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WELCOME TO THE VIRTUAL WORKSPACE





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Business and IT are entering an inverted world, where technical innovation does not come from enterprise IT but from the consumer, where mobility is central and the desktop is optional, and where standardization must give way to flexibility and innovation. The transition to this new model for client computing coincides with another major change, the end-of-life of the most successful operating system of all time, Windows XP. There is no question that these changes will be deeply disruptive; however, great change also brings great opportunity. The opportunity to reinvent and recreate the client computing environment to support a fast changing business world are almost without precedent and must not be squandered.

Central to this transition is the creation of the Virtual Workspace: a new personal computing environment that combines yesterday's physical desktop with the tablet, smart phone, and cloud services of today and tomorrow. The Virtual Workspace is not tied to a single device; instead it is a means of merging consumer-led innovation with the enterprise-class services needed to ensure not just that individual employee productivity needs are met, but that this is achieved without compromising end-to-end system security.

This paper reviews the key business drivers and technologies that are coming together to create the Virtual Workspace that will be at the heart of tomorrow's client computing environment, and shows how to get there.



A Desktop Shaped By History

On August 12, 1981 Philip “Don” Estridge introduced the world to the IBM 5150 Personal Computer. At the time he shocked IBM executives by forecasting that that IBM would sell 250,000 PCs in three years, 10 times as many as IBM's best-selling computer to date. Just four years later IBM announced that it had sold over 1 million of Estridge's PCs, driven by business users savvy enough to realize the benefits, and bold enough to bypass IT leadership and buy their own PCs. Tragically, Estridge did not live to hear this news. He died with his wife in a plane crash just days before the announcement was made. The release of the IBM PC was a transformative event, one that in time would far exceed even Estridge's most optimistic projections of its future potential; changing forever how the computer would be viewed by society. Even in its earliest days Estridge recognized something new and unique about the personal nature of the PC.

“What we discovered was that the way people responded emotionally to PC's was more important than what the computer actually did.

Don Estridge – President, IBM Entry Systems Division¹

Much has changed since the launch of the personal computer. User interfaces have transformed beyond all recognition; from the blocky white-on-black text of the DOS command prompt, to richly graphical interfaces driven by a mouse, touch and even voice. At the same time, computers are faster, smaller, and cheaper than ever before, with even the simplest mobile phone having many times the computing power of the original IBM 5150. While these changes are immediately visible, the most significant changes are more subtle; the computer is now both ubiquitous and ever-connected, creating new opportunities and expectations about its availability and utility.

Yet for all this, one thing has remained the same, today's personal computing experience is still centered on the device. With few exceptions, applications are still installed locally and the only way to ensure that required applications are available as needed is to rigorously enforce standardization, making sure every PC has every application installed. This model has worked, after a fashion, almost unchanged for the last 30 years, but it is starting to show its age.

The device-centric computing model was not designed to meet today's challenges and will not readily adapt to support the new opportunities offered by today's technology. The emergence of cloud computing services, desktop virtualization, and the

availability of a new generation of portable devices have catalyzed the creation of major new technology trends that are rapidly reshaping personal computing. Personal computing today has reached an inflection point. Some would have it that we are entering a post-PC era, but this change is less about replacing the traditional PC, and more about offering a new way of working with computers that frees individuals to use them in new ways.



The iPad Effect

Although the IBM 5150 Personal Computer was far from being the first desktop computer, there is no doubt that it was the spark that ignited the explosive growth of PC era. So it was with the Apple iPad. Tablet computers have been tried before, and while many succeeded at some level, all were flawed in one way or another; frequently too slow or too heavy, or encumbered with screen technology that made them difficult to use, none performed well enough to be considered a viable alternative to a PC or laptop.

The Apple iPad was the first tablet computer to deliver a device with the size, performance, battery life, and user experience needed to create a compelling tablet computer. Just as with the IBM PC, while the Apple iPad was not the first tablet, there is no doubt that it was the spark that ignited a new era of personal computing. The IT department that found itself at the center of dramatically disruptive business-led change with the arrival of Don Estridge's PC is seeing history repeat itself as it learns to adjust to the changes wrought by Steve Jobs' iPad.

