



Microsoft
Desktop Optimization Pack
for Software Assurance



Flexible Desktop Computing

White Paper

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Abstract

Meeting both IT and end user needs in today's business environment can be challenging. Microsoft currently offers a range of desktop computing options—from traditional PCs to thin clients and from Terminal Services to hosted virtual machines—that give large organizations the flexibility needed to meet their diverse user and IT requirements. These computing options were designed to help simplify and lower the costs of desktop management and enable a much more agile, secure and satisfying computing experience. Each of these solutions has its own management characteristics, providing enterprise customers the ability to choose from a range of client computing options based on their particular needs.

Microsoft continues to invest in new technologies and licensing models, such as the Microsoft Desktop Optimization Pack and Windows Vista Enterprise Centralized Desktop to expand the number of desktop deployment options. This white paper describes how Microsoft solutions address different end-user scenarios and examines the various traditional and emerging desktop computing options best suited for typical personas in enterprises. It serves as a guide for helping organizations determine the most effective desktop computing and deployment infrastructure for their growing and evolving workforce and changing business needs.

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I. Background: Evolving Desktop Landscape for End Users & IT Professionals

Managing IT in today's business environment is much more challenging than it was even a few years ago, due to changes in how end users view workplace technology and how IT must manage corporate clients:

End User Expectations

- *Increase in Mobility:* Laptops are outpacing sales of desktop PCs due to proven productivity gains; however, this means that users expect applications and data to be accessible anywhere.
- *Consumerization:* Users, who are increasingly tech savvy in their home environments, expect their own personal configurations and freedom in the workplace. In addition, users are increasingly using their own devices to access corporate applications and data.

IT Pro Pressures

- *Cost:* As computing complexity grows due to new form factors, dispersed networks and an increasingly mobile workforce, the cost of deploying and managing enterprise PCs has increased significantly. Deployment costs for device are \$160 - \$350 per PC¹ and managing each PC can add another \$200 - \$1,300 annually per device².
- *Security:* Stolen laptops and malicious attacks are now commonplace. Last year over 750,000 laptops were lost or stolen in the U.S. alone³. Securing corporate laptops and desktops against viruses, breaches and theft takes tremendous IT resources, not to mention the immeasurable damage that data loss alone can bring to enterprises and their customers⁴.
- *Compliance:* Regulations such as Sarbanes-Oxley, HIPAA and Basel II include stringent requirements for protection of privacy and corporate information, and they prescribe significant punitive consequences if compliance is not maintained⁵.

The result of all these factors is an inherent tension, albeit not necessarily a negative one, between IT and end-user needs. End user demands for ubiquitous access fly in the face of the increased control IT must have to secure the enterprise and bring down the costs of managing client devices. Organizations must find the right balance between IT control and employee productivity to facilitate their pertinent business and the regulatory needs.

¹ IDC, *Optimizing Infrastructure*

² IDC, *Optimizing Infrastructure*

³ Forrester, *2007 Security Budgets Increase*

⁴ Forrester, *2007 Security Budgets Increase*

⁵ InformationWeek, *Compliance Spending To Reach \$28 Billion By 2007*

II. Levers for Understanding Flexible Desktop Computing for OS

The premise behind Microsoft's flexible desktop computing vision is that deploying Windows clients is no longer just about installing a copy of the OS on a PC. Increased availability of high bandwidth network and advances in all forms of virtualization relevant to the desktop—application, machine and presentation—have changed the landscape of client computing, particularly in the enterprise. Microsoft is committed to providing its customers with options when it comes to deploying Windows client environments.

The flexibility Microsoft offers in its range of desktop computing options is best understood across three dimensions:

1. Local vs. Centralized Execution

Microsoft offers flexibility where the processing for user desktop sessions occurs. A user can leverage the local compute power of his/her device when the OS is installed locally. This is the most common way of running Windows on PCs. Alternately, user can connect remotely to a system that is running in a data center. Presentation Virtualization, or the ability to detach the user interface from the OS, enables centralized execution. Utilizing Microsoft's Remote Desktop Protocol (RDP) technology, the user interface from a centrally hosted Windows environment (whether client or server) can be delivered remotely to a user's access device which can be a full PC or a thin client.

There are advantages and disadvantages to both the local and central execution models and picking one option over another (or employing a combination) is based on a combination of both user and IT needs/requirements. For example, all centralized execution options require a persistent network connection and therefore, cannot be used offline. Usage scenarios that need offline capabilities always use local execution. However, centralized execution is the only way to guarantee that applications and data always reside in the data center. This provides a level of control and security that is difficult to match in a local execution model.

2. Static vs. Dynamic Compute Stack

As shown in Figure 1, the client compute stack is made of the OS, data and applications, which have traditionally been statically configured to support a single desktop computing solution. This is a result of traditional OS/application installation and data storage technologies. With respect to desktop deployment, this means that the OS, application execution/presentation and user data are all self-contained within a single device. This model has the advantage of simplicity because it leverages well understood technologies that ship with Windows. In addition, because the PC is configured to be completely self-sufficient, this solution is well-suited to mobile use. However, the tight binding between the various layers may not be appropriate for all scenarios. Because of this, Microsoft has introduced new Windows deployment options that achieve similar results in terms of mobility but also enable increased flexibility.

By reducing the dependencies between computing layers, Microsoft enables IT to free the different elements of the system from one another. Each layer can then use other system resources generically and does not need to be configured individually for specific systems. Resources can be used on any system, in real-time, on an as-needed basis. The layers can be brought together

dynamically on the users' machines. IT can also manage the layers atomically. In this decoupled model, users can access applications and data on any client device—whether thin or rich—from anywhere.

