Does this also have implications for rethinking data visualization?

When it comes to spreadsheets, trying to do the same thing a mouse and a keyboard do with a multi-touch interface is going to be very difficult. But you can do it by looking at visual representations of data.

I will give you an example. Newsmap (http://newsmap.jp/) brings up a screen, and the visual interface is very indicative of what story has been viewed. It's all represented as squares on the box, and the size of the squares describes how many people have accessed this page and stayed on it. It uses screen real estate to show the importance and the relevance of the story. A Newsmap-type of site works much better on a multi-touch interface.

I believe we will get to the point where you will look for visualization of data in such a way that these devices become the natural way to use things. Apple's Keynote is an example. I have built a few presentations using Keynote on the iPad, and you can do some pretty decent presentations at this point in time. Apple hasn't addressed all of the issues yet, but the company will revise as it goes forward.

It sounds like there are two different camps of users that you are supporting: the people such as the claims adjusters who are obviously on the road a lot, definitely using the mobile device most of time, with certain kinds of input that they need to provide; and then finance and accounting, for example, who might be on the older-style mouse-and-keyboard interface for quite a while. Could you pretty much treat them separately?

Yes. It will take a while to change that second population, but the first one is really looking for convenience. The biggest part for our claims reps is the interaction with the insured. When somebody has a loss, the face-to-face interaction is a big deal. To the extent that the device or the computing infrastructure that you give them is seamless to the way they interact with people, it's very useful. Contrast that with somebody who is sitting and looking at spreadsheets and creating PowerPoint presentations. We are looking at the opportunities for us to continue to figure out how to use mobile devices there.

What kinds of mobile vendors are approaching you and your company most frequently and with what kind of messages?

It's been the small players, a carrier because of the two-year contract that we signed with them, and the device vendors wanting to talk about where they see mobile heading. The device vendors are pretty serious about the business marketplace. They are bringing a lot of their thought leadership and showing how you can build applications. They are just trying to get mind share in this space.

It's been helpful because we are able to let them know our requirements from a product standpoint. For example, we tell them our camera is going to be critical for claims, here are the reasons why, here are the things that our claims reps do, and it's important that we have this type of camera. These vendors are getting used to working with the enterprise environment.

"The device vendors are pretty serious about the business marketplace. They are bringing a lot of their thought leadership and showing how you can build applications. They are just trying to get mind share in this space."

The new power of the cybernetic employee

Mark Pesce of FutureSt Consulting considers how work gets done differently in the new mobile enterprise.

PwC: One of the main points we're making in this issue of the *Technology Forecast* is that the enterprise workforce is really a cybernetic system, with workers becoming inseparable from the devices and the personalized information clouds they bring with them. How should enterprises adapt to accommodate these cybernauts?

MP: What's happening is that the cybernauts are bringing their own mind-set. If you took away the device, the mind-set would persist, and it does. You can think of Web sites as devices. Corporations can block Web sites, but that doesn't actually change the way people are thinking.

Cybernauts don't really respect the layout of the information flows as dictated by a hierarchy. That is the core first principle that you need to work from. The information flows they use probably don't have anything to do with the hierarchy of information flows that have been established over the organization's lifetime.

Toffler called this the adhocracy 40 years ago. We're now seeing what the adhocracy looks like and how it has been facilitated, because everyone is now walking around with the equivalent of 1980s Cray supercomputers in their pockets. Everyone now has tools to manage that. The CIO must come to terms with the fact that everyone is walking

around with significant IT capabilities. People don't think of these as significant IT capabilities, but they are.

That then changes the equation. What is the CIO doing? The CIO was responsible for protecting, preserving, and defending the corporate data and for providing a way for the corporation to access that data. He or she still needs to do that, but in some ways that's become significantly less important because everyone walking into the organization is bringing their own IT infrastructure and all of the powers and capabilities that that gives them.

There will be arguments between these various IT capabilities. One set of IT capabilities will tend to inhibit another set of IT capabilities. We don't really have any good mechanism in place for arbitrating that. Maybe that's where the CIOs need to start thinking. How do you arbitrate? When an employee comes in who is better connected than anyone else in your entire organization, how do you arbitrate with that person's capabilities? How do you allow them to deploy those capabilities meaningfully without impacting your own organization?

We find this now with Twitter. Twitter has been the paradigmatic example of how organizations can spring holes in their fabric because people will just start Twittering about all sorts of stuff.



Futurist **Mark Pesce** heads his own consultancy called FutureSt, lectures at the Australian Film Television and Radio School, and is an honorary associate at the University of Sydney. He co-invented the Virtual Reality Modeling Language (VRML). In this interview, Pesce sheds light on how enterprises are adapting to the way workers in a cybernetic system do their work.