As a consumer technology, the iPhone had already introduced a highly compelling user experience that provided many of the foundations behind the iPad, but its small screen size limited its value as a general-purpose business tool. The launch of the Apple iPad in 2010 broke that barrier and created new expectations amongst consumers and employees alike as to how business tools could perform. The iPad's seamless connectivity and instant availability opened peoples' eyes to the possibility that work could be performed anywhere and at any time. The Apple App Store showed how applications could be placed in front of millions of potential customers far more cheaply and quickly than was otherwise possible and then delivered on demand with no more than the touch of a button. The applications themselves also contributed to the iPad's appeal. Many iPad apps take advantage of cloud services to either store data, or perform some parts of an application's function. By combining local display with remote storage and execution, iPad Apps are frequently able to deliver a better experience than would otherwise be possible.

Bring Your Own Device

Although Apple targeted the iPad exclusively at the consumer market and did not offer any enterprise management capabilities until iOS 4 was released, it did not stop iPads appearing within the enterprise, following the same path that the IBM PC did 30 years before. From the start the business benefits of tablet ownership were readily apparent and it has rapidly proven to be an unstoppable force for change.

An unforeseen consequence of this activity was that the iPad quickly became the catalyst responsible for moving Bring Your Own Device (BYOD) programs from a niche practice exploited by technology vendors like Citrix Systems to showcase their solutions to a mainstream business-driven technology strategy. BYOD presents a significant set of challenges especially with regard to data security and threat management. However, at the same time BYOD does not mean surrendering all control. As with all technologies, successful implementation is dependent upon there being appropriate policies and procedures to control its use and it must be assumed that changes to existing systems will be required.

Irrespective of their extent, the benefits of BYOD programs are starting to be more readily understood. A recent report by Forrester indicated that 37% of US tablet owners bring their own tablets to work² (adoption in emerging markets is even higher). The devices that appear in BYOD programs are not limited to phones and tablets. Many BYOD programs are set up primarily to provide employees with the option to choose their own desktop or, more usually, laptop computer. An Aberdeen Group survey shows that 72% of organizations have established policies permitting the use of employee owned devices for business purposes³. At the same time, many different financing models exist; some offering employees a direct payment or stipend to subsidize the cost of purchase allowing the employee to supplement the payment if they wish to. Others, less generously, transfer the full cost of purchasing the device to the employee. Regardless of how it is implemented, positive reaction to BYOD is more likely to help companies do better where it counts, serving customers and increasing productivity, than the reactive threat management approach to BYOD that some have adopted.

The Consumerization of IT

Now more than ever, it is personal experience as consumers of technology that informs expectations of technology in the workspace. At the time when technology in the home is frequently more advanced than technology in the workspace and when individual consumers are adopting increasingly

sophisticated decision-making processes when selecting personal products, many business IT users are now seeking greater participation in business technology decision-making. The ease-of-use and the instant gratification of on-demand access to applications on iPads and Android tablets have pushed Consumerization of IT (CoIT) into the limelight with serious questions being asked of IT departments that are not always easy to answer within the context of current IT service delivery.



If applications can be delivered on demand to an iPad in a corner café, then why not to a PC in a corner office?

A recent report by IDG Enterprise⁴ indicates that the business benefits of CoIT for the most part trend towards the intangible, with the largest positive impact contributing to user satisfaction (79%), user productivity (76%) and process efficiency collaboration (68%). However, a growing number of CIOs are looking to take advantage of lessons learned from CoIT by reshaping existing IT services and directly addressing the question "If applications can be delivered on demand to an iPad in a corner café, then why not to a PC in a corner office?" However, rather than ceding control to an unmanaged consumer service, by creating their own managed CoIT experience they can retain the initiative in the face of this unwelcome external competition. If done right, this not only reduces employees temptation to look at consumer services to deliver against enterprise IT requirements, but it also frees up enterprise IT resources that were previously engaged in application provisioning to work on more valuable services, and so delivering measurable ROI.

The challenge here is not so much in putting a new consumer-friendly face on existing services so much as doing so in a way that works across the much broader array of client devices that BYOD initiatives will spawn. To compete in a CoIT lead marketplace, enterprise IT must strive to delight its business customers and to do that it, must do more than emulate the single platform app stores of Amazon, Apple, and Google.