Windows Client

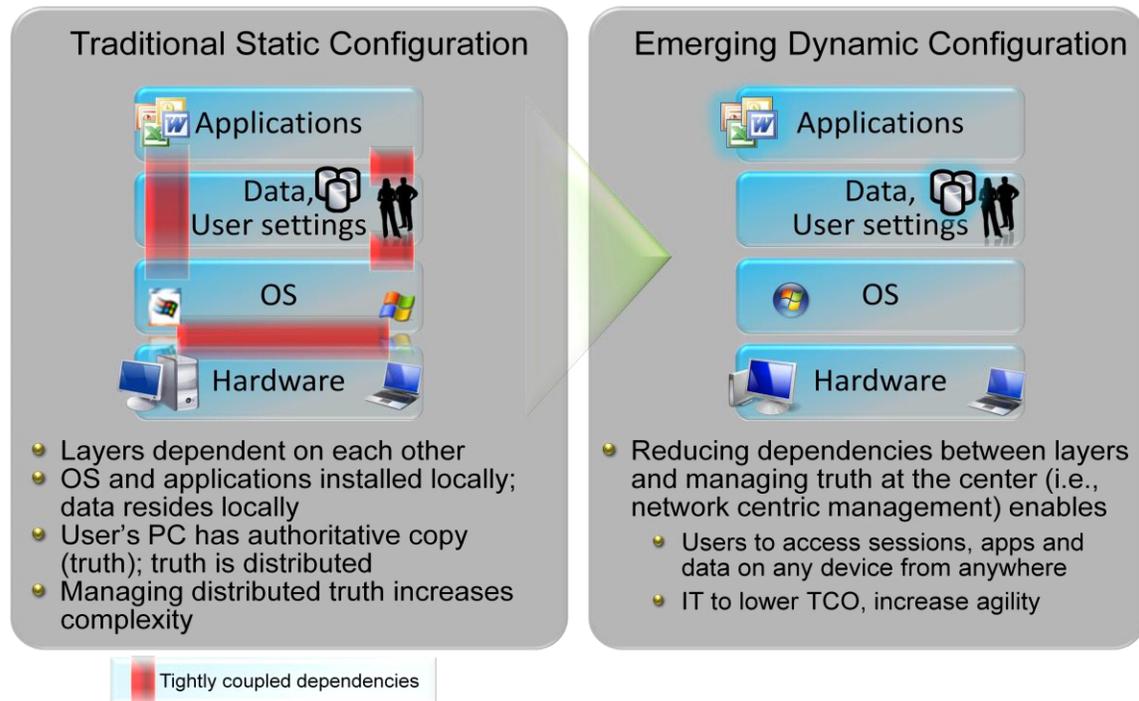


Figure 1

3. Distributed vs. Network Centric Management

In typical client computing with rich client all the components of the stack are locally installed and tightly bound. Since the rich clients are distributed, this involves managing and servicing the layers of the stack in a distributed fashion on the individual clients. From the IT perspective, this is a multi-instance servicing model, where each client that hosts the authoritative copy (or the "truth") of its OS installation as well as its applications and data need to be managed across the enterprise. This can prove to be challenging due to configuration drifts in local clients arising from configuration events being applied independently to each end user's environment.

Decoupling the different layers of the client computing stack and reducing dependencies between the layers enable managing components atomically and servicing single instance of components ("truth") centrally, yet preserve the flexibility of components coming together dynamically to execute in either a local or centralized fashion. This form of administration, called "network centric management," is different than traditional client management architectures in that the authoritative copy of an OS and application packages are both created and maintained centrally. When a user logs in, the end-user device or the centralized system hosting an end-user session access the OS or application packages over the network and execute on the host device. Network

centric management enables a single-instance servicing model, where OS and application package configuration changes made in one central location can be made available to all users in a deterministic manner. This provides for an unprecedented level of agility and manageability, with end-users being able to access their OS and applications from anywhere and IT being able to deploy software with a high level of agility and simplicity.

III. Flexible Desktop Computing Options for the OS

Microsoft offers numerous flexible desktop computing options for Windows, each providing varying end-user productivity, security and total cost of ownership (TCO). This section describes these computing options for Windows.

The following Microsoft products are used to enable the various flexible desktop computing options for the OS:

- *Windows Vista Enterprise* – the premium edition of Windows Vista optimized for medium and large organizations (<http://www.windowsvista/enterprise>)
- *Windows XP Embedded (XPe) and Windows CE* – embedded Windows thin client OSes (<http://www.microsoft.com/embedded>)
- *Windows Fundamentals for Legacy PCs (WinFLP)* – Windows-based client OS for transforming legacy PCs into thin clients (<http://www.microsoft.com/licensing/sa/benefits/fundamentals.mspix>)
- Windows Server Terminal Services – Microsoft’s server-based computing platform (<http://www.microsoft.com/terminalservices>)
- Virtual PC and Virtual Server – Microsoft’s current machine virtualization products (<http://www.microsoft.com/virtualization>)

In addition, Microsoft offers licensing specifically to support flexible desktop computing models, such as:

- Diskless PCs and Remote Boot for booting client systems from centrally hosted disk images (<http://www.windowsvista.com/enterprise>)
- Windows Vista Enterprise Centralized Desktop for centrally hosting client VMs on server hardware (<http://www.windowsvista.com/enterprise>)
- Terminal Services CALs (<http://www.microsoft.com/windowsserver2003/howtobuy/licensing/ts2003.mspix>)
- Remote Desktop License (RDL) for Blade PCs (http://download.microsoft.com/download/7/8/5/7855930A-7660-4971-8230-189E9CD06366/rdl_licensing.doc)

It is important to note that there is not necessarily a one-to-one relationship between the products and licensing offered; i.e., some of the offerings above are products while others are licensing rights. For example, Windows Vista Enterprise is a product, but Windows Vista Enterprise Centralized Desktop is a licensing right.

This flexible desktop computing options enabled by Microsoft offerings above can be grouped logically by their mode of execution. These client computing options are displayed graphically in Figure 2 below and work along an axis from the rich, distributed Windows PC models on the left to the thin, centralized execution models on the right.