Some organizations have still not established social media policies, which to my mind is almost an impeachable offense. The ABC here in Australia has basically gotten it down to four lines:

- Do not mix the professional and the personal in ways likely to bring the ABC into disrepute.
- Do not undermine your effectiveness at work.
- Do not imply ABC endorsement of your personal views.
- Do not disclose confidential information obtained through work.1

But of course, just tell people this. These are rules of thumb. They are common sense, but people need to know it, and the organizations need to know it. And a lot of times when this doesn't happen, the organizations get in huge amounts of trouble.

Organizations have spent a tremendous amount on collaboration tools, but aren't employees just going on the Web and using what's there, because those tools are simpler and more powerful?

One time I was brought in to persuade a vice chancellor of a university to embrace Web 2.0, because the university's own IT department was not taking advantage of social media

When the IT department is not providing the solutions to people's problems, people will immediately go outside because such a wealth of things is available. People are constantly saying, "Oh, look at this great cool Web site! That solves my problem." And they'll start using it.

So the IT department now isn't just managing for itself—it's competing against all of the rest of the Internet for its users, the same as any normal portal Web site would be.

How should we think of tablets like the Apple iPad? Are they primarily for data consumption?

We're just at the beginning. In 10 years' time, we will not be thinking about the tablet primarily as a consumption device, which is

where Apple and [Steve] Jobs think it is. By 2020, after we've had 10 years to evolve how we manipulate that interface, we're going to think of tablets as consumption and creation devices.

How should the CIO think about the mobile applications environment as it is changing?

The easy way out is to grasp the HTML5 bull by the horns, because then you have something that will be cross-platform and that will work on your PC, your tablet, your smartphone....

Is that the default if you don't have a lot of resources to dedicate to this?

I would think so. How many examples of amazing HTML5 applications are we going to have to see before we understand that, ves, you do lose something if you're developing an app that's platform specific versus HTML5? Generally, for mobile applications, what you lose by developing for a specific platform will not be significant because the devices have locative capabilities and they have full HTML/HTTP capability, which is basically what you're going to need. You might not need fancy access to the camera, for example, although you might need some access to the camera. There are tagged images you

and the students themselves were

going to use external resources. I had to show the department this conversation was happening without them, because they were not providing a place for that conversation to take place. The IT department strictly controlled the Web sites that could be handled through the university. We did a survey and found that 60 subterranean Web sites were being run by different programs in the university, because they needed a wiki so they could share their work with colleagues on the other side of the world.

See ABC News, "The ABC of social media use," http:// www.abc.net.au/news/stories/2009/11/05/2733929.htm, accessed October 26, 2010.

"The IT department now isn't just managing for itself—it's competing against all of the rest of the Internet for its users, the same as any normal portal Web site would be."

might need, for example, but you can send people out to the field with a simple app to take photos that they will upload to a database. That stuff is easy. But for data entry and data analysis activities, I think the organization should be looking at HTML5. That's the foundation for the next 10 years.

One reason the Apple iPhone app culture developed was because HTML had become rather retarded and stultified, in that there were no major improvements from 1996 on. The app culture on the iPhone was the real kick in the pants. It was the competition HTML needed to go to the next level. But now that it's there, it would be wise for people to think about their deployment strategies around HTML5.

Srini Koushik of Nationwide [see the interview on page 44] thinks the mouse and keyboard interface is going away and being replaced by the multi-touch interface. Is it?

Gestural interfaces will evolve over the next 10 years. I don't see gestural interfaces as being fundamentally incompatible with HTML5. It will take some time for them to become fully blended. In 2015, we won't be having this conversation, because they will be fully blended. We already have some of the JavaScript hooks in HTML5 for gestural interfaces. We'll just see more of them. Apple, Google, and HP will be pushing very hard to do that because that's going to be a core foundation for Android, iOS, and webOS.

So HTML5 will take care of, perhaps, 80 percent of enterprise needs?

Perhaps it's 90 percent. HTML is your low-hanging fruit. So you'll think about how to farm out your 10 percent to a tiny little app that's not going to take much development time to deploy, but does just this one thing that you can't do in HTML5.

The nice thing about the app culture is that it has radically rethought what the app should do. It can do one thing. It does it well, and you're out. As opposed to Battleship Word, which has grown and grown and grown and grown? It's the exact opposite methodology.

Will native apps silo the data and inhibit sharing in the process?

Native apps use HTTP. They may use a socket, but probably not. Here's the way to think about an app. An app is basically a really well-engineered UX [user experience] in front of Webaccessible data. An app does one thing really well. An app is the front end, rather than anything that has to do with the ontology of a data set. It will become problematic if everyone thinks about an app as a silo of its own stuff, rather than a nicely engineered UX to a set of data.

When does it become necessary to develop native apps?

An app provides a user experience that is difficult or impossible to provide via the Web. The temptation with the app is to remove functionality rather than to increase it. Consumers will reject that. They expect any app to have the same functionality that the Web does plus what the Web can't do—not less.

Some Web designers have definite biases toward particular technologies. Should enterprises be selective about what development tools they offer?