Mobility

If BYOD and CoIT are sending waves of change rippling through enterprise IT, so too is the rapid growth of mobile application usage. The H1 2011 Allot MobileTrends Report⁵ showed a 77% increase in mobile data bandwidth use worldwide compared with H2 2010; in contrast, fixed data bandwidth increased only 25% in the same period. Bandwidth growth is not the only sign that mobile device usage is on the increase, nor is this purely a consumer phenomenon. As of October 2011, 92% of Fortune



500 companies had started testing or deploying iPads within their enterprises⁶ looking at mobile devices as productivity enhancers to be exploited, not as threats to be countered. Even though the vast majority of tablets sales to date have been iPads, it is important to not lose sight of alternatives. While the iPad and iPhone have retained the limelight, Android-based smartphone sales have overtaken iPhone sales by a substantial margin and Android-based tablets are competing directly with the iPad as well as defining new markets that Apple has so far failed to address. Although SAP made headlines recently with the announcements that it had purchased 18,000 iPads, what was not as well reported was the fact that this accounted for less than 50% of SAP's mobile devices. It is too early to tell if Windows 8 will establish Microsoft as a viable competitor to either of the market leaders, but given the importance of this market it is clear that Microsoft will do all it can to compete.

Regardless of platform, one thing is clear, tablet computing has arrived and must be taken into consideration as a key part of every enterprise's client computing strategy.

Worldwide, Android devices outsell iOS devices over 2 to 1, with future trends indicating that this ratio will increase as the growth in smartphone adoption slows in Apple's primary markets (i.e., North America and Europe) while accelerating in emerging markets where PC penetration has been low. The Allot MobileTrends Report for H2 2011 confirms this trend towards

Android, reporting that Android app store traffic grew by 232%, almost four times faster than the iOS App Store.

What is most important to understand here is that the mobile device market is too large, too volatile, and too hard-fought for any single mobile device platform to dominate for the foreseeable future. Addressing the challenge of mobile device adoption will be one of the most pressing challenges of the next two years as adoption increases and technology increasingly diversifies.

The Changing Desktop

The changes brought about by BYOD and CoIT programs and the need for increased mobility have arrived at the same time as enterprise IT is facing its biggest challenge since December 31, 1999. Windows XP has been the mainstay of desktop ever since its introduction in August 2001, defining the standard user experience and application programming environment for both home and business computing for over a decade, but now support is coming to an end. Mainstream Support for Windows XP ended on April 14, 2009. On April 8, 2014 Microsoft will stop providing Extended Support, marking the end of life for the single most successful operating system ever released and effectively forcing its customers to migrate to Windows 7.

Desktop Virtualization

When desktop virtualization was first proposed it was seen by many as the ideal means of addressing many of the deficiencies inherent in conventional distributed desktop management technologies. So much so that when early implementations failed to live up to inflated expectations, many announced the technology was a failure. Yet less than 5 years after VMware introduced the first virtual desktop broker with Virtual Device Manager 1.0, desktop virtualization has already captured 4% of the overall enterprise desktop market, and a recent Entelechy Associates survey reported that over 70% of IT organizations are planning to adopt desktop virtualization for some or all of their desktops by 2014.

Everybody recognizes that at its heart, server virtualization is all about being able to consolidate server workloads onto fewer physical servers. Desktop virtualization is more subtle, more far reaching. It's not about consolidating desktop workloads on to physical servers, although frequently this is part of the picture; rather it's about being able to orchestrate the creation of personalized working environments, the applications, data and configuration settings that each user needs to do their job, while at the same time ensuring conformance with organizational governance, risk and compliance management policies. Even with that said, desktop virtualization is still difficult to pin down; its rapid evolution and the rich diversity of system architectures adopted by competing vendors contribute to the difficulties of understanding the technology and its benefits.

Desktop virtualization architectures are complex and diverse; however, they can generally be characterized in two forms: either as a centralized or distributed architecture.

In the centralized model (often referred to as VDI), multiple virtual desktops run on a virtual infrastructure hypervisor located in a data center with keyboard, mouse, and display data passed between endpoint and data center using a remote display protocol. In contrast, the distributed model has the virtual desktop running locally on a conventional desktop PC or laptop.