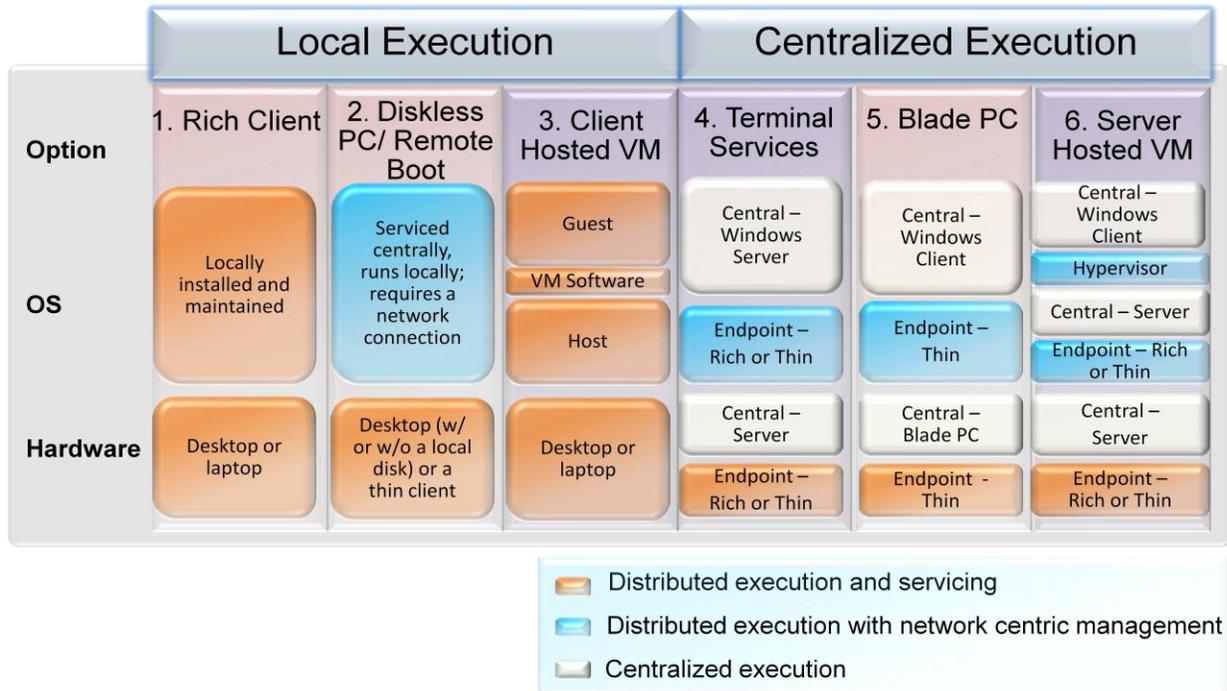


Figure 2

Local Execution

1. Rich Client

In this traditional, rich client model the OS is locally installed on standard PC hardware, providing the richness, versatility and offline capabilities for which PCs running Windows are well known for. However, this option involves distributed servicing of the OS, which if not managed well can increase TCO. In addition, local storage of data can make rich clients vulnerable to security breaches and data loss/theft when adequate measures for protecting the local data are not employed.

2. Diskless PC and Remote Boot

In this model, the OS is pre-installed into an image file that is stored on a centralized storage system such as a Storage Area Network (SAN), rather than on a local hard drive. When the PC is booted, the OS is delivered on-demand over the network and executes locally using local resources. This allows for a dynamic environment in which an OS, applications and data can all move freely among client machines. The software technology for diskless PCs and remote boot is nascent and requires significant network bandwidth as well as a persistent network connection. However, the advantage of this model is in centralizing servicing of the operating system as well as the ability to instantly upgrade or roll back the version of Windows on a system, which makes it particularly useful during OS migrations.

3. *Client Hosted Virtual Machine*

In this model, Windows is executed within a virtual machine environment hosted on one of the two aforementioned distributed computing options (rich client or diskless PC with remote boot). This approach helps mitigate compatibility issues that exist between applications and the OS by allowing multiple versions of Windows to run on the same piece of standard desktop hardware simultaneously. In addition, this model can be used offline, when used in conjunction with a rich client. However, this option adds the burden of managing two distinct and distributed OS instances on the host device.

Centralized Execution

4. *Windows Server Terminal Services*

Terminal Services provides a server-based computing architecture for running multiple users' desktops and applications on a single server. The server creates an isolated session for every user and presents the user interface (presentation virtualization) to the users' end-point device, which can be either a rich or thin client; this ensures that applications and data remain within the data center. Terminal Services also uniquely benefits from a number of economies due to its shared computing architecture. For example, there is only one OS installation which needs to be maintained per terminal server and for all the users of that system. However, this configuration introduces some challenges. Specifically, each user does not have the flexibility to customize his/her environment in a way that the user may be accustomed to doing with a rich client. Also, applications need to run on a Windows Server OS, which may not be supported by application vendors.

5. *Blade PC*

With this model, a client OS is executed on dedicated blade PC hardware that resides in a data center. There is a one-to-one mapping of a user to a blade, and the access device is primarily a thin client (a rich client can also be used as an access device). This model provides a rich experience similar to Windows running on a traditional PC, coupled with the benefits of physical centralization. These benefits include the ability to physically secure the core hardware and software powering the system's computing as well as any data that may reside on the blade. The thin client access device usually runs an embedded operating system, and has little value independent of the centralized blade PC. This model also offers the advantage of bare metal PC performance, unencumbered by a session or machine virtualization layer, as well as the ability to support free seating/roaming users. The main disadvantage of this option is the cost, which is primarily driven by supporting only one concurrent user per blade.

6. *Server Hosted Virtual Machine*

This model combines the benefits of both Terminal Services and Blade PC models in that it allows discrete instances of Windows client OSes to run simultaneously on server hardware and presents

the user interface to the users end-point device, which can be either a rich or a thin client; this ensures that applications and data remain within the data center. It does this by leveraging server (machine) virtualization. Server hosted VMs provide users with a traditional Windows client experience that more closely emulates the flexibility and application compatibility of Windows running on a rich client. This also avoids vendor support issues with applications that arise with Terminal Services. Relative to blade PCs, server hosted VMs enable better density by allowing more than one user per physical blade. However, relative to Terminal Services (which leverages a single Windows server installation with session isolation), hosting individual Windows client VMs is less scalable and supports fewer concurrent users per server. Supporting any server hosted VM deployment is a machine virtualization layer and a set of management tools. Microsoft provides Virtual Server as the VM layer today and will offer Windows Server Virtualization natively in Windows Server 2008. Microsoft will also offer System Center Virtual Machine Manager later this year, which provides management technology for virtual machines.

The various compute options described above have certain core benefits which align with specific use cases. Therefore, choosing an appropriate compute option requires carefully considering the requirements of a given user scenarios. This document walks through the general process of matching compute options to user profiles in section V.

IV. Flexible Desktop Computing Options for Applications, Data and Management

The prior section discussed the different options Microsoft offers for deploying Windows operating systems for client computing. However, OS deployment is only one piece of the puzzle. Applications and data are critical resources that users need to access from their desktop sessions. Therefore, having flexible deployment options for applications and data are key to providing a complete solution.