There's no one right way. You need to offer multiple methodologies. This is the part where the CIO becomes involved. Rather than saying that this is the right way to do it, offer the data up and allow the communities that use that data to project that data as it's best for them. That's a policy decision, not a design decision. That's the essence of mashup culture. Google has been very good about that. Behind that simple interface is a whole set of APIs [application programming interfaces] that allows you to use the data almost any way you like.

Are mashups a leading indicator of how work might change given these kinds of developments? More people able to do more kinds of reporting, with less need to go to IT for reports? People who don't have developer skills but are able to step in that direction?

I'd love to see something like Google App Inventor or a similar tool for iPhone like Titanium that allows you to write an application in HTML or JavaScript and then compiles it into Objective-C. When you get tools like that, you significantly decrease the barriers to entry. App Inventor allows you to program Android by dragging block components into place. They use it as a teaching tool, but with it, an IT department could say, "Here's the corporate data, and here's a couple of blocks. Put the blocks together the way you want for your division." Over the next 10 years, those tools are going to become more pervasive, the quality will go up, and the ease of use will go up.

It won't be a weird decision or a hard decision for an IT department to make. IT can say, "Here's the data. We're not going to mandate how to use it.

Here are some tools. Here's what our designers think you want to do with it, but you folks can go make them."

Will this lead to more app sprawl and a more pressing need for app rationalization?

Because the app itself is generally just the viewing controller, the model [in a Model-View-Controller, or MVC, scheme] doesn't change. Even if an app ages, the data that the app is manipulating is in the corporate data center, and it's fine. So if an app ages out, you're not losing anything, even if you discontinue support for that app or if there's an operating system revision and that app no longer works.

The more a company can hew to that idea, the safer it'll be. You're never going to be completely safe. Of organizations running Windows, 60 to 65 percent are still running XP, even though Microsoft said the company will stop supporting it. It's that same problem, but I think it's proliferating much more broadly. The problem being, of course, that a data migration from XP to Windows 7 is difficult, and there will be losses. But if you've done your app strategy right, it shouldn't be a lossy transition. But again, that requires policy—architectural policy, not so much design policy—around "Here's how we expect you will work with the corporate data. If you don't do this, it will be bad."

Is the big shift really entrusting more power to more people, which implies the need for policy changes and more training?

Review policy will be important. You do still want to say, "Hi, send us your code. We'd like to look at it because we just want to see if you're doing things that aren't going to come back to bite us in two years." There will need to be a review process. But you're empowering users to work with the corporate data as they want to. Yes, it requires more training and trust, and it requires more policy.

What's the implication for talent here? What kind of people do organizations need to attract, given the trends you've just described?

We're getting to the point now where more and more people—for example, those coming out of university—have a smattering of Web skills. If that means they can get a better job in accounting, that opens up the doors in ways we weren't thinking of before. It allows us to tweak the requirements a little bit. It does mean that organizations need to communicate the new requirements to the education sector, so that students are getting the necessary credentialing before they come out and work.

But often the students are picking up these skills informally as much as they are from formal coursework.

Absolutely. They're picking it up on the street. But teaching someone the MVC model? That's not rocket science. Implementing it beyond a certain point requires some training, but teaching people how to build something that doesn't break when you start changing things—that's a course that someone could easily get in their college education. It's a course that could be called something like "Corporate Data Systems." If people are going into finance or administration or marketing, then this course should be part of their curriculum, just to give them that background. Then, when they're exposed to this stuff at the office, they know what they're doing.

Should enterprises look for people who are different from the kinds of people they're used to looking for?

It's going to be a bit of both. Those different people are starting to come through the door. There's a bit of a mismatch, because in some ways those employees aren't being fully utilized. And that's probably leading to some dissatisfaction on the job as

well, because they feel they have a set of skills that's broader than what they are engaging by playing with Excel all day, or whatever it might be. And so it's almost the strategy for employee retention more than anything else. If you want to retain them, the more you can keep them entertained with tasks that challenge them, the better.

One thing we didn't touch on that's relevant: the quality or nature of IT policy as it addresses what's outside the organization. What happens when employees are going more exterior than interior for their information?

What that means is that those chains of authority and hierarchy inside the organization are bypassed [as discussed earlier]. It also means those employees are building chains of authority for themselves that exist only partially inside of the organization. Organizations as we've known them aren't at all prepared for that. Everything becomes much more fluid and fungible in that environment. But that's part and parcel of what happens in 2010 when your 22-year-old college graduate walks into work and whips out his smartphone. That's who that person is now. They've got chains of connection that are inside and outside—on Facebook and LinkedIn, as well as inside the building.

The way that the organization counters that is through digital social networks inside the organization. Inside the organization, those are networks of expertise. The CIO needs to get on top of that, to be one of the key catalysts for that transition. That data is immensely valuable to the organization because it's creating a force to pull employees in, even as they're intent on building outward. It provides the internal force that employees will need, because otherwise they're going to tip the ship over.

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To have a deeper conversation about how this subject may affect your business, please contact:

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