Individual use cases and functional requirements will dictate which architecture will provide the most appropriate solution — VDI offers the flexibility of delivering Windows applications to non-Windows endpoints such as smart phones and tablets, at the cost of requiring a comprehensive data center infrastructure to host the desktops. Distributed desktop virtualization forgoes the central infrastructure in favor of a standard PC or laptop which permits disconnected operation, but requires conventional endpoints using an x86 architecture processor. Both models provide a centrally managed, yet individually personalized desktop executing on top of hypervisor, and both can create desktops by assembling multiple independent layers (typically consisting of a base operating system and default applications set, individual applications, user profile data, and any individual user files) into a personal desktop image. The number of layers and how they are assembled varies between individual solutions and which third-party components are used, but the same general approach is common to all desktop virtualization solutions.

Although costs can vary significantly depending on operational requirements, the overall cost of desktop virtualization is trending downwards as technology improves and is expected to achieve parity with conventional desktop solutions by the end of 2012. Capital cost aside, desktop virtualization can offer significant reduction in operating expenses when compared to conventional desktop management solutions; however, the primary financial justification for implementing desktop virtualization is better measured in terms of improving business services than in reducing IT costs.

Although not as dramatic and certainly not as attention grabbing as the Millennium bug, for the great many IT professionals who have entered the profession since January 1, 2000, the transition to Windows 7 is the single largest project they have ever faced. It is not simply a case of updating the desktop operating system and replacing older incompatible or underpowered systems with new hardware. Many applications originally developed for Windows XP require special handling to ensure that they will work on Windows 7, repackaging applications so that they will install in "Windows XP Mode," or taking advantage of third-party application virtualization tools that allow applications to be run in a self-contained bubble independent of the operating system. However, although most relatively recent applications can be made to run on Windows 7, a significant percentage are completely incompatible and will not work at all, requiring additional work to update or replace these applications.

Faced with the challenges of migrating to Windows 7, meeting the new challenges and business expectations that BYOD and CoIT are bringing and somehow accommodating an ever-increasing number of non-Windows devices and applications into the enterprise, many IT departments are looking at desktop virtualization as a single tool to resolve all these issues.

Desktop virtualization provides a ready means of overcoming the challenge of performing an incremental in-place transition

from Windows XP to Windows 7, while ensuring cross-platform application compatibility. Depending on the solution chosen, it is relatively straightforward to implement a desktop virtualization solution that will provide seamless access to both Windows XP and Windows 7 applications. Allowing the development of a flexible migration strategy based on location, function, or by individual application, as necessary. At the same time, desktop virtualization provides a means of supporting BYOD programs—either by providing an enterprise standard virtual desktop platform for use on employee owned devices without interfering with the underlying platform, or by using VDI to provide remote access to a Windows desktop or applications. VDI also provides a ready means of delivering Windows applications onto non-Windows endpoints (e.g., thin-clients, smart phones, tablets, and Apple MacBooks).

Beyond its ability to streamline Windows 7 migration activities and extend the Windows desktop to non-Windows endpoints, desktop virtualization's main value comes from its user-centric approach to systems management. As the combined forces of BYOD, CoIT, and pervasive mobility come together to create a new generation of client computing, a management paradigm based around the ability to deliver applications to devices will no longer be able to keep pace with demands. Instead, technologies that take a user-centric approach will be the only viable way of

ensuring that applications can be accessed independent of device ownership or platform.

The Virtual Workspace

Although the Windows desktop will remain a significant part of this next-generation workspace, for an increasing number of activities the desktop will disappear altogether. It doesn't take long for anyone who has used a smart phone or tablet to understand this. The rich desktop offered by modern windowing operating systems has gone, replaced by a grid of application icons and folders. The applications themselves occupy the full screen and the ability to move or resize them has largely disappeared. This use of full-screen-only applications is not limited to smart phones and tablets where small screens limit the utility of resizable windows. The freestanding kiosks found in many public places typically run a single full-screen Windows application that is frequently delivered using VDI.

While for many the user interface is being simplified, it is also being extended. For an increasing number of workers, the conventional desktop paradigm will no longer be enough. As mobile workers and knowledge workers increasingly adopt a broader range of device types (not just smart phones, tablets, and PCs of today, but the collaborative computing systems, smart TVs, and advanced tele-presence systems of the very near future) and switch between them many times a day, the conventional desktop paradigm breaks down. Where applications and information are increasingly sourced and consumed across devices with an ever increasing diversity of form factor and operating system, the ability to manage diverse applications, data sources, and deliver them successfully to diverse endpoints will become essential.