Microsoft offers the following products and features to provide flexibility in managing applications and data. Please note that some of the solutions, like SoftGrid Application Virtualization, are relevant across all the computing models described in the previous section. Others, like Offline Folder Redirection, are specifically designed to support certain types of scenarios/users.

The following Microsoft products are used to enable the various flexible desktop computing options for applications, data and management:

- Microsoft SoftGrid Application Virtualization – the market leading application virtualization and on-demand streaming platform for Windows client environments (<http://www.microsoft.com/softgrid>). SoftGrid Application Virtualization is a key component of the Microsoft Desktop Optimization Pack (www.windowsvista.com/optimizeddesktop) when used for the Desktop and is available standalone when SoftGrid Application Virtualization for Terminal Services is used.
- System Center – Microsoft’s family of leading IT management solutions (<http://www.microsoft.com/systemcenter>)

Applications

Microsoft SoftGrid Application Virtualization

Microsoft SoftGrid Application Virtualization transforms Windows client applications from products that are normally installed and tightly coupled within the client compute stack into dynamic services that can be delivered to client environments on-demand. In addition, SoftGrid enables IT to manage and update application packages from the center of the network and to have those packages and changes replicated immediately to client environments when users run their approved applications.

Microsoft SoftGrid Application Virtualization provides benefits to all the variations of the local and centralized processing models. These benefits vary slightly depending on the exact desktop computing option. However, all the environments benefit from the following capabilities:

- **Microsoft SoftGrid Application Virtualization benefits for both local and centralized execution**
 - *Eliminate Application Conflict* – SoftGrid eliminates application-to-application conflict and enables applications that normally conflict (for example, two different versions of the same application) to run side-by-side. By deploying applications via SoftGrid, IT is able to eliminate app-to-app conflict testing and to drastically reduce the time it normally takes to deploy new applications or to update existing ones.

- *Simplify & Accelerate Application Deployment* – By eliminating application-application conflicts, SoftGrid greatly enhances agility of deploying applications to a rich client. Many customers have seen the time to deploy applications go from several weeks to several days when using SoftGrid⁶.
 - *Consolidate and Standardize OS Images* – SoftGrid allows IT to remove the majority of applications that they normally pre-install into OS images and to make those packages available as centrally managed, on-demand services. Consequently, this allows organizations to reduce the number of OS images that exist by department or division and to move closer to having a single OS image for their entire enterprise.
 - *Reduce Support Calls* – SoftGrid transforms software configuration problems from incidents that normally require systemic debugging of a user’s entire operating environment into much simpler tasks. With SoftGrid, help desk technicians are able to quickly and easily revert user applications to a known good state without disrupting other parts of the system. This capability has enabled SoftGrid customers to reduce the time spent on helpdesk calls by over 30%⁷.
- **Specific Microsoft SoftGrid Application Virtualization benefits for local execution**
 - *Enable roaming, free-seating and offline use* – Microsoft SoftGrid Application Virtualization enables roaming and free-seating with rich clients with local execution in a way that has traditionally only been possible using a centralized execution model. Additionally, since SoftGrid enables caching of applications on local devices, it also allows offline use which has not been possible with centralized execution models. With SoftGrid, applications follow roaming users as they move between different local host devices. For example, a user can start his/her day at a desktop machine in their headquarters location, and move to a laptop as he/she travels to a second corporate location and then use a different desktop machine at the second corporate location. In each case, the user is presented with a personalized set of IT sanctioned applications that are delivered dynamically to “meet” his/her needs on each device. The applications are always being processed within the local computing environment using local system resources, not on a SoftGrid application server.
 - **Specific Microsoft SoftGrid Application Virtualization benefits for centralized execution**
 - *Consolidate Servers* – Microsoft SoftGrid Application Virtualization for Terminal Services allows IT to reduce the number of terminal servers in their environment, in some cases by 33–40%⁸.

⁶ SoftGrid, Return on Virtualization™ Case Study, <http://go.microsoft.com/fwlink/?LinkId=92495>

⁷ SoftGrid, Return on Virtualization™ Case Study, <http://go.microsoft.com/fwlink/?LinkId=92495>

⁸ SoftGrid, Return on Virtualization™ Case Study, <http://go.microsoft.com/fwlink/?LinkId=92496>

This is made possible through the elimination of application conflicts and the resulting ability to host a much greater number of application packages and configurations per server than is possible with traditional software deployment methodologies. With static application deployment, administrators normally need to create Terminal Services silos (separate groups of terminal servers dictated by application conflict rather than utilization) long before they reach maximum utilization on the servers they have already deployed. SoftGrid greatly reduces (and in certain cases eliminates) these silos and allows IT to size their Terminal Services farms according to the desired peak concurrent user capacity.

- *Standardize server hosted virtual machines and PC blades* – The server hosted VM and blade PC models by themselves simply centralize the execution of a Windows client OS from an endpoint device to the data center. However, this does not inherently solve all the challenges associated with application and client management. With a static application deployment model, IT must maintain and service a unique VM or blade per user. This can lead to a scenario where application and client management are nearly as complex and costly as in a distributed processing model.

By introducing Microsoft SoftGrid Application Virtualization into server hosted VM and PC blade environments, IT can move away from maintaining a static relationship between VMs/blades and users and toward dynamic assignment of those compute resources. This also allows IT to get away from having to create and maintain VM/blade images per department or division and to standardize the configuration of those systems for all users.

Terminal Services RemoteApp™

- **Benefits for local execution** – Windows Server “Longhorn” Terminal Services introduces a new feature called TS RemoteApp. This capability allows individual applications that are hosted on a terminal server to be made available to an end user on a rich client device and to have those applications appear like they are running locally. This is made possible through the seamless window technology which powers TS RemoteApp and which eliminates the “second desktop” that normally appears with Terminal Services environments accessed from rich clients.

TS RemoteApp enables IT to mix and match applications that they deploy directly to end-point devices and those which they host centrally on terminal servers. This provides IT with the flexibility to determine the appropriate deployment methodology for each application. For example, an application which is graphically intensive may be better suited for local deployment to an end-point device, where it can directly leverage the local graphics subsystem of that machine. However, a client/server application which transmits large amounts of data across the network may perform much faster in a centrally hosted deployment model.