Gartner believes that the desktop PCs central role is coming to an end, to be replaced in the near term by personalized Virtual Workspaces spanning multiple device types, seamlessly accessing applications and data hosted in multiple locations.

“Major trends in client computing have shifted the market away from a focus on personal computers to a broader device perspective that includes smartphones, tablets and other consumer devices. Emerging cloud services will become the glue that connects the web of devices that users choose to access during the different aspects of their daily life... The reign of the personal computer as the sole corporate access device is coming to a close, and by 2014, the personal cloud will replace the personal computer at the center of users' digital lives.

Steve Kleynhans - Research Vice President, Gartner⁷



Kleynhans is not alone in thinking that the Virtual Workspace is coming. At the first Consumerization of IT in the Enterprise conference, which was held in San Francisco in March 2012, Mark Templeton - President and CEO of Citrix Systems, Inc. also reported on how quickly the transition from a PC-centric workspace to a cloud-centric workspace is taking place. Nor is this exclusively the domain of analysts and vendors; some of America's leading financial institutions are already making plans to implement against this vision, citing a combination of real business benefits coupled with a desire to establish a new client computing baseline as justification for this investment.

While the future of Windows applications is assured, so too is the future of the conventional desktop PC. VDI and cloud-based applications accessed through lightweight desktop clients will become increasingly relevant in every workplace, and mobile computing technologies will continue to proliferate, but for many workers and many workplaces, rich applications running locally on a conventional desktop PC (virtualized or not) will remain. The same is also true for conventional desktop management technologies; there are still scenarios where conventional device-based management is perfectly adequate and where the benefits of maintaining a mature, well-managed desktop management system outweigh any possible advantage associated with the transition to an alternative user-centric management solution.

Early adopters and analysts aside, it is too soon to say with any confidence if the Virtual Workspace will overtake the personal computer within two years. Nevertheless, if workers are to remain productive in an environment where no single technology predominates, a new approach is needed and it will only be a matter of time before the Virtual Workspace is as ubiquitous as the Windows desktop is today. Even then the PC era will be far from over. Cloud-hosted applications, Software as a Service, mobile apps, and web apps developed in HTML 5 may be in the limelight, but as was highlighted by the Y2K problem, applications, especially big enterprise applications, have a tendency to stick around far longer than their developers might have originally intended. The inertia behind the Windows platform is such that no matter how good an alternative might exist, the possibility of Windows being displaced in this decade is remote to say the least. This intractability makes the need for the Virtual Workspace all the more important. As personal computing diversifies to incorporate greater variety of client computing device types and application platforms, the cloud services that Gartner's Kleynhans envisages as gluing together this web of devices, must not just work with next-generation

cloud-based applications but must also accommodate today's Windows applications.

With all that said, it's time to start looking at how to get to the future, today.

Moving to the Virtual Workspace

Infrastructure Assessment

Getting to the Virtual Workspace requires first that organizations have a comprehensive understanding of their existing client computing environment. Individual devices, whether they are PCs, tablets, or smart phones, are becoming less important. Instead the focus needs to be on applications and data; specifically awareness of not just which applications are installed, but which applications and information are accessed, by whom, when, where, how often, and from which device.

Working with Windows

Every organization with any dependency upon Windows applications (i.e., almost everyone) needs to consider how Windows applications will be integrated into the Virtual Workspace. Will Windows applications be fully integrated into the Virtual Workspace through a user-centric management platform on day one, or will they continue to be managed through whatever device-centric management platform is currently in place? This is more a question of priorities than anything else; if the primary benefits of a user-centric Virtual Workspace accrue from the delivery of non-Windows applications, deferring integration of Windows applications with the Virtual Workspace management platform may make sense. Regardless, it is clear that a user-centric Windows application management platform will be better suited to integration with the Virtual Workspace than any device-centric application management. For those organizations that have not yet completed the migration to Windows 7, consideration of desktop virtualization as a central part of the migration process is all the more important. Not only will it afford greater flexibility during the migration process but, if done right, it will also accelerate and simplify subsequent transition to the Virtual

Workspace once the immediate challenge of Windows 7 migration has been addressed. Most importantly, regardless of any decision to implement desktop virtualization or not, every activity needed to successfully migrate to Windows 7 is also required to move to the Virtual Workspace.