Data

Offline Folder Redirection in Windows Vista and Windows Server 2008

- **Benefits for local and centralized execution** – Offline folder redirection (OFR) technology, which has been greatly enhanced in Windows Vista⁹, enables IT to remove the static relationship that has traditionally existed between a user’s PC and data. Client-side caching is an automated process that stores copies of user’s work files on his/her PC to conserve network bandwidth. If the user is connected over a slow link, using a local copy of a network file also smoothes and stabilizes user’s transitions between online and offline states.

Without OFR, the authoritative store for a user’s data is hosted on the PC’s local hard drive. This exposes user data to reliability and security risks, including data loss or theft. By using OFR, the authoritative copy of a user’s data can be stored on the network and client-side caching enables creating a synchronized replica on the local rich client PC. This allows a user the flexibility of taking his/her data offline while maintaining the authoritative source on the network. This protects the user from data loss in case his/her local machine is lost or fails.

Similarly, OFR in Windows Server 2008 ensures that a user’s network copy of data is available from any Terminal Services sessions that the user has available to him/her.

BitLocker™ Drive Encryption in Windows Vista Enterprise

- **Benefits for local execution** – In order to provide complete data protection, especially for laptop users, Microsoft has introduced BitLocker Drive Encryption with Windows Vista Enterprise. BitLocker encrypts the local hard disk and ensures that none of the information that is replicated on the local drive (OS, applications or user data) using Client-side caching is accessible by an unauthorized user in case a user’s laptop is lost or stolen.

Management

System Center

- **Benefits for local and centralized execution** – Microsoft offers System Center, a family of leading IT management solutions that helps organizations proactively plan, deploy, manage, and optimize their IT environments. The System Center family, comprised of products such as System Center Configuration Manager, System Center Operations Manager, includes a comprehensive set of management capabilities for deploying, configuring and monitoring all the distributed and centralized computing options discussed in this paper.

Total Cost of Ownership (TCO) is always been a key factor when evaluating different computing architectures. It is absolutely essential to understand that management is the key differentiator between an efficient and optimized computing infrastructure and an environment that is difficult and costly to maintain. **A computing architecture (whether local or centralized) by itself does not necessarily provide a lower TCO.** The direct costs (comprised of Hardware, Software and IT Labor)

⁹ *Offline Files in Windows Vista*, <https://blogs.technet.com/filecab/archive/2006/07/11/441131.aspx>

of managing rich clients with local execution in well managed environments can be lower than that for Terminal Service environments with centralized execution. Sometimes organizations adopt thin client, server-based environments with the assumption this is a way to reduce desktop management costs. However, very often these customers realize that just centralizing the processing of their client environments is not enough to achieve a satisfactory TCO. Having a proper management infrastructure, that is effectively deployed and that enables IT best practices, is vital to controlling costs regardless of the chosen computing model(s). Further information on optimizing enterprise infrastructure for rich client computing is available at www.microsoft.com/io.

V. Selecting Computing Options Based on Worker Personas

The previous sections show how Microsoft enables a range of client computing options that have certain core benefits to meet the needs of specific use cases. Therefore, choosing an appropriate compute option requires carefully considering the requirements of a given user scenarios. This section walks through the general process of matching compute options to certain typical user profiles or personas.

To do that, this section describes a set of user scenarios that are typical to most enterprises, and groups them into four different personas: Mobile Information Workers, Office/Stationary Information Workers, Power Information Workers, and Task Workers. These personas may not be characteristic of every enterprise environment and should be viewed as examples to selecting and matching computing options. Below is a brief description of each persona.

1. *Mobile Information Workers*

These types of users are highly mobile due to travel and are frequently outside the corporate network. They use a variety of applications that are usually running locally (i.e. Office, CRM, etc.) and therefore require a rich computing experience. They also need the ability to access applications and data offline as well. Sample users include sales force and corporate executives.

2. *Office/Stationary Information Workers*

These users are connected to the corporate network most of the time, and expect a rich client experience that can handle the broad range of tasks which fall under their responsibility. They use applications such as Office, CRM and ERP Line of Business (LOB) applications, as well as web and project management tools. Sometimes, these users need the ability to access their desktops and/or LOB applications from home. Sample users include typical office or branch workers.

3. *Power Information Workers*

These users run high-end, specialized LOB applications from within the corporate network. They need highly-performing, highly available computing solutions that provide reliable access. Many of these users move frequently from one workstation to another and therefore require a “Free Seating” environment. Sample users include financial traders, CAD engineers and graphic designers.

4. *Task Workers*

These users have more focused responsibilities usually based on data entry tasks. They tend to use a small number of LOB applications and are always connected to the corporate network. Usually they only need limited computing performance but like the Power Information Worker, need to move from one workstation to another in a Free Seating environment. Sample users include call center employees, bank tellers, factory workers and retail point of sale (POS) cashiers.

The next part of this section looks at capabilities these sample user personas desire and IT requires to provide the desktop environment, and maps them to the desktop computing options described in earlier sections.

1. Mobile Information Workers – Windows Vista Enterprise with Microsoft Desktop Optimization Pack

	Capabilities Desired	Microsoft Computing Options
End Users	Rich User Experience	<ul style="list-style-type: none"> Windows Vista Enterprise is built to deliver superior business performance in mobile PCs that provide a rich computing experience where applications execute locally when disconnected, and performance is consistent whether in the office or on the road
	Offline Usage	<ul style="list-style-type: none"> With Windows Vista’s Offline Folder Redirection, user data can be centrally stored, cached locally, making it available for offline use SoftGrid Application Virtualization enable applications to be provisioned centrally and cached locally to provide offline use
	Access to Applications and Data from multiple IT sanctioned PCs	<ul style="list-style-type: none"> Due to the network centric management capabilities that SoftGrid brings to applications and that Windows Vista brings to data, it is possible to provide a seamless experience for users whether they are using a desktop at the office or traveling with a laptop
IT	Application Compatibility	<ul style="list-style-type: none"> Microsoft SoftGrid Application Virtualization significantly reduces application-to-application conflicts Windows Vista Enterprise provides licensing for four local VMs to alleviate application-to-OS compatibility
	Protecting User Data from Loss, Theft	<ul style="list-style-type: none"> Offline Folder Redirection protects the loss of user data by storing the authoritative copy of a user’s data on the network and creating a locally cached replica for offline use Windows Vista Enterprise with BitLocker™ Drive Encryption encrypts all data on local hard disk, giving IT the peace of mind that any locally cached data is protected even when a mobile PC is stolen

The two primary technologies recommended for mobile workers are Windows Vista Enterprise and Microsoft SoftGrid Application Virtualization available as part of Microsoft Desktop Optimization Pack.

Windows Vista Enterprise is an edition of Windows Vista that optimized for medium and large organizations. It delivers the rich, enhanced security experience that users in medium and large organizations require, enabling them to work productively with any of their applications while inside the corporate network or outside. Windows Vista Enterprise is available exclusively for Software Assurance

customers. (Software Assurance is a maintenance offering that helps organizations get the most from Microsoft software through a broad range of benefits, from deployment planning and staff training to product support and software upgrades.)

Microsoft SoftGrid Application Virtualization virtualizes applications, decoupling them from the OS. It enables applications to run locally without installation and at the high performance levels users expect. This meets the user's need for reliable connected and offline use. In addition, because applications are provisioned via Active Directory and Group Policy and user application preferences can be stored centrally, users can access their applications with their personalized settings from any IT sanctioned PC. This ability for applications to follow users helps mobile workers be productive while traveling or using multiple PCs.

Microsoft SoftGrid Application Virtualization allows IT to rapidly provision applications by eliminating the need to test virtualized applications for compatibility with other applications running on the PC. In addition, SoftGrid protects the underlying OS from configuration changes normally due to application installation. This greatly simplifies application support and reduces need for time consuming helpdesk intervention. Finally, SoftGrid enables IT to inherently provide disaster recovery for user applications by allowing those packages to be easily replicated between data centers.

Security enhancements in Windows Vista Enterprise includes new features such as BitLocker™ Drive Encryption, which prevents locally cached data from being viewed in the event of lost or stolen laptops. With BitLocker, all user and system files are encrypted. In addition, Windows Vista's Offline Folder Redirection helps preserve user data by automatically synching and enhancing security on a back-end server transparently without user interaction.

Risks associated with mobility (i.e. lost notebooks, damaged hardware, etc.) are mitigated without the sacrifice of user experience by using PCs running Windows Vista Enterprise with Microsoft Desktop Optimization Pack. For instance, when a user switches PCs or workstations they can become productive immediately on another PC with a standard corporate OS image simply by logging on to their AD domain. All their applications, including personalized settings, as well as their data from the last time they synchronized their offline folders become available on the new PC. This notion of a "Replaceable PC" enables all benefits and flexibility of local execution that rich clients are known for, while removing any tight binding of users' applications and data with a particular host device.

Thus, the computing option that best meets the capabilities desired by a mobile worker persona is a Replaceable PC comprised of Windows Vista Enterprise with Microsoft Desktop Optimization Pack.

2. Office/Stationary Information Workers - Windows Vista Enterprise augmented with Terminal Services

	Capabilities Desired	Microsoft Computing Options
End User	Rich user experience	<ul style="list-style-type: none"> Windows Vista Enterprise operating system is specifically built for medium and large enterprises in mind, and enables rich computing experience
	Mostly in Corporate Network, Some Remote Access	<ul style="list-style-type: none"> Terminal Services provides access to remote desktops and programs through secure SSL VPN connections
	Broad Range of Applications	<ul style="list-style-type: none"> Traditional applications that are locally installed or applications delivered via Microsoft SoftGrid Application Virtualization run on the rich client PC For applications that need to be executed in the data center, Terminal Services RemoteApp provides a seamless experience
IT	Application Compatibility	<ul style="list-style-type: none"> Microsoft SoftGrid Application Virtualization for Terminal Services ensure terminal servers are simple (fewer or no silos), flexible and easy to manage
	Secure, Centralized Data	<ul style="list-style-type: none"> Offline Folder Redirection protects the loss of user data by storing the authoritative copy of a user's data on the network Applications delivered via Terminal Services protects sensitive corporate information by keeping it confined the data center

Office/Stationary Information workers require rich computing in order to use a range of applications, whether they are going on the web, using multimedia or creating reports. Although these users (who may be business analysts, general office workers or branch workers) typically don't require very high-performance computing, they expect a compelling and reliable experience. These workers live in a mostly-connected world as the bulk of their usage is from within the corporate environment. They may occasionally need remote access capability both within and outside the corporate network.

An excellent solution for these workers is a combination of Windows Vista Enterprise for primary use along with Terminal Services for occasional remote access. To give these workers the rich experience they require, customers can employ Windows Vista Enterprise, which as previously mentioned is an edition of Windows Vista that optimized for medium and large organizations. It delivers the rich, enhanced security experience that users in medium and large organizations require, enabling them to work productively with any of their applications. Applications can be either locally installed using traditional software deployment methods or delivered via Microsoft SoftGrid Application Virtualization.

Although Office/Stationary Information Workers are mostly connected to the corporate network, they sometimes require remote access from home or to certain applications from within the corporate network, Microsoft recommends using Terminal Services to supplement their rich client running Windows Vista Enterprise. In this scenario, applications can be accessed via RemoteApp and from the Internet using the Terminal Services Gateway (to be available in Windows Server 2008). Data accessed while using applications delivered via RemoteApp is centrally stored and managed.

Depending on the type of applications the information workers use, IT can enable access either via Terminal Services RemoteApp, Internet Explorer 7, or a combination of both. If users don't need access to an entire desktop, customers should opt for Terminal Services RemoteApp, which enables them to have their remote applications seamlessly integrated with the local desktop. For Rich Internet Applications, Microsoft recommends Silverlight or Silverlight Streaming, which delivers content-rich scenarios on different platforms and form factors.

Customers who want to centralize *and* enable offline data access for Office/Stationary Information Workers can employ OFR in Windows Vista and Windows Server 2008. OFR ensures that users can access their data from any PC they have logged in from within the corporate environment. OFR in Windows Server 2008 ensure that a user's network copy of data is available from any Terminal Services sessions that the user has available to him/her. Microsoft SoftGrid Application Virtualization in Microsoft Desktop Optimization Pack and Microsoft SoftGrid Application Virtualization for Terminal Services work in both situations.

When to use Terminal Services

Several key factors need to be considered in choosing Terminal Services. They include:

- 1. Whether the data associated with applications needs to be stored centrally for security or regulatory purposes;*
- 2. Whether applications are graphically intensive;*
- 3. Whether access device has a rich client OS; and*
- 4. Whether the user needs to work offline*

Many enterprises use a combination of applications deployed on the local rich client and those delivered via Terminal Services for different usage scenarios.

Consider deploying applications on the local desktop primarily when the data can be stored locally, when applications are processor and/or graphically intensive or when the user has low or no bandwidth.

Consider using Terminal Services when data needs to be stored centrally or when it isn't feasible to run the application locally on the desktop, such as from a remote location (home, branch offices, etc.) or using a thin client access device.

3. Power Information Workers – Windows Vista Enterprise or Windows Vista Enterprise Centralized Desktop or Diskless PC/Remote Boot with Microsoft Desktop Optimization Pack

	Capabilities Desired	Microsoft Computing Options
End Users	Rich User Experience	<ul style="list-style-type: none"> Windows Vista Enterprise running locally enables high performance applications that are CPU and graphics intensive
	Free Seating with High Uptime and Availability	<ul style="list-style-type: none"> By enabling network centric management, Microsoft SoftGrid Application Virtualization allows these workers to roam from one system to another with no downtime Microsoft SoftGrid Application Virtualization can be dynamically stacked above any of the three ways of provisioning Windows Vista Enterprise: 1) locally installed on a rich client or 2) running in a centrally hosted VM or 3) booting from the network and running on a local rich client
IT	Secure, Centralized data	<ul style="list-style-type: none"> Offline Folder Redirection enables storing the authoritative copy of a user's data on the network Applications delivered via Terminal Services protects sensitive corporate data by keeping it confined the data center Dynamically making user data available to users , IT can securely keep data centrally, while allowing users to access their data from any workstation they are authorized to use Operating system, Windows Vista Enterprise, is either locally installed on rich clients, centrally hosted in virtual machines or remotely booting on local client devices. Windows Vista Enterprise Centralized Desktop provides users the right to access server hosted client VMs from a local access device. Remote Boot/Diskless PC from third parties enable enterprises with stringent security and compliance requirements or mission-critical disaster recovery plans to use remote boot of OS. In this model, OS, applications and data are stored centrally and execute locally using local resources
	Application Compatibility	<ul style="list-style-type: none"> Microsoft SoftGrid Application Virtualization enables IT to eliminate application-to-application conflicts

Power Information Workers usually require high availability of their applications and data; and the ability to access their applications and data from within the corporate environment, i.e., Free Seating. Since these workers are usually the first ones to adopt innovative and emerging scenarios, one of the main advantages of Windows Vista Enterprise is that it gives Software Assurance customers the most

flexibility in deploying Windows desktops. If IT wants to deploy and execute desktops locally there is the ability to use local virtual machines on diskless PCs with remote boot for PCs. Diskless PCs can help reduce TCO by eliminating PC hard drives while centralizing OS, data storage and applications.

For centralized execution of desktops in the data center, enterprises can choose from Windows Vista Enterprise Centralized Desktops or Terminal Services. Windows Vista Enterprise Centralized Desktop is a new subscription license to provision Windows Vista Enterprise in virtual machines running on a server and accessed via either rich client or thin client using a remoting protocol such as Microsoft RDP. This is particularly relevant to certain specific use cases such as outsourced developers who need administrator rights, a capability which is not available in a terminal session. Terminal Services is a proven and scalable model for most customers, but for interested early-adopter customers Windows Vista Enterprise Centralized Desktop is a new option to explore.

Comparing Terminal Services and Windows Vista Enterprise Centralized Desktop

- ***Terminal Services*** – Multi-user, server-based computing using isolated sessions to run many users on one server
- ***Windows Vista Enterprise Centralized Desktop*** – is essentially a version of Windows Vista Enterprise that is licensed for installation on a virtual machine residing on a server. Both Windows Vista Enterprise Centralized Desktop and Terminal Services can be accessed by rich clients and thin clients using access protocols such as RDP.

There are several key factors when choosing between these two models:

Technology Maturity – Terminal Services is a proven and mature technology solution. Conversely, Windows Vista Enterprise Centralized Desktop is a relatively new and emerging solution.

Scalability and Price/Performance – Terminal Services provides significantly higher numbers of users per server than Windows Vista Enterprise Centralized Desktop model due to the lightweight nature of session virtualization and isolation used to separate users on a terminal server compared to full machine-based virtualization.

Separation of Users – Windows Vista Enterprise Centralized Desktop solutions use virtual machines to separate users and give each user their own operating system within which they can be given administrative privileges, if needed. Terminal Services uses a single operating system shared between multiple users and, thus, users will never be granted elevated privileges. While both technologies offer a level of separation between user environments, Windows Vista Enterprise Centralized Desktop provides much stronger isolation.

Application Support and Maintenance – Windows Vista Enterprise Centralized Desktop uses Windows Vista operating systems, which means any application certified for Windows Vista will be compatible with this model. Although most applications run on Terminal Services, especially with SoftGrid for Terminal Services, some application vendors do not support their applications

on Terminal Services because it runs on Windows Server as opposed to Windows client.

Operating System Maintenance – With Windows Vista Enterprise Centralized Desktop, each user gets their own dedicated OS instance; with Terminal Services, only one OS instance is needed for many, possibly hundreds, of users. Windows Vista Enterprise Centralized Desktop has the advantage of aligning with Windows Vista patching cycles and can be managed in the same way as other desktops in the organization. Terminal Services on the other hand involves fewer number of OS images to be managed.

4. **Task Workers** – Rich client running Windows Vista Enterprise in standard user mode; PCs with Windows Fundamentals for Legacy PCs; Thin Client with Windows Embedded

	Capabilities Desired	Microsoft Computing Options
End Users	Windows Familiarity	<ul style="list-style-type: none"> Windows Vista Enterprise running in standard user mode, Windows Fundamental for Legacy PCs, Windows XP embedded, and Windows CE all provide familiar Windows environments so users can work productively in a highly controlled desktop environment
	Free Seating with No Downtime	<ul style="list-style-type: none"> Microsoft SoftGrid Application Virtualization and Terminal Services allow users to roam freely among different workstations in their environment, without any downtime
	Access to 1-2 line of business applications (e.g., CRM, ERP, etc.)	<ul style="list-style-type: none"> Microsoft SoftGrid Application Virtualization provides application access to users running Windows Vista Terminal Services Remote Desktop or RemoteApp provides access to applications running on terminal server Windows Vista Enterprise Centralized Desktops for Thin Clients provides users the right to access hosted client VMs from thin client devices
IT	Repurpose General PCs	<ul style="list-style-type: none"> For IT seeking to reduce costs by repurposing legacy PCs, Windows Fundamentals for Legacy PCs provides a secure thin OS that can be used on PCs
	Small Footprint	<ul style="list-style-type: none"> IT Pros that need to work with a small footprint for the OS can choose from several options: Windows Embedded Options (Windows XPe and Windows CE) and WinFLP. All Embedded OSes work with Terminal Services

Task Workers have more focused responsibilities than the other personas described earlier. They may be call center employees, warehouse workers, retail employees or administrative assistants. Task workers tend to use just a few applications, such as bank branch teller software, terminal applications or even low-end CRM and line of business applications. However, they usually do not have a dedicated work station and must be able to access these applications/data from any desk within the corporate environment. The most important capabilities for task workers are ensuring a familiar Windows interface and enabling free-seating in an always-connected environment, so that users can work productively from shared client devices. User roaming can be easily handled with SoftGrid Application Virtualization running on Windows Vista or with Terminal Services where applications executed on the server can be accessed via any connected client device.

Choosing the Right Client OS Platform

In addition to providing group policy to help manage Windows Vista running on a rich client, Microsoft offers several thin-client OS solutions that can ensure Windows familiarity for Task Workers: Windows Fundamental for Legacy PCs (WinFLP), Windows XP Embedded (Windows XPe) and Windows CE. Here's how to evaluate the best thin-client OS for different environments:

- ***Windows Fundamental for Legacy PCs (WinFLP):***

WinFLP is well-suited to both general purpose PCs and thin clients built on PC hardware. It is also ideal if customers are using older client hardware. WinFLP also provides the most flexibility of all three of these OSes since it can always be repurposed back into rich client use. WinFLP is purchased as part of Software Assurance. It is serviced by Microsoft, which means customers automatically get patches and updates for the lifetime of their license.

- ***Windows XP Embedded:***

Windows XPe is designed for thin clients that have small footprints, such as line of business and/or browser terminals. Windows XPe features re-factored Windows Internet Explorer 6, increased componentization and component size reduction. One thing to consider when buying Windows XPe is that it is purchased and supported through thin-client OEM vendors such as HP, Wyse and Neoware. OEM vendors must pre-test patches on their specific devices and deliver these patches to the customer.

- ***Windows CE Embedded:***

Windows CE is best used on basic and browser terminals that are typically replacements for green screens. It is a componentized operating system designed from the ground up to power small footprint devices. Just like Windows XPe, Windows CE Embedded is purchased and supported by thin-client OEM vendors.

To centralize desktops on the server on thin clients, enterprises can utilize Terminal Services or Windows Vista Enterprise Centralized Desktop for Thin Client licensing to provision secure Windows Vista VMs on a server based infrastructure delivering the Windows experience to reduced desktop hardware. However, as Windows Vista Enterprise Centralized Desktop model is still emerging, Terminal Services is available as a well-tested option for most task worker usage scenarios.

To summarize, this section provides a general guidance on how a typical enterprise should think about different Microsoft desktop computing options suited for various user personas. Although these user personas may not map exactly the same in every environment, the purpose is to show how Microsoft can provide technologies that are well-suited to typical user personas. Mapping these technologies and deployment methods to end user and IT professional needs is the recommended approach for selecting compute options specific to your user personas and usage scenarios.

VI. Conclusion: Microsoft's Flexible Desktop Computing Options

As the complexity of desktop environments grows, reconciling end user capabilities with IT professional requirements is increasingly difficult. The purpose of this paper is to:

- a) Demonstrate the wide range of desktop computing options that Microsoft provides for its customers. Microsoft provides multiple solutions which enable enterprises to calibrate the needed amount of end user freedom and IT control. In the end, this flexibility can help boost user productivity while securing corporate assets in IT managed environments.
- b) Provide a generalized guideline on when to choose which desktop computing option. Analyzing different user personas, along with the associated IT requirements, provide insight into the desktop needs and capabilities (i.e., offline usage, Free Seating environments, etc.) for various user groups. Matching these needs and capabilities to Microsoft desktop computing options provides the needed flexibility to have either singular or hybrid deployment models for disparate user personas.

The following provides a snapshot of typical worker personas and their respective IT requirements matched with specific Microsoft offerings:

- **Mobile Information Workers** – *Windows Vista Enterprise with Microsoft Desktop Optimization Pack*
 - Replaceable PCs with applications and data on-demand
- **Office/Stationary Information Workers** – *Windows Vista Enterprise augmented with Terminal Services*
 - Windows Vista Enterprise installed on and executing on rich client
 - Windows platform with seamless RemoteApp experience
- **Power Information Worker** – *Windows Vista Enterprise or Windows Vista Enterprise Centralized Desktop or Diskless PCs/Remote Boot with Microsoft Desktop Optimization Pack*
 - Unique licensing rights such as diskless PCs and access to Windows Vista Enterprise Centralized Desktops subscription
- **Task Worker** – *Rich client running Windows Vista Enterprise in standard user mode; PCs with Windows Fundamentals for Legacy PCs; Thin Client with Windows Embedded*
 - Windows familiarity with small footprints and locked down clients

With the right tools for the right jobs, workers can be more productive and flexible while IT can protect and secure corporate data at a lower TCO. As a people ready company, Microsoft provides the right technologies so enterprises can realize the full potential of its employees.

VII. For More Information

For more information about Windows Vista Enterprise Centralized Desktop, Virtual Server, and the other technologies and topics presented in this paper, please contact your Microsoft account team or visit the following Web sites:

Windows Vista Enterprise Centralized Desktop

www.windowsvista.com/enterprise

Virtual Server 2005 R2

www.microsoft.com/virtualserver

SoftGrid Application Virtualization

www.microsoft.com/softgrid

Microsoft Desktop Optimization Pack for Software Assurance

www.windowsvista.com/optimizeddesktop

Windows Server 2003 Terminal Services

www.microsoft.com/terminalservices

System Center Virtual Machine Manager

www.microsoft.com/scvmm