When looking specifically at Windows applications, extending the infrastructure assessment to gather data on desktop resource utilization information is invaluable, especially if considering VDI as a desktop virtualization strategy. CPU and memory utilization data will aid with the overall system sizing, and a comprehensive understanding of IOPS data is essential to accurate storage infrastructure sizing.

Although most Windows applications will work out of the box, some will need attention, and some may simply not work at all. However, regardless of their claimed compatibility, all applications must be evaluated, and this can be a challenge. Even in the smallest of organizations, the number of installed applications can run into hundreds. In large organizations this number could extend to many thousands, especially where application version control has not been fully effective or where administrative privileges on desktops have not been rescinded. Regardless of the size of the organization, the time and effort associated with manually reviewing every application cannot be afforded. Fortunately, a number of tools exist that can readily assess compatibility and in some cases recommend remediation actions. While some of these tools deliver more than others, each of them offers a significant improvement over manual assessment, delivering higher-quality results more quickly and at a lower cost than is otherwise possible .

Analysis and Recommendation

While application compatibility assessment is essential to determine the size of any remediation effort, without an adequate understanding of application usage it is difficult to develop a remediation strategy. Understanding which applications require attention is one thing; understanding which applications should be remediated, replaced, or ignored is something else again. Here application usage data becomes



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essential to the migration process. In many organizations, 90% of all work is performed using 10% of all identified applications; conversely 90% of applications are used less than 10% of the time. Not altogether unsurprisingly, but still of vital importance, is the knowledge that in many cases 50% or more of installed applications are never used.

Knowing which applications fall into this latter group is the single largest timesaver when it comes to both deploying Windows 7 and moving to the Virtual Workspace. Knowing which group the remaining applications fall into is essential to the creation of the next-generation workspace. Not only is this information essential to prioritization of remediation efforts, but is also extremely valuable in defining application delivery strategy. It is only by knowing where applications are used is it possible to make appropriately informed decisions regarding how they should be delivered. For example, if analysis shows that an application is used exclusively by mobile workers then this information can be used to determine if that application should continue to be delivered as a Windows application, or if it should be replaced by an application designed explicitly for use on a tablet or smart phone. Similarly if it is clear that a Windows 7 compatible application is used by all office workers, it may be appropriate to consider delivering this application as part of a core desktop image. Regardless of the approach taken, only by understanding how an application is used is it possible to recommend how it should be delivered .

The Enterprise App Store

The Virtual Workspace may be the glue that links people and applications across any client computing device, but it is very much more than just a list of installed applications. It must also be the self-service catalog where users can select the tools they need just as they can with consumer app stores.

Consumer app stores are simple systems, only supporting one platform and only concerned with ensuring that any payment due is correctly processed. Enterprise IT requirements are both more stringent and more diverse. BYOD and CoIT bring

increasingly diverse platforms into the enterprise alongside the conventional Windows PC, all of which must be accommodated. At the same time, enterprise IT must take into consideration application licensing rules and the need to be able to support complex approval processes and provisioning workflows that may be needed before some applications can be made available .

Completing the Journey

The Virtual Workspace goes beyond the static aggregation of device, applications, and data that is today's personal computing experience, to combine cloud services, mobile platforms, and conventional Windows PC—not in terms of what they are, but in terms of what they do and how they are used, creating an integrated workspace that is centered on the user's needs and informed by the capabilities of the device in use.

The Virtual Workspace is not a tablet or a smartphone, but a context-aware, user-centric environment where devices and applications interact with data in ways that are consistent with both the users' needs and device capabilities. That means an app-centric, touch-enabled, location-aware experience on a tablet or phone, and a mouse-driven windowing environment on the desktop. All delivered through a common portal that understands context and configures itself accordingly.

This paper started by looking at how the Consumerization of IT is reshaping enterprise IT, however this movement can only go so far. There is no consumer equivalent of the Virtual Workplace. The walled gardens offered by Apple, Amazon, and Google do not begin to approach the needs of the enterprise and never will. Consumerization may have shown what enterprise IT must do in the face of change, but it does not limit what it can do. The Virtual Workspace is the evolution of the consumerization of IT; it delivers the flexibility that business users have come to expect, but extends it across all platforms and at the same time allows enterprise IT to provide the governance needed to protect the organization, its clients and their data .